

## Exam GIINT



Society of  
Actuaries

### Introduction to General Insurance

# GIINT



Canadian  
Institute of  
Actuaries

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8:30 am–10:00 am

### DIRECTIONS

1. DO NOT BREAK THE SEAL OF THE BOOKLET UNTIL THE SUPERVISOR TELLS YOU TO DO SO.
2. This test consists of 60 multiple-choice test questions. You will have a total of one and a half hours in which to answer them and record your answers on the answer sheet. NO ADDITIONAL TIME WILL BE ALLOWED FOR CODING YOUR ANSWER SHEET. Failure to stop writing or coding your answer sheet after time is called will result in the disqualification of your answer sheet and possible further disciplinary action.
3. There are five answer choices for each question, lettered (A) through (E). Answer choices for some questions have been rounded. For each question, choose the best answer. On your answer sheet, find the row of circles with the same number as the question. Then find the circle in that row with the same letter as your answer. Use a soft lead pencil and blacken the circle completely. INDICATE ALL YOUR ANSWERS ON THE ANSWER SHEET. No credit will be given for anything written in the booklet.
4. Answer sheets are mechanically scored. BE SURE THAT EACH MARK IS BLACK AND COMPLETELY FILLS ONLY THE INTENDED ANSWER CIRCLE. Make no stray marks on the answer sheet. Choose only one answer for each question. If you change an answer, erase your first mark completely and mark your new choice.
5. Use the blank portions of booklet pages and the tablet of paper provided for your scratch work.
6. Do not spend too much time on any question. If a question seems too difficult, go on to the next question. You may return to unanswered questions if you finish before time is called.
7. Your score will be based on the number of questions that you answer correctly. There will be no deduction for wrong answers. Therefore, it is to your advantage to answer every question.
8. After time is called, the supervisor will collect the booklet and your answer sheet separately. DO NOT ENCLOSE THE ANSWER SHEET IN THE BOOKLET. All booklets and answer sheets must be returned. THE QUESTIONS ARE CONFIDENTIAL AND MAY NOT BE TAKEN FROM THE EXAMINATION ROOM.

#### Example

Calculate the value of  $x$  in the equation  $x + 6 = -3$ .

- (A) -9
- (B) -3
- (C) -2
- (D) 3
- (E) 9

#### Sample Answer

● (B) (C) (D) (E)

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**\*\* BEGINNING OF EXAMINATION \*\***  
**INTRODUCTION TO GENERAL INSURANCE**

**NOTE concerning this sample exam** – The order in which the questions appeared on a particular CBT administration of the exam is different from this sample.

- 1.** Which of the following is NOT an operating goal of an insurer?
  - (A) Comply with legal requirements.
  - (B) Concentrate risk.
  - (C) Meet customer needs.
  - (D) Earn a profit.
  - (E) Fulfill its duty to society.
  
- 2.** What are the three core functions that exist within a typical insurer?
  - (A) Accounting, actuarial, and underwriting.
  - (B) Actuarial, claims, and underwriting.
  - (C) Accounting, marketing and distribution, and sales.
  - (D) Claims, marketing and distribution, and underwriting.
  - (E) Actuarial, marketing and distribution, and sales.

**3.** Which of the following errors is the most significant problem in measuring insurer profitability?

- (A) Errors in setting adequate rates.
- (B) Errors in estimating future investment returns.
- (C) Errors in estimating loss reserves.
- (D) Errors in estimating sales growth.
- (E) Errors in classification of loss exposure units.

**4.** Which of the following is NOT a reason insurers are subject to governmental regulation?

- (A) Protect consumers against fraud.
- (B) Guarantee insurer profit.
- (C) Maintain insurer solvency.
- (D) Prevent unfair discrimination.
- (E) Protect consumers against unethical marketing behavior.

- 5.** Which of the following is the primary reason insurer solvency is monitored by regulators?
- (A) Insurers hold large sums of money for the benefit of consumers.
  - (B) Insurers are inherently financially unstable.
  - (C) The cost of insurer insolvencies is shifted to taxpayers.
  - (D) Solvency of insurers is easily measured without much cost.
  - (E) The claims-paying ability of insurers can be analyzed by most consumers and businesses.

- 6.** Which of the following are the three major goals of insurance rate regulation?
- (A) Ensure that rates are adequate, are not excessive, and are unfairly discriminatory.
  - (B) Ensure that rates guarantee insurance company solvency, are affordable, and are not overly complex.
  - (C) Ensure that rates do not allow insurers excessive or unreasonable profits, are high enough to pay all claims and expenses, and result in fair, consistent, and equitable charges among all insured groups.
  - (D) Ensure that rates are not affected by competition, are not excessive, and are not discriminatory.
  - (E) Ensure that rates are actuarially sound, are affordable to all, and are equitable.

7. Which of the following types of insurance customer is most likely to have the broadest choice of risk financing alternatives?

- (A) Individual.
- (B) Professional partnership.
- (C) Small business.
- (D) Middle market account.
- (E) National account.

8. Which of the following are advantages of allowing qualified producers to handle certain types of claims?

- I. Lower loss adjustment expenses.
- II. Larger payments to claimants.
- III. Quicker service to policyholders.

- (A) I only.
- (B) I and II only.
- (C) I and III only.
- (D) II and III only.
- (E) I, II, and III.

- 9.** Which of the following is the principal method of determining a prospect's insurance needs?
- (A) Having a conversation to determine what insurance coverage the prospect wants to purchase.
  - (B) Performing a thorough risk management review of the prospect's loss exposures.
  - (C) Selling the prospect as much coverage as it can afford, given its insurance purchasing budget.
  - (D) Determining if the prospect's insurance needs can be placed in the standard market or placed in the residual market.
  - (E) Determining which insurer offers the most attractive contingent commission arrangement for the prospect's desired coverage.

- 10.** Which of the following does NOT determine the underwriting capacity of an insurer?
- (A) The volume of premiums written relative to the insurer's policyholders' surplus.
  - (B) Availability and cost of adequate reinsurance.
  - (C) Regulatory guidelines.
  - (D) Ability to generate an acceptable return on equity.
  - (E) Standardized methods used to organize underwriting activities.

**11.** Which of the following actions must be taken by a line underwriter if policy limits on an application exceed the line underwriter's binding authority?

- (A) Seek approval from supervisory personnel within the underwriting department.
- (B) Accept the application but reclassify the loss exposure.
- (C) Accept the application and ignore binding authority restrictions.
- (D) Accept the application as a favor to the producing agent or broker.
- (E) Decline the application.

**12.** Numerous factors help shape an insurer's underwriting policy. Which of the following is NOT a constraint that would cause certain types of insurance or classes of business to be avoided?

- (A) Reinsurance treaties exclude the business.
- (B) The insurer's personnel lack needed marketing and underwriting expertise.
- (C) Intense competition in the line of business would result in insufficient profit opportunities.
- (D) The underwriter is experiencing a high hit ratio on policies quoted.
- (E) Policy forms, rates, and rating plans are not available to the insurer at a reasonable cost.

- 13.** COPE is an acronym describing a common tool used in underwriting the fire peril and other causes of loss to property. What does COPE stand for?
- (A) Conditions, Omissions, Perils, and Exclusions.
  - (B) Construction, Occupancy, Protection, and External exposure.
  - (C) Commercial, Operations, Production, and Entertainment.
  - (D) Concealment, Omissions, Protection, and Exclusions.
  - (E) Construction, Occupancy, Perils, and External exposure.
- 
- 14.** Which of the following policy provisions does NOT affect the determination of the amount an insurer is obligated to pay at the time of a covered loss to property?
- (A) The policy's coverage limit.
  - (B) The insurable interest of all persons insured at policy inception.
  - (C) The policy's deductible provisions.
  - (D) The policy's coinsurance provisions.
  - (E) The policy's provisions for establishing the value of the insured property.



- 15.** Which of the following is NOT a characteristic of umbrella and excess liability insurance?
- (A) Each requires the insured to pay for losses equal to the self-insured retention or the deductible.
  - (B) Each provides liability coverage in excess of the underlying policy limits.
  - (C) Umbrella liability insurance provides coverage for gaps in the underlying policies but excess liability insurance does not.
  - (D) Both umbrella and excess liability insurers must assume defense of a claim if the underlying insurer cannot due to its insolvency.
  - (E) Loss frequency rather than loss severity is the primary concern in underwriting umbrella and excess liability insurance.

- 16.** Which of the following is an ethical obligation insurers have with regard to using their superior knowledge of loss control and prevention?
- (A) Earn a profit.
  - (B) Provide funds for government sponsored disaster relief programs.
  - (C) Decline coverage for exposures that may have a loss.
  - (D) Assist in preventing or reducing accidental losses.
  - (E) Discourage risk-taking in business and personal activities.

- 17.** Which of the following statements about premium auditing is true?
- (A) Premium auditing is verification of premium information included on an insurer's financial statements.
  - (B) Premium auditing is a methodical examination of the insured's operations, records, and books of account to determine the actual exposure units and premiums for insurance to be provided in the next policy period.
  - (C) Premium auditing is a regulatory function that determines if the insurer has paid the correct amount of premium taxes to the states in which it operates.
  - (D) Premium auditing is a methodical examination of the insured's operations, records, and books of account to assist in underwriting decision-making.
  - (E) Premium auditing is a methodical examination of the insured's operations, records, and books of account to determine the actual exposure units and premiums for insurance already provided.

- 18.** Which of the following is NOT a reason why accurate premium audits are important to the insurer?
- (A) Undetected premium audit errors may allow the insurer to retain premium overcharges and boost profits.
  - (B) Incomplete or inaccurate premium audits cause costly extra work and a loss of efficiency.
  - (C) Accurate premium audits assure equity in prices charged insured customers that present similar loss exposures.
  - (D) Premium developed from premium audits is fully earned.
  - (E) The insurer's cash flow depends on timely and accurate billing of auditable commercial insurance.

**19.** Which of the following is NOT included among an insurer's claim representatives?

- (A) Insurance agents and brokers.
- (B) Independent claim adjusters.
- (C) Public claim adjusters.
- (D) Managing general agents (MGAs).
- (E) Staff claim representatives.

**20.** Which of the following is NOT a reason that a court of law may find an insurer to be guilty of bad faith claim settlement practices if it has denied payment of a claim?

- (A) Failing, without legal cause, to fulfill a contractual promise.
- (B) Mishandling the claim resulting in financial detriment to the insured or third party claimant.
- (C) Failing to comply with the implied duty of good faith claim settlement.
- (D) Denying a claim for which coverage was neither provided nor intended in the contract of insurance.
- (E) Failing to deal with the claimant fairly and in good faith.

- 21.** Which of the following should a claim representative do when deciding how thoroughly to investigate a claim?
- (A) Be sure the investigation has been thorough enough to satisfy a judge and jury that good faith claim handling procedures have been followed.
  - (B) Comply with requirements of the Fair Credit Reporting Act by avoiding any access to the claimant's financial information.
  - (C) Collect enough evidence to support denial of the claim.
  - (D) Be sure to spend no more time on settling the claim than is considered standard by claim department guidelines.
  - (E) Refer most claims to the insurer's special investigations unit (SIU).
- 
- 22.** Which of the following potential claimants does NOT have an insurable interest in property damaged or destroyed by a covered cause of loss?
- (A) An unsecured creditor of the property owner.
  - (B) A person who leases the property from the owner.
  - (C) Warehouse operators acting as custodians of the property.
  - (D) Common carriers transporting the property.
  - (E) Business partners holding property as owners in common.

- 23.** Which of the following causes of loss are common carriers liable for when a shipper's goods are damaged?
- (A) By an act of God.
  - (B) By theft while the property is in the care, custody, and control of the carrier.
  - (C) By negligence of the shipper.
  - (D) By some inherent defect or vice of the goods.
  - (E) By exercise of public authority.
- 
- 24.** Betty Smith is an avid golfer. While teeing off at her golf club recently, she sliced her shot and hit her golfing partner, Susan Jones, in the face causing Susan to suffer a laceration, severe pain, and temporary loss of vision in one eye. Betty immediately contacted her insurance agent, reported the mishap, and inquired about coverage under her homeowners' insurance policy. The agent in turn reported the claim to the insurance company. In settling the claim, which step would NOT be followed by the insurer's representative?
- (A) Identify the insurance policy covering Betty Smith.
  - (B) Acknowledge receipt of the claim to the agent.
  - (C) Advise Susan not to contact an attorney.
  - (D) Determine if the loss occurred during the policy period.
  - (E) Document and file all information concerning the claim.

**25.** Which of the following is NOT a reason why reinsurance is purchased?

- (A) Reinsurance increases underwriting capacity.
- (B) Reinsurance reduces the number of claims incurred.
- (C) Reinsurance stabilizes loss experience.
- (D) Reinsurance may provide underwriting guidance.
- (E) Reinsurance provides catastrophe protection.

**26.** Which of the following is true regarding a facultative reinsurance contract?

- (A) The reinsurer is obligated to accept all loss exposures underwritten by the primary insurer.
- (B) The primary insurer must negotiate a separate agreement for each loss exposure it wants to reinsure.
- (C) The reinsurer agrees in advance to accept a set proportion of all loss exposures underwritten by the primary insurer.
- (D) Both the primary insurer and the reinsurer may cancel the contract at any time with sufficient notice.
- (E) Reinsurance protection continues as long as the primary insurer renews the insured's coverage.

**27.** Which of the following reinsurance programs is best suited for a primary insurer experiencing rapid premium growth in its personal auto insurance line of business?

- (A) Finite risk reinsurance.
- (B) Excess of loss treaty reinsurance.
- (C) Pro rata facultative reinsurance.
- (D) Quota share treaty reinsurance.
- (E) Per occurrence excess of loss treaty reinsurance.

**28.** Which of the following is the traditional and most commonly used system for compensating victims of auto accidents?

- (A) Pure no-fault system.
- (B) Absolute liability system.
- (C) Tort liability system.
- (D) Vicarious liability system.
- (E) Modified no-fault system.

**29.** Which of the following is the basic argument in favor of no-fault auto insurance systems currently used in the United States?

- (A) No-fault systems eliminate fraudulent claims.
- (B) No-fault systems offer rich benefits at lower overall cost.
- (C) No-fault systems offer unlimited medical benefits.
- (D) No-fault systems settle auto claims more quickly at lower cost.
- (E) No-fault systems eliminate all attorney involvement in auto injury cases.

**30.** Under which type of auto insurance arrangement are all auto insurers in a state required to issue policies and service their proportionate share of high-risk drivers based on the insurer's auto insurance premium written in the state?

- (A) Joint underwriting association.
- (B) Automobile insurance plan.
- (C) Unsatisfied judgment fund.
- (D) Reinsurance facility.
- (E) Specialty automobile plan.



**31.** Which of the following is NOT contained in the Declarations page of the Personal Auto Policy (PAP)?

- (A) Policy period.
- (B) Insuring agreement.
- (C) Policy number.
- (D) Name of the insurer.
- (E) Limits of insurance for each coverage provided.

**32.** Liability coverage – Part A is the most common part of the Personal Auto Policy (PAP). Which of the following is NOT covered under the liability section of the PAP?

- (A) A newly acquired auto that replaces a vehicle previously described in the policy.
- (B) A trailer owned by the named insured.
- (C) A borrowed auto used by the insured as a temporary substitute during servicing of the insured's primary vehicle.
- (D) A nonowned van that the insured drives to the grocery store each week.
- (E) A pickup truck owned by the named insured and shown in the policy's Declarations.

- 33.** Which of the following is NOT considered to be an uninsured motor vehicle by the Uninsured Motorists Coverage – Part C of the Personal Auto Policy (PAP)?
- (A) A vehicle for which no bodily injury liability insurance or bond applies at the time of the accident.
  - (B) A hit-and-run vehicle whose operator cannot be identified.
  - (C) An uninsured vehicle furnished for regular use by a family member.
  - (D) A vehicle insured with an insurer that denies coverage due to the insurer's insolvency.
  - (E) A vehicle insured for less than the minimum liability limit required by the state's financial responsibility law.

- 34.** Which of the following is NOT a duty of an insured after an auto accident covered under the Personal Auto Policy (PAP)?
- (A) Submit proof of loss.
  - (B) Submit to a physical examination if requested.
  - (C) Agree to an examination under oath.
  - (D) Admit negligence to the police if at fault.
  - (E) Provide prompt notice to the insurer.

**35.** Which of the following is NOT a common endorsement added to the Personal Auto Policy (PAP)?

- (A) Snowmobile endorsement.
- (B) Limited Mexico coverage endorsement.
- (C) Auto loan/lease (Guaranteed Auto Protection – GAP) coverage.
- (D) Towing and labor cost coverage.
- (E) Garage Business endorsement.

**36.** Which of the following is true regarding tenants of rented apartment units?

- (A) Tenants have no need for Homeowners insurance.
- (B) Tenants must insure both the apartment building and their personal property.
- (C) Tenants are eligible for Homeowners insurance using HO-3 (the Special Form).
- (D) Tenants are eligible for Homeowners insurance using HO-4 (the Contents Broad Form).
- (E) Tenants are eligible for Homeowners insurance using HO-8 (the Modified Coverage Form).

**37.** One of the Conditions in Homeowners HO-3 (the Special Form) lists the insured's duties after a property loss. Which of the following statements concerning this condition is true?

- (A) The insured's claim representative might not require that all of these duties be performed.
- (B) The insurer is prevented from denying a claim even if the insured fails to perform required duties.
- (C) All listed duties always must be performed prior to final claim settlement.
- (D) Claim representatives usually waive most or all duties expected of the insured.
- (E) As long as the insured gives prompt notice of the loss, the insurer cannot require other duties to be performed.

**38.** Spencer has a Homeowners HO-3 policy that provides \$320,000 of insurance on his dwelling, which has a current replacement value of \$500,000. Ignoring any deductible, how much will Spencer collect if his kitchen with a replacement value of \$30,000 but an actual cash value of \$26,000 is destroyed in a fire?

- (A) \$20,800
- (B) \$24,000
- (C) \$26,000
- (D) \$28,000
- (E) \$30,000

- 39.** Which of the following is NOT an exclusion in Section II of the Homeowners HO-3 policy?
- (A) Intentional injuries.
  - (B) Business activities.
  - (C) Transmission of a communicable disease.
  - (D) The gradual yet accidental seepage of pollutants from the insured's septic system into the neighborhood water supply.
  - (E) Injuries caused by operation of a motor vehicle registered for use on public roads.

- 40.** Which of the following statements regarding the "severability of insurance" condition in the HO-3 Special Form insurance policy is true?

- I. The condition applies insurance separately to each insured.
  - II. The condition does not increase the insurer's limit of liability for any one occurrence.
  - III. The condition allows the policy to cover a claim brought by one insured against another insured.
- (A) I only.
  - (B) I and II only.
  - (C) I and III only.
  - (D) II and III only.
  - (E) I, II, and III.

- 41.** Which of the following motor vehicles is NOT covered under Section II – Liability coverage in the ISO HO-3 policy?
- (A) Motor vehicle in dead storage on an insured location.
  - (B) Motor vehicle powered by one or more batteries that cannot exceed five miles per hour on level ground that is designed as a toy for use by children under the age of seven.
  - (C) Motor vehicle used solely to service a residence.
  - (D) Motor vehicle used for snow removal on public roads within one mile of an insured location.
  - (E) Motor vehicle designed for assisting people who are handicapped.

- 42.** Which of the following statements about Fair Access to Insurance Requirements (FAIR) plans is true?
- I. FAIR plans make property insurance coverage available for exposures located in areas underserved by the voluntary market.
  - II. FAIR plans are uniform in methods of operation and products offered in all states.
  - III. FAIR plans require covered property to meet inspection criteria established by the plan.
- (A) I only.
  - (B) I and II only.
  - (C) I and III only.
  - (D) II and III only.
  - (E) I, II, and III.

- 43.** Which of the following is NOT typically contained in the declarations page of a Commercial Package Policy?
- (A) The description of the covered property.
  - (B) The list of mortgagees, if any.
  - (C) The list of optional coverages, if any.
  - (D) The cancellation provisions.
  - (E) The policy period.
- 
- 44.** What is the fundamental difference between the three commercial property insurance covered causes of loss forms – Basic Form, Broad Form, and Special Form?
- (A) The type(s) of property covered.
  - (B) Only the Special Form offers additional coverage for fungus and collapse.
  - (C) The number of perils listed in each causes of loss form.
  - (D) The Basic Form names the perils covered while the Broad and Special Forms cover all perils that are not specifically excluded.
  - (E) Both the Basic and Broad Forms are written on a named perils basis while the Special Form provides coverage for all direct causes of loss not specifically excluded.

- 45.** ABC Corporation is insured under a Business and Personal Property Coverage Form that specifies a \$4 million limit of insurance on the building and a \$500,000 limit on business personal property at the building's address. The policy has a \$10,000 deductible. A \$4.4 million loss to the building and a \$400,000 loss to business personal property result from a covered cause of loss. Two trees also are destroyed, resulting in a \$1,000 loss fully covered by BPP Coverage Form's Outdoor Property coverage extension. Assuming no coinsurance penalty applies, what is the amount payable after consideration of the deductible and policy limits?
- (A) \$3,901,000.
  - (B) \$3,910,000.
  - (C) \$4,391,000.
  - (D) \$4,401,000.
  - (E) \$4.791,000.
- 46.** Which of the following is true regarding the "No Benefit to Bailee" condition used in commercial property forms?
- (A) Limits a bailee's liability for damages to the property of others in the bailee's care, custody, and control.
  - (B) Is intended to defeat a bailee's attempts to limit its liability for damages to property insured by the bailor.
  - (C) Makes the bailee's insurance secondary to insurance of the bailor.
  - (D) Defeats the insurer's right of subrogation against the bailee.
  - (E) Requires the insured to hold harmless any bailee who has temporary custody of the insured's property.



- 47.** Which of the following statements concerning the Agreed Value optional coverage available for purchasers of the Business and Personal Property Coverage Form is NOT true?
- (A) This option removes any uncertainty regarding compliance with the coinsurance clause.
  - (B) Insurers typically require proof of value before providing agreed value coverage.
  - (C) Agreed values of property are shown on the policy's declarations page.
  - (D) If the limit of insurance is less than the agreed value, the full agreed value of property destroyed by a covered cause of loss will be paid.
  - (E) If this coverage option is not renewed, the Coinsurance condition is reinstated.
- 
- 48.** Which of the following factors does NOT result in higher premiums on commercial property insurance?
- (A) Larger limits of insurance.
  - (B) Smaller deductible amounts.
  - (C) Broader covered causes of loss.
  - (D) Higher coinsurance requirements.
  - (E) Additional optional coverages.

- 49.** The most widely used general liability insurance form is the Insurance Services Office, Inc. (ISO) Commercial General Liability (CGL) policy. Which of the following statements about the CGL are true?
- I. It can be written to cover the insured's legal liability arising from premises and operations.
  - II. It can be written to cover the insured's legal liability arising from products and completed operations.
  - III. It can be included in a Commercial Package Policy that provides coverage for both property and liability losses.
- (A) I only.
  - (B) II only.
  - (C) III only.
  - (D) I and II only.
  - (E) I, II, and III.

- 50.** The most widely used general liability insurance form is the Insurance Services Office, Inc. (ISO) Commercial General Liability (CGL) policy. Which of the following is NOT covered by the CGL with respect to the insured's legal liability?
- (A) Bodily injury.
  - (B) Property damage.
  - (C) Personal injury.
  - (D) Intentional injury.
  - (E) Advertising injury.

**51.** Which of the following are paid by the Commercial General Liability form's Coverage C – Medical Payments?

- I. Only medical expenses for which the insured is legally liable.
- II. Medical expenses arising from injuries resulting from an accident occurring on the insured's premises.
- III. Medical expenses from injuries arising out of the insured's completed operations.

- (A) I only.
- (B) II only.
- (C) I and II only.
- (D) II and III only.
- (E) I, II, and III.

**52.** Which of the following statements regarding certain supplementary payments under Coverages A and B of the Commercial General Liability policy are true?

- I. Such payments are in addition to the policy limits.
- II. Such payments are used to pay for court costs.
- III. Such payments are used to pay for prejudgment interest on amounts awarded to the plaintiff.

- (A) I only.
- (B) II only.
- (C) I and II only.
- (D) II and III only.
- (E) I, II, and III.

- 53.** Chip is a volunteer worker at his church's mid-week adult day care facility. He accidentally spilled hot coffee on one of the elderly participants, Mary. After being treated for third-degree burns, Mary sued both the church and Chip for damages resulting from her injury. The church is insured under the Commercial General Liability (CGL) policy. Which one of the following statements is true?
- (A) The church cannot be sued because it operates the adult day care facility as a charity at no charge to participants.
  - (B) Mary cannot sue the church because she voluntarily participated in the adult day care program.
  - (C) No coverage applies because the CGL only covers commercial businesses.
  - (D) Only the church would be covered by the CGL as a named insured.
  - (E) Both the church and Chip would be covered as insureds under the CGL policy.
- 
- 54.** The owner, who also is the landlord, of an office building has Premises and Operations coverage under a Commercial General Liability (CGL) policy with a general aggregate limit of \$5 million. The policy does not contain a Products and Completed Operations aggregate limit. Which of the following is true regarding any damages caused by products and completed operations for which the insured is liable?
- (A) The damages will not be covered by the CGL.
  - (B) The damages will be paid without regard to fault.
  - (C) The damages will be paid without regard to limit.
  - (D) The damages will be applied to the policy's general aggregate limit.
  - (E) The damages will be paid up to \$5 million in excess of the policy's general aggregate limit.

- 55.** In the United States, which of the following is true regarding workers compensation?
- (A) Workers Compensation is governed by a system of laws that vary from state to state.
  - (B) A federal system that assures uniformity across the country governs workers compensation insurance.
  - (C) Workers Compensation is an exclusive remedy that effectively shields employers from all liability suits for work-related injuries.
  - (D) Workers Compensation statutes require employers to purchase insurance as the exclusive way to demonstrate financial responsibility to pay claims for work-related injuries to their employees.
  - (E) Employers that cannot meet workers compensation insurers' underwriting criteria are left to rely on their Employers Liability insurance policy.
- 
- 56.** Workers compensation statutes apply to virtually all industrial workers and to most other kinds of private employment. However, there are a few exceptions to the requirement to have workers compensation coverage. Which of the following is NOT an exception?
- (A) Casual employees only hired for a short period of time.
  - (B) Employees in certain states that do not require coverage in firms with few employees.
  - (C) Full-time employees who are paid without formal acknowledgment of employment status.
  - (D) Domestic workers in states that exempt their employers from obtaining coverage.
  - (E) Farm laborers in states that exempt their employers from obtaining coverage.

**57.** Which of the following are true regarding the Voluntary Compensation and Employers Liability endorsement to the Workers Compensation and Employers Liability (WC & EL) insurance policy?

- I. It extends workers compensation coverage for types of employment typically exempt from statutorily mandated coverage.
- II. It allows the employer to have the insurer pay benefits in excess of those required by statute in cases of severe work-related injuries.
- III. It extends coverage to employees who are residents or citizens of the United States or Canada but temporarily outside those countries for business purposes.

- (A) I only.
- (B) II only.
- (C) I and II only.
- (D) I and III only.
- (E) I, II, and III.

**58.** Which of the following is true regarding “drop-down” coverage that pays claims for which the underlying commercial liability policies do not provide coverage, regardless of aggregate limits?

- I. It is provided by commercial excess liability insurance.
- II. It is provided by commercial umbrella insurance.
- III. It is typically subject to a self-insured retention.

- (A) I only.
- (B) II only.
- (C) I and III only.
- (D) II and III only.
- (E) I, II, and III.

**59.** Which of the following is NOT a way that aircraft insurance resembles auto insurance?

- (A) Both are divided into liability and physical damage sections.
- (B) Both require strict qualification and licensing of drivers or pilots.
- (C) Both exclude obligations of the insured under workers compensation laws.
- (D) Both exclude loss due to wear and tear, mechanical breakdown, or tire damage.
- (E) Both may contain non-liability payment of medical expenses for occupants.

**60.** Which of the following is an important difference between coverage provided by commercial general liability (CGL) insurance and coverage provided by professional liability and management liability insurance?

- (A) Costs of legal defense often are paid within (not in addition to) policy limits in CGL policies while these costs are paid in addition to policy limits in professional liability and management liability policies.
- (B) Unlike CGL policies, legal liability must be admitted by the insured for coverage to apply under professional liability and management liability policies.
- (C) Professional liability and management liability policies are written with a claims-made trigger less frequently than are CGL policies.
- (D) The CGL often has large limits of liability coverage while professional liability and management liability policies have smaller limits.
- (E) Unlike CGL policies, professional liability and management liability policies often give the insured the right to participate in the decision regarding whether or not a claim should be settled or contested.

**Answers to February 10, 2014 Introduction to General Insurance Exam**

<b>Question</b>	<b>Answer</b>	<b>Question</b>	<b>Answer</b>	<b>Question</b>	<b>Answer</b>
1	B	21	A	41	D
2	D	22	A	42	C
3	C	23	B	43	D
4	B	24	C	44	E
5	A	25	B	45	C
6	C	26	B	46	B
7	E	27	D	47	D
8	C	28	C	48	D
9	B	29	D	49	E
10	E	30	B	50	D
11	A	31	B	51	B
12	D	32	D	52	E
13	B	33	C	53	E
14	B	34	D	54	D
15	E	35	E	55	A
16	D	36	D	56	C
17	E	37	A	57	A
18	A	38	C	58	D
19	C	39	D	59	B
20	D	40	E	60	E



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**SOCIETY OF ACTUARIES**  
**Introduction to Ratemaking & Reserving**

# **Exam GIIRR**

## **MORNING SESSION**

**Date:** Wednesday, October 30, 2013

**Time:** 8:30 a.m. – 11:45 a.m.

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### **INSTRUCTIONS TO CANDIDATES**

#### **General Instructions**

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).
  - a) The morning session consists of 13 questions numbered 1 through 13.
  - b) The afternoon session consists of 8 questions numbered 14 through 21.

The points for each question are indicated at the beginning of the question.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

#### **Written-Answer Instructions**

1. Write your candidate number at the top of each sheet. Your name must not appear.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets since they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam GIIRR.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Tournez le cahier d'examen pour la version française.



**\*\*BEGINNING OF EXAMINATION\*\***  
**Morning Session**

- 1.** (4 points) All automobile insurance policies for A-Z Insurance Company sold in 2012 have premiums paid annually of 1,680. Effective January 1, 2013, there was a 20% rate increase for all new and renewal policies.

You are given the following information for three policies:

<b>Policy Number</b>	<b>Effective Date</b>	<b>Policy Status as of 12/31/2013</b>
14902	09/01/2012	Cancelled 02/28/2013
14903	12/16/2012	Expired 12/15/2013
14904	06/16/2013	In-force as of 12/31/2013

Assume all months count as 1/12th of a year, and approximate mid-month dates as one half of a month.

- (a) (3 points) Calculate the total earned exposure units and total earned premium in each of the four calendar quarters in 2013.
- (b) (1 point) Calculate the total unearned premium at December 31, 2012 and December 31, 2013.

2. (5 points) You are investigating data triangles from your company's liability line of business. The annual trend is expected to be 9%.

- (a) (1 point) Describe the patterns that would be expected in the triangle of average reported claims (i.e., reported severities) and in the triangle of the ratios of closed to reported counts in a stable environment.

You have calculated the average case estimate triangle as follows:

Accident Year	Average Case Estimate by Month of Development				
	12	24	36	48	60
2008	4,505	5,126	5,467	6,730	8,256
2009	4,723	4,950	5,734	8,235	
2010	5,246	5,679	6,934		
2011	5,436	7,924			
2012	6,234				

- (b) (1 point) Determine whether the above triangle of average case estimates is representative of a stable environment.
- (c) (1 point) Identify two reasons why historical reported claims may not be appropriate for use in a traditional development-based projection method.
- (d) (2 points) Describe an approach, for each of the two reasons identified in (c), that the actuary can implement for use in a development-based projection.

3. (5 points) You are given the following information to formulate rates for the forecast period for a company that writes kite manufacturer product liability policies:

Experience Period	Total Kite Sales Revenue	Distribution of Sales by Policy Limits	
		1 Million	2 Million
2010	96,000	53%	47%
2011	100,000	50%	50%
2012	150,000	65%	35%
2013	110,000	48%	52%
<b>Forecast Period</b>			
2015	120,000	45%	55%
<b>Current Limit Differential</b>		1.00	1.50

The exposure base for the product liability insurance policy is sales revenue and the assumed annual trend in sales revenue for the experience and forecast periods is 5%. All policies are annual and are assumed to be written uniformly throughout the year.

- (a) (1 point) Describe the purpose of premium trend and on-level factors.
- (b) (2 points) Calculate premium trend factors to apply to each of the four years in the experience period.
- (c) (1 point) Assign weights to each year in the experience period and describe the rationale for such weights.
- (d) (1 point) Explain how the premium trend factors would be affected by the following:
  - (i) A 10% rate increase that is implemented at the beginning of 2014.
  - (ii) The introduction of a loyalty discount program at the beginning of 2015.

4. (7 points) Assume that the information in the table below represents the experience for a portfolio of automobile third-party liability coverage and that the annual pure premium trend is 2.1%.

Accident Year	On Level Earned Premium	Paid Claims	Paid Cumulative Development Factors
2009	14,900	6,200	1.50
2010	14,800	4,600	2.30
2011	14,400	2,200	4.80
2012	14,900	800	18.70

- (a) (4 points) Calculate the projected ultimate claims using the Cape Cod method with paid claims.

You have also calculated the projected ultimate claims using the Cape Cod method with reported claims. The projected ultimate claims using reported claims are significantly greater than the projected ultimate claims using paid claims.

- (b) (1 point) Explain two situations that could result in such a difference in Cape Cod projections based on paid and reported claims.
- (c) (1 point) Describe how the actuary can incorporate professional judgment in the Cape Cod method.
- (d) (1 point) Explain the major difference between the Bornhuetter Ferguson and Cape Cod projection methods.

5. (4 points) You have submitted an automobile insurance rate filing to the regulator. This line of business has a mandatory coverage as well as an optional coverage, and fixed expenses have been allocated to both mandatory and optional coverages in determining the overall rate change indications.

The following information was submitted to the regulator:

	<b>Mandatory Coverage</b>	<b>Optional Coverage</b>
Trended ultimate claims (000)	2,250	1,695
Trended earned premium at current rate level (000)	3,260	2,190
ULAE as a ratio to claims	8.0%	8.0%
Variable expenses as a percentage of premium	10.0%	10.0%
Profit and contingencies as a percentage of premium	5.0%	5.0%
Fixed expenses as a ratio to premium at current rate level	11.5%	11.5%
Indicated Rate Change	1.2%	11.9%
Proposed Rate Change Submitted to Regulator	0.0%	10.0%

The regulator has responded to your rate filing submission and is asking you to allocate all fixed expenses to the mandatory coverage.

- (a) (2.5 points) Determine the revised indicated rate change for both the mandatory coverage and optional coverage by allocating all fixed expenses to the mandatory coverage.
- (b) (1.5 points) Draft a response to the regulator outlining why you believe your expense allocation method is more appropriate.

6. (4 points) You are projecting ultimate claims for Dunkum Auto Insurer for its third-party automobile property damage coverage. Investigative testing and interviews with management have led you to believe that a Berquist Sherman adjustment may be necessary.

You are given the information in the following table about closed and ultimate counts:

Closed Counts at Maturity Ages in Months					Selected Ultimate Counts
Accident Year	12	24	36	48	
2009	1,777	2,310	2,541	2,617	2,617
2010	1,884	2,449	2,514		2,800
2011	1,997	2,345			2,938
2012	1,860				3,081

- (a) (1 point) Describe two situations where Berquist Sherman methods are most commonly implemented.
- (b) (1 point) Recommend disposal ratios for each maturity age.
- (c) (1 point) Calculate the development triangle of adjusted closed counts using your recommended ratios from (b).

You determine that the best relationship between closed counts and cumulative paid claims (in thousands) can be described by an exponential curve of the form  $y = ae^{bx}$ , where  $y$  represents cumulative paid claims and  $x$  represents closed counts. Your analysis shows that the parameters for accident year 2009 from 24 to 36 months are  $a = 2,345.11$  and  $b = 0.00047$ .

- (d) (1 point) Calculate adjusted paid claims at December 31, 2011 for accident year 2009 using the information above and the adjusted closed count triangle.



7. (4 points) Grossi and Kunreuther define two types of uncertainty, aleatory and epistemic.

The definitions are:

“Aleatory uncertainty is the inherent randomness associated with natural hazard events ...”

“... epistemic uncertainty is the uncertainty due to lack of information or knowledge of the hazard.”

- (a) (2 points) Provide an example of each type of uncertainty with regard to earthquake models and explain why each example reflects that type of uncertainty.
- (b) (1 point) Describe which of these types of uncertainty can be reduced by collecting more data, and illustrate your response using your example from part (a).
- (c) (1 point) Explain how logic trees can be used to reflect epistemic uncertainty in the construction of exceedance probability curves.

8. (5 points) You are given the following claims information about an insurer that has been operating for three years:

Accident Year	Paid Claims at Maturity Ages			Ultimate Claims	Case Estimates as of Dec. 31, 2012
	12	24	36		
2010	7,000	9,000	10,000	10,000	0
2011	5,000	8,000		10,000	1,000
2012	4,000			10,000	4,000

Paid ULAE is equal to 500, 800, and 1,000 in calendar years 2010-2012, respectively. For each accident year, 50% of claims are expected to be paid during the first 12 months, 30% from 12 to 24 months, and 20% from 24 to 36 months.

- (a) (0.5 points) Describe two of the key assumptions of the classical paid-to-paid method.
- (b) (1.5 points) Estimate unpaid ULAE as of December 31, 2012 using the classical paid-to-paid method and a multiplier of 50%. Justify any selections.
- (c) (0.5 points) Describe the Kittel refinement to the classical paid-to-paid method and the weakness it is designed to address.
- (d) (1 point) Explain the weakness of the classical paid-to-paid method that the Mango-Allen smoothing adjustment is designed to address and identify a situation in which it would be useful.
- (e) (1 point) Estimate unpaid ULAE as of December 31, 2012 using the classical paid-to-paid method, a multiplier of 50%, and the Mango-Allen smoothing adjustment.
- (f) (0.5 points) Compare the significance of ULAE for reinsurers to that of primary insurers and explain the reason for any difference.

9. (5 points) You are revising your company's automobile insurance rates to include the new risk characteristic *color of car*, without introducing any change to the overall average rate level. The information in the following table was provided for the classification analysis:

Car Color	Trended Earned Premium at Current Rate Level	Trended Ultimate Claims	Ultimate Counts
White	568,000	449,000	775
Black	780,000	606,000	935
Other	1,150,000	837,000	1,635
Total	2,498,000	1,892,000	3,345

The full credibility standard is 1,537 ultimate counts.

The square root rule is used for partial credibility.

The complement of credibility is equal to 1.

- (a) (2 points) Calculate the indicated class relativities for the risk characteristic *color of car*.
- (b) (0.5 points) Explain what is implied by a complement of credibility of 1.
- (c) (1.5 points) Determine the *color of car* classification relativities and the revised base rate assuming a base class of *other*, given that the current base rate is 475.
- (d) (1 point) Describe how you could check the risk characteristic *color of car* for distributional bias relative to another risk characteristic such as *territory*.

- 10.** (5 points) You are calculating premium liabilities for Acme Insurance Company, which writes only property and liability business.

Line of Business	Unearned Premiums as of Dec. 31, 2013	2011 Ultimate Accident Year Claims Ratio	2012 Ultimate Accident Year Claims Ratio	2013 Ultimate Accident Year Claims Ratio
Gross of Reinsurance				
Property	120,000	60%	500%	50%
Liability	120,000	90%	85%	95%
Net of Reinsurance				
Property	100,000	55%	100%	55%
Liability	100,000	90%	95%	100%

- The claims ratios include ALAE, but not ULAE.
  - The 2012 claims ratios on property reflect the impact of a 1-in-100 year hurricane.
  - ULAE is 10% of claims (including ALAE), which is not covered by reinsurance.
  - There are no reinsurance costs beyond what is reflected in the net unearned premiums.
  - Maintenance expenses are 5% of gross unearned premiums.
  - Commission of 15% of premiums has already been paid. There is no incentive commission.
- (a) (1.5 points) Select expected claim ratios for each line of business, gross and net of reinsurance, that will be used in the determination of premium liabilities. Justify each selection.
- (b) (2 points) Calculate the net premium liabilities for Acme as of December 31, 2013 given the selected expected claim ratios in (a) and the information provided.
- (c) (0.5 points) Explain the purpose of a premium deficiency reserve.
- (d) (0.5 points) Determine, based on your calculations in (b), Acme's premium deficiency reserve as of December 31, 2013.
- (e) (0.5 points) Explain how premium liabilities for Acme would change if some of the liability policies are written using sales as an exposure base that are subject to audit following the end of the policy period.

- 11.** (4 points) You have been given the following information for a projection of ultimate claims:

<b>Accident Year</b>	<b>Actual Reported Claims</b>	<b>A Priori Expected Claims</b>	<b>Reported CDF</b>
2008	57,800	62,000	1.00
2009	53,100	59,500	1.05
2010	25,200	51,000	1.10
2011	20,600	49,000	1.50
2012	19,300	52,100	2.00

- (a) (2 points) Develop an estimate of ultimate claims for 2008 and 2012 using the following methods:
- (i) Development method
  - (ii) Expected method
  - (iii) Bornhuetter Ferguson method
  - (iv) Benktander method, one iteration
- (b) (1 point) Evaluate the reasonableness of the inputs for the Bornhuetter Ferguson method.
- (c) (1 point) Select estimates of ultimate claims for 2008 and 2012 and justify your selections.

- 12.** (4 points) Claim sizes in a particular year are uniformly distributed on (0, 100). Over a number of years, inflation doubles all claim sizes.
- (a) (1 point) Illustrate this inflationary trend effect on the layer from 0 to 50 and the layer from 50 to 100 using a graph with cumulative claim frequency along the x-axis and claim size along the y-axis.
- (b) (3 points) Determine the inflationary trend factors that apply to each of the following layers using the graph from (a):
- (i) 0 to 50
  - (ii) 50 to 100
  - (iii) 0 to 100

- 13.** (4 points) A mature claims-made policy sold in 2013 has expected claims of 625, distributed such that expected claims with accident year lag  $k$  are  $500 \times (0.2)^k$ . This pattern is expected to persist with future annual report year claim trend of 10%.
- (a) (1 point) Calculate the expected claims on an occurrence policy sold in 2013.
  - (b) (1 point) Calculate the second-year claims-made step factor.
  - (c) (1 point) Calculate the second-year claims-made tail factor.
  - (d) (0.5 points) Identify the gap in coverage that can arise when changing from claims-made coverage with one insurer to claims-made coverage with a different insurer.
  - (e) (0.5 points) Explain how the gap in (d) can be addressed.

**\*\*END OF EXAMINATION\*\***  
**Morning Session**

**USE THIS PAGE FOR YOUR SCRATCH WORK**



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**SOCIETY OF ACTUARIES**  
**Introduction to Ratemaking & Reserving**

# **Exam GIIRR**

## **AFTERNOON SESSION**

**Date:** Wednesday, October 30, 2013

**Time:** 1:30 p.m. – 3:45 p.m.

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### **INSTRUCTIONS TO CANDIDATES**

#### **General Instructions**

1. This afternoon session consists of 8 questions numbered 14 through 21 for a total of 40 points. The points for each question are indicated at the beginning of the question.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
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Tournez le cahier d'examen pour la version française.





**\*\*BEGINNING OF EXAMINATION\*\***

**Afternoon Session  
Beginning with Question 14**

- 14.** (6 points) You are given a table of reported claims and the corresponding age-to-age factors:

Accident Year	Reported Claims Maturity Age in Months						
	12	24	36	48	60	72	84
2006	13,944	16,887	18,990	20,178	21,040	21,708	22,209
2007	10,150	12,078	13,509	14,261	14,815	15,315	
2008	8,626	10,322	11,561	12,200	12,740		
2009	8,366	10,081	11,292	11,993			
2010	6,380	7,541	8,478				
2011	5,962	7,201					
2012	10,190						

Accident Year	Reported Claims Age-to-Age Factors Maturity Age Interval in Months					
	12 - 24	24 - 36	36 - 48	48 - 60	60 - 72	72 - 84
2006	1.211	1.125	1.063	1.043	1.032	1.023
2007	1.190	1.118	1.056	1.039	1.034	
2008	1.197	1.120	1.055	1.044		
2009	1.205	1.120	1.062			
2010	1.182	1.124				
2011	1.208					
Simple 3-year Average	1.198	1.121	1.058	1.042	1.033	1.023

- (a) (1.5 points) Calculate three alternative average age-to-age factors for the interval 12-24, based on:
- (i) Volume weighted 3-year
  - (ii) Medial 5x1
  - (iii) Geometric 3-year
- (b) (1 point) List three considerations in selecting age-to-age factors.

## 14. Continued

You have decided to use the simple 3-year average with the original Bondy method as the tail factor.

- (c) *(1.5 points)* Calculate the percentage of incremental reported claims expected between 48 and 60 months.

The reported claims for 2012 contain a single large claim of 4,000.

- (d) *(1 point)* Calculate the ultimate claims for this accident year both with and without a large claim adjustment.
- (e) *(1 point)* State an assumption underlying each approach in (d).

**15.** (4 points)

- (a) (1 point) State the two basic principles on which prospective experience rating plans are based.
- (b) (2 points) Propose an experience rating formula and explain how it takes into account these two basic principles.

An insured company, WC Plumbing, reported a substantial operating loss in the latest year. Given that it experienced only three claims during the year, it is considering enrollment in a retrospective rating plan in an attempt to save on insurance costs.

- (c) (1 point) Recommend whether, from WC Plumbing's perspective, it would be a good candidate for retrospective rating and justify your recommendation.



- 16.** (6 points) You are conducting a ratemaking analysis for a portfolio of automobile insurance policies and are given the information in the following two tables:

<b>Calendar Year</b>	<b>General and Other Acquisition Expenses</b>	<b>Direct Earned Premiums</b>
2008	108,000	691,000
2009	138,000	725,000
2010	115,000	770,000
2011	126,000	834,000
2012	130,000	866,000

Budgeted Direct Earned Premium at Current Rate Level	895,000
Budgeted Exposure Counts (vehicles)	1,150
Weighted Average Trended Pure Premium	476.00
ULAE as a Ratio to Claims	8.0%
Commissions as a Percentage of Premium	12.0%
Premium Taxes as a Percentage of Premium	2.0%
Licenses as a Percentage of Premium	1.0%
Profit and Contingencies Factor	3.0%

- (a) (2 points) Select a fixed and variable expense ratio as a percentage of direct earned premiums to be used for ratemaking purposes assuming that historically 30% of general and other acquisition expenses are considered to be fixed expenses. Justify your selection.
- (b) (2 points) Calculate the indicated rate and indicated rate change given the selected fixed expense ratio from (a).

Recent rate changes and shifts in the mix of business can lead to distortions when using an approach based on a selected fixed expense percentage applied to a projected average premium for ratemaking.

- (c) (2 points) Explain how each of these situations can affect the level of fixed expenses in a ratemaking analysis and recommend a solution for each to avoid potential distortion.

17. (5 points) Student Insurance Company writes four-month property policies for university students living in apartments. Policies are issued according to the university terms, which are Fall (September 1 to December 31), Spring (January 1 to April 30), and Summer (May 1 to August 31). Assume an annual frequency trend of 0% and an annual severity trend of 2.5%.

Accident Period	Reported Counts at Maturity Age in Months						Exposures	Ultimate Severity
	4	8	12	16	20	24		
Summer 2010	2,510	5,010	7,079	7,079	7,079	7,079	250,000	2,300
Fall 2010	1,401	4,221	10,287	10,287	10,287	10,287	350,000	2,320
Spring 2011	3,009	4,805	8,672	8,672	8,672	8,672	300,000	2,340
Summer 2011	2,622	5,240	7,614	7,614	7,614	7,614	262,500	2,360
Fall 2011	1,466	4,406	10,696	10,696	10,696	10,696	367,500	2,380
Spring 2012	3,137	5,030	9,293	9,293	9,293		315,000	2,400
Summer 2012	2,687	5,422	7,912	7,912			270,000	2,420
Fall 2012	1,504	4,527	11,339				378,000	2,440
Spring 2013	3,246	5,163					324,000	2,460
Summer 2013	2,761						277,500	2,480

Accident Period	Age-to-Age Factors				
	Maturity Age Interval in Months				
	4-8	8-12	12-16	16-20	20-24
Summer 2010	2.00	1.41	1.00	1.00	1.00
Fall 2010	3.01	2.44	1.00	1.00	1.00
Spring 2011	1.60	1.80	1.00	1.00	1.00
Summer 2011	2.00	1.45	1.00	1.00	1.00
Fall 2011	3.01	2.43	1.00	1.00	1.00
Spring 2012	1.60	1.85	1.00	1.00	
Summer 2012	2.02	1.46	1.00		
Fall 2012	3.01	2.50			
Spring 2013	1.59				

Project ultimate claims for Spring 2013 and Summer 2013 using a frequency-severity method given the information above, and justify all selections.

**18.** (4 points) Big Cat Insurance Company (BCI) is considering entering into a securitization agreement with respect to hurricane losses in a well-defined geographic region. One of its concerns with regard to such agreements is basis risk.

(a) (1 point) Define basis risk and describe how it can occur in this context.

BCI is considering four types of securitization:

- I. Indemnity-based securitization
- II. Index-based transaction
- III. Parametric indices
- IV. Notional portfolio

(b) (2 points) State if there is basis risk for BCI with each of these securitization types. If there is no basis risk, explain why not, and if there is basis risk, explain how that securitization type creates basis risk.

(c) (1 point) Indicate an action BCI can take to reduce basis risk for two of the securitization types that you identified as having basis risk.

19. (5 points) The following table of reported counts for Exposition Insurance Company was produced based on information through December 31, 2012:

Accident Year	Reported Counts at Maturity Age in Months							Selected Ultimate Count
	12	24	36	48	60	72	84	
2006	1,492	1,940	2,134	2,198	2,242	2,264	2,287	2,287
2007	1,582	2,056	2,262	2,329	2,376	2,400		2,424
2008	1,676	2,179	2,397	2,469	2,519			2,544
2009	1,777	2,310	2,541	2,617				2,669
2010	1,884	2,449	2,694					2,800
2011	1,997	2,596						2,938
2012	2,116							3,081

You are conducting an actual to expected analysis of reported counts as of April 30, 2013. At your request, your actuarial student Tony produced the table below, based on actual reported counts as of April 30, 2013 that you provided. Tony noted that the percent reported values as of December 31, 2012 were determined by taking the ratio of the reported counts as of December 31, 2012 to the selected ultimate counts. He further noted that linear interpolation was used to obtain the April 30, 2013 cumulative development factors.

Accident Year	Actual Reported April 30, 2013	Expected Reported April 30, 2013	Percent Reported Dec. 31, 2012
2006	2,287	2,287	100.0%
2007	2,409	2,408	99.0%
2008	2,514	2,519	99.0%
2009	2,628	2,626	98.1%
2010	2,710	2,711	96.2%
2011	2,806	2,673	88.4%
2012	2,635	2,318	68.7%

## 19. Continued

- (a) (1 point) Show that Tony's calculation for accident year 2010 is correct, based on the methodology he used.

The selected ultimate counts were based on taking several methods into account (rather than being the result of a strict application of one specific method, such as the development method).

- (b) (2 points) Write a brief note to Tony explaining why it may have been more appropriate to use the cumulative development factors from one specific method for this task.

The actual reported values as of April 30, 2013 for accident years 2011 and 2012 are both larger than expected.

- (c) (2 points) Provide two questions you would pose to your company colleagues in an investigation of this observation.

**20.** (6 points)

- (a) (1 point) Describe two situations for which the expected method would be a preferred approach for projecting ultimate claims.
- (b) (1 point) Define exposure base and leading indicator.
- (c) (1 point) Describe two desirable characteristics of exposures for actuarial work.

You are given the following information about Motor Insurance Company (MI), which has been selling automobile insurance for five years:

- All policies are annual policies and are issued on January 1 of each year.
  - At the 2012 cost level, the expected claim ratio is 75%.
  - At the 2012 cost level, the pure premium is 220.
  - The annual pure premium trend is 2.4%.
  - MI has had no rate changes in the past five years.
  - For 2008, the earned premium is 24,540,000 and earned vehicles are 87,600.
  - Tort reform was instituted on January 1, 2009, resulting in a reduction in severity of 30%.
  - MI introduced a 10% discount on January 1, 2010 that is applicable to 40% of its customers.
- (d) (3 points) Calculate the expected claims for 2008 using the expected method with the following approaches:
- (i) Expected claim ratio
  - (ii) Pure premium

**21.** (4 points)

You are given the following information to calculate deductible factors:

<b>Claim Range</b>	<b>Counts in Interval</b>	<b>Claims</b>
0-250	200	30,000
250-750	300	150,000
>750	100	150,000
Total	600	330,000

- (a) (2 points) Calculate the indicated deductible factors for deductibles of 250 and 750 relative to a base of zero deductible.
- (b) (0.5 points) State two assumptions that you needed to make in using the information above to perform the calculation in part (a).
- (c) (1.5 points) Determine the range into which the deductible factor for a 500 deductible must fall in order to be consistent with the deductible factors calculated in part (a) and explain your reasoning.

**\*\*END OF EXAMINATION\*\***  
**Afternoon Session**

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**SOCIETY OF ACTUARIES**  
**Introduction to Ratemaking & Reserving**

# **Exam GIIRR**

## **MORNING SESSION**

**Date:** Wednesday, April 30, 2014

**Time:** 8:30 a.m. – 11:45 a.m.

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### **INSTRUCTIONS TO CANDIDATES**

#### **General Instructions**

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).
  - a) The morning session consists of 13 questions numbered 1 through 13.
  - b) The afternoon session consists of 9 questions numbered 14 through 22.

The points for each question are indicated at the beginning of the question.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

#### **Written-Answer Instructions**

1. Write your candidate number at the top of each sheet. Your name must not appear.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam GIIRR.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

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**\*\*BEGINNING OF EXAMINATION\*\***  
**Morning Session**

1. (4 points) No Name Insurance Company has written the following general liability policies:

<b>Effective Date</b>	<b>Term</b>	<b>Premium</b>
1/1/2012	Annual	5,000
4/1/2012	Annual	1,000
7/1/2012	6-month	500
10/1/2012	2-year	5,000
1/1/2013	Annual	2,000
7/1/2013	Annual	1,500

- (a) (3 points) Calculate earned and written premium for calendar years 2012 and 2013. No Name does not treat multi-year policies as multiple annual policies.
- (b) (1 point) Explain how the calculation of written and earned premium might be different if No Name Insurance Company wrote motorcycle policies in a winter climate instead of general liability policies.

2. (7 points) You are given the following information:

Accident Year	Reported Claims					Earned Premium
	12	24	36	48	60	
2009	140	280	336	356	363	605
2010	150	330	389	416		700
2011	120	240	288			525
2012	110	242				520
2013	130					500

Accident Year	Age-to-Age Development Factors			
	12-24	24-36	36-48	48-60
2009	2.00	1.20	1.06	1.02
2010	2.20	1.18	1.08	
2011	2.00	1.19		
2012	2.20			

- No development is expected after 60 months.
  - Paid claims for accident year 2013 as of December 31, 2013 total 75.
- (a) (1 point) Estimate the unpaid claims for accident year 2013 using the development method with simple all-year average development factors.
- (b) (0.5 point) Calculate the accident year 2012 claims expected to be reported in 2014 using the development factors from part (a).
- (c) (0.5 point) State the two primary assumptions of the development method.
- (d) (1 point) Estimate the ultimate claims for accident year 2012 using the Bornhuetter Ferguson method with an expected claim ratio of 60%.
- (e) (0.5 point) Describe two situations when the Bornhuetter Ferguson method may be preferable to the development method.
- (f) (1.5 point) Compare actual reported claims to expected reported claims for accident year 2012 and comment on the reasonableness of the Bornhuetter Ferguson method.

## 2. Continued

You are monitoring the results given the following information:

Accident Year	Selected Ultimate Claims	Expected Percent Reported at Dec. 31, 2013	Reported Claims at Mar. 31, 2014	Actual versus Expected Reported Claims from Dec. 31, 2013 through Mar. 31, 2014		
				Actual	Expected	Difference
2009	363	100%	363	0	0.0	0.0
2010	428	98%	426	10	3.0	7.0
2011	312	92%	296	8	4.5	3.5
2012	314	77%	259	17	11.7	5.3
2013	320	37%	178			

- (g) (1 point) Calculate the difference between the actual and expected reported claims from December 31, 2013 through March 31, 2014 for accident year 2013, using linear interpolation of the expected percent reported.
- (h) (1 point) Identify two questions you might ask in your further investigation based on the results from part (g).

3. (4 points) You are given the following censored data:

Claim Range	Counts In Interval	Capped Claims
<b>1,000,000 Limit Policies</b>		
0 – 1,000,000	3,333	858,000,000
<b>2,000,000 Limit Policies</b>		
0 – 1,000,000	2,900	629,000,000
1,000,000 – 2,000,000	305	470,000,000
<b>3,000,000 Limit Policies</b>		
0 – 1,000,000	3,100	625,000,000
1,000,000 – 2,000,000	330	533,000,000
2,000,000 – 3,000,000	32	77,000,000

- (a) (2.5 points) Calculate the increased limits factors for the 2,000,000 and 3,000,000 policy limits, assuming a 1,000,000 basic limit.
- (b) (0.5 point) Determine the range into which a 4,000,000 increased limits factor should fall, considering consistency with the factors determined in part (a).
- (c) (0.5 point) Explain why consistency is important for increased limits factors.
- (d) (0.5 point) Explain why it is important to know whether claims have been capped or not in determining increased limits factors.

4. (5 points) You are given the following information as of December 31, 2013:

Accident Year	Incremental Closed Counts			Selected Ultimate Counts
	12	24	36	
2011	600	280	120	1,000
2012	660	308		1,100
2013	720			1,200
<b>Selected Proportion of Closed Counts</b>	<b>60%</b>	<b>70%</b>	<b>100%</b>	

Accident Year	Incremental Paid Claims		
	12	24	36
2011	774,000	1,535,000	1,839,000
2012	632,000	1,258,000	
2013	1,292,000		

- No development was observed or is expected after 36 months.
  - Assume the annual severity trend is 3.5%.
- (a) (3 points) Estimate total unpaid claims as of December 31, 2013 using the claims closure method.
- (b) (1 point) Discuss how the following additional information would affect your estimate in part (a):
- (i) New legislation lengthens the statute of limitations.
  - (ii) The company introduces a new system to accelerate claims processing and settlement.
- (c) (1 point) Describe a situation in which a frequency and severity method is preferred to other projection methods.

- 5.** (4 points) A fundamental relation connecting the insurance savings,  $\psi(r)$ , and the insurance charge,  $\phi(r)$ , in a retrospective rating plan is  $\psi(r) = \phi(r) + r - 1$ , where  $r$  is the entry ratio.
- (a) (1 point) Describe the insurance savings and insurance charge.
  - (b) (1 point) Draw a graph with cumulative claim frequency along the x-axis and entry ratio along the y-axis, and identify the areas on the graph corresponding to  $\psi(r)$  and  $\phi(r)$ .
  - (c) (1 point) Explain how the graph demonstrates the validity of the fundamental relation above.
  - (d) (1 point) Define  $\psi(r)$  for the limiting case where losses are all equal.



6. (5 points) You are given the following two triangles:

Accident Year	Reported Claims Gross of Salvage – Personal Property			
	12	24	36	48
2010	500	950	1,055	1,066
2011	525	998	1,108	
2012	551	1,047		
2013	579			

Accident Year	Reported Salvage – Personal Property			
	12	24	36	48
2010	21	63	107	139
2011	22	66	112	
2012	23	69		
2013	35			

Assume a reported claims tail factor at 48 months of 1.00 and a reported salvage tail factor at 48 months of 1.15.

Estimate ultimate salvage for accident year 2013 using two different methods.

7. (4 points)

- (a) (1 point) Provide two examples of expense items that are typically unallocated loss adjustment expenses (ULAE) and two examples of expense items that are typically allocated loss adjustment expenses (ALAE).

Simple Insurance Company plans to use the data in the table below to estimate unpaid ULAE as of December 31, 2013.

Calendar Year	Paid Claims	Reported Claims	Paid ULAE
2011	1,200	1,300	110
2012	1,100	1,100	110
2013	1,000	900	110
Total	3,300	3,300	330

- The total of case estimates as of December 31, 2013 is 900.
  - The total IBNR as of December 31, 2013 is 1,000.
- (b) (1 point) Explain one weakness of the classical paid-to-paid ULAE estimation method using the data from the table above.
- (c) (1 point) Estimate unpaid ULAE as of December 31, 2013 for Simple Insurance Company using the Kittel refinement to the classical paid-to-paid method.
- (d) (1 point) Explain the major steps in determining unpaid ULAE using a count-based method.

8. (4 points) Sinking Sand Insurance Company (SSIC) currently has four portfolios of policies with catastrophe exposure. A recent run of its catastrophe model has produced the following table of possible catastrophe losses in one year. The following statements apply to the model output:

- The six events listed are the only events produced by the model that have catastrophe losses for at least one of the portfolios.
- The events are mutually exclusive. At most one of them can happen in a given year.

Event Number	Probability	Possible Catastrophe Losses in Millions			
		Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4
1	0.003	100	100	400	0
2	0.003	50	100	0	0
3	0.002	100	200	0	0
4	0.002	100	50	0	0
5	0.001	100	100	0	700
6	0.001	50	50	0	0

SSIC's policy is that the probability that total losses in one year on the four portfolios exceed 250 (million) must be less than or equal to 0.005.

To meet its policy goal SSIC is considering dropping one of the portfolios. The following results were obtained from an analysis that omits each of Portfolios 3 and 4.

Measure	With Portfolio 3 Removed	With Portfolio 4 Removed
Expected Value	2.95	3.45
Standard Deviation	34.98	37.56
Probability total losses > 250	0.003	0.005

- (a) (0.5 point) Show that the two probabilities that total losses exceed 250 were correctly calculated.
- (b) (2 points) Recommend which of the two portfolios should be dropped. Justify your choice.
- (c) (1.5 points) Describe each of the following special issues regarding portfolio risk. For each issue, indicate if it is addressed by the analysis performed in part (b) and then support your answer.
- (i) Data quality
  - (ii) Uncertainty modeling
  - (iii) Impact of correlation

**9.** (5 points)

- (a) (0.5 point) Define retroactive date for policies written on a claims-made basis.
- (b) (0.5 point) Give an example of an insurance product for which claims-made coverage is prevalent **and** explain why this type of coverage is appropriate for that type of risk.
- (c) (1 point) Compare claims-made and occurrence coverage on the following features:
  - (i) Cost, given that the underlying frequency and severity are increasing
  - (ii) Precision in pricing, given sudden unpredictable changes in trend or reporting pattern
  - (iii) Opportunity to earn investment income
- (d) (1 point) Explain how coverage gaps can occur for insureds purchasing claims-made coverage by providing two examples.
- (e) (2 points) Calculate the tail factor for a mature claims-made policy given a pure premium of 1,000 for occurrence coverage, a 10% annual pure premium trend, and a claims reporting pattern of 50%, 30%, 20%.

- 10.** (4 points) In conducting investigative analysis for XYZ Insurer, you noted a significant change in case reserve estimates. The following information is provided:

Accident Year	Average Case Estimates		
	12	24	36
2011	5,010	5,890	8,940
2012	5,260	8,450	
2013	7,200		

Accident Year	Open Counts		
	12	24	36
2011	210	175	70
2012	240	190	
2013	250		

Accident Year	Paid Claims		
	12	24	36
2011	610,000	1,840,000	3,250,000
2012	530,000	1,640,000	
2013	570,000		

- Assume the annual severity trend for XYZ Insurer is 5%.
  - Use simple average age-to-age development factors and the Bondy method for the tail factor.
- (a) (3 points) Calculate the projected ultimate claims using the Berquist-Sherman method for XYZ Insurer.

Your analysis of XYZ Insurer has shown that there has also been a change in settlement rates.

- (b) (1 point) Explain how you create the reported claims triangle with the Berquist-Sherman adjustments for changes in both case estimates and settlement rates.

- 11.** (5 points) You are given the following information for a line of business where you are projecting ultimate claims:

<b>Accident Year</b>	<b>Earned Exposures</b>	<b>Reported Claims as of Dec. 31, 2013</b>
2011	5,580	702,000
2012	5,670	545,000
2013	5,460	515,000

<b>Development Period</b>	<b>Age-to-Age Development Factor</b>
12-24	1.50
24-36	1.28
36-48	1.13
48-60	1.04
Tail factor	1.02

- You select an annual frequency trend of 2.2%.
  - You select an annual severity trend of 4.5%.
- (a) (4 points) Estimate the ultimate claims for this line of business using the Cape Cod method.
- (b) (1 point) Identify the three key components of the actuarial control cycle and illustrate with the selection and use of trend rates in reserving and ratemaking.

**12.** (5 points) You are reviewing Specific Insurance Company's estimates of ultimate claims for two books of business where conditions have been changing.

Book of business 1: Volume has remained relatively stable but the underlying claims have been deteriorating over the past ten years.

Book of business 2: Volume and claim experience have remained steady and there has been a strengthening of case estimates.

(a) (2.5 points) Explain whether you expect the estimate of ultimate claims to understate, overstate or be similar to actual ultimate claims for book of business 1, for the following methods:

(i) The expected method

(ii) The development method on reported claims

(iii) The Bornhuetter Ferguson method on reported claims

(b) (2.5 points) Explain whether you expect the estimate of ultimate claims to understate, overstate or be similar to actual ultimate claims for book of business 2, for the following methods:

(i) The expected method

(ii) The development method on reported claims

(iii) The Bornhuetter Ferguson method on reported claims

- 13.** (4 points) You are estimating on-level factors for a book of business that only has annual policies with the following historical rate changes:

<b>Effective Date of Rate Change</b>	<b>Rate Change Percent</b>
July 1, 2011	+7%
April 1, 2013	-3%

In addition, a new discount of 10% was implemented on May 1, 2012 that applied to 20% of all policies and did not affect the level of insurance coverage.

- (a) (0.5 point) State the key assumption that underlies the parallelogram method.
- (b) (3 points) Calculate the on-level factor to be used to adjust calendar year 2011 earned premium to current rates.
- (c) (0.5 point) Explain how you would recognize a state-mandated change in minimum policy limits in the on-level calculation.

**\*\*END OF EXAMINATION\*\***  
**Morning Session**



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**SOCIETY OF ACTUARIES**  
**Introduction to Ratemaking & Reserving**

# **Exam GIIRR**

## **AFTERNOON SESSION**

**Date:** Wednesday, April 30, 2014

**Time:** 1:30 p.m. – 3:45 p.m.

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### **INSTRUCTIONS TO CANDIDATES**

#### **General Instructions**

1. This afternoon session consists of 9 questions numbered 14 through 22 for a total of 40 points. The points for each question are indicated at the beginning of the question.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
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**\*\*BEGINNING OF EXAMINATION\*\***

**Afternoon Session  
Beginning with Question 14**

- 14.** (4 points) The following development triangles have been constructed based on your company's data:

Accident Year	Cumulative Paid Claims			
	12	24	36	48
2010	2,150	4,510	6,480	7,650
2011	2,460	5,190	7,450	
2012	2,370	4,890		
2013	3,260			

Accident Year	Cumulative Reported Claims			
	12	24	36	48
2010	7,010	8,510	9,560	9,890
2011	8,320	10,340	11,150	
2012	9,610	11,620		
2013	9,620			

Accident Year	Cumulative Closed Counts			
	12	24	36	48
2010	22	39	54	64
2011	20	44	62	
2012	25	47		
2013	29			

Accident Year	Cumulative Reported Counts			
	12	24	36	48
2010	76	79	82	83
2011	82	93	94	
2012	98	108		
2013	90			

The following subsequent claim transactions were provided after the above triangles were constructed:

Transaction Date	Transaction Description	Claim ID	Case Estimate	Claim Payment
Mar 7, 2010	Open new claim file	1	150	
Jun 16, 2010	Payment on reported claim file	1		50
May 30, 2011	Open and close new claim file	2		90
Sep 22, 2011	Payment and change in case	1	-90	100
Jan 30, 2012	Open new claim file	3	250	
May 21, 2012	Close reported claim file	1	-60	60
Aug 18, 2012	Payment and change in case	3	-100	140

Claim ID	Occurrence Date
1	Jan 20, 2010
2	Mar 1, 2010
3	Oct 16, 2011

Restate the four data triangles to include the transactions from the subsequently provided claim transaction data.

15. (4 points) The following historical information on a liability line of business is provided:

Experience Period	Percent Earned Exposures by Policy Limits		
	500,000	1,000,000	2,000,000
2011	24%	52%	24%
2012	22%	52%	26%
2013	20%	52%	28%
Current Increased Limits Factors:	0.90	1.00	1.15

- (a) (1 point) Explain the purpose of premium trend adjustments.
- (b) (1.5 points) Calculate *and* select an annual trend due to the shift in policy limits.

You are conducting a ratemaking analysis for this liability line of business for rates to be effective September 1, 2014. The new rates are to be in effect for one year, with 67% of the policies written for an annual term and 33% written for a six-month term.

- (c) (1.5 points) Calculate the trend factor to be used for 2012 earned premium using the annual trend selected in part (b).

- 16.** (6 points) You are an actuary at United Personal Property Insurance (UPPI). You are analyzing the risk classification factors for territory. The information in the following table was provided:

Territory	Trended Ultimate Pure Premium	Ultimate Counts	Written Exposures	Existing Relativity
A	450	1,200	15,200	1.00
B	475	729	12,400	0.95
C	507	635	10,700	1.10

- The full credibility standard is 900 ultimate counts.
  - The square root rule is used for partial credibility.
  - The complement of credibility is assigned to the existing relativity.
- (a) (3 points) Calculate the indicated rating relativities using the pure premium one-way analysis procedure. The indicated relativities should be shown so that the base territory A has no change.

You are also provided with the following information:

Trended Ultimate Pure Premiums				Written Exposures			
	Age of Home				Age of Home		
Territory	0-15 years	16+ years	Total	Territory	0-15 years	16+ years	Total
A	390	510	450	A	7,600	7,600	15,200
B	400	525	475	B	4,960	7,440	12,400
C	461	576	507	C	6,420	4,280	10,700
<b>Total</b>	417	530	<b>474</b>	<b>Total</b>	18,980	19,320	<b>38,300</b>

- (b) (2 points) Calculate the first set of age-of-home factors using the minimum bias procedure. Use the existing territory relativities as inputs to the calculation.
- (c) (1 point) Explain why you expect the rating factors for territory calculated using the one-way procedure to be the same or different than the rating factors for territory calculated using the minimum bias procedure. In your response, give two reasons.

17. (4 points) You are performing investigative testing of development triangles using the following table of ratios:

Accident Half- Year	Ratios of Paid Claims to Reported Claims							
	6	12	18	24	30	36	42	48
2010-1	0.75	0.85	0.90	0.97	0.97	0.98	0.99	1.00
2010-2	0.67	0.83	0.90	0.97	0.98	0.98	0.99	
2011-1	0.74	0.84	0.89	0.97	0.98	0.98		
2011-2	0.67	0.85	0.89	0.97	0.97			
2012-1	0.74	0.83	0.90	0.94				
2012-2	0.67	0.84	0.82					
2013-1	0.70	0.79						
2013-2	0.61							

- (a) (1 point) State two observations about the pattern of the ratios of paid claims to reported claims in the above table.
- (b) (1 point) Explain a possible cause of each observation from part (a).
- (c) (1 point) State two other diagnostics you would review to confirm your observations from part (a), and describe the patterns you expect to see for each diagnostic.
- (d) (1 point) State two examples of actions that could result in shifts in the average reported claims.

- 18.** (5 points) You are provided with the following information as of December 31, 2013 for a company established January 1, 2011:

<b>Accident Year</b>	<b>Earned Premium</b>	<b>Selected Ultimate Claims</b>	<b>General Expenses</b>
2011	45,100	32,470	6,540
2012	47,500	34,680	6,790
2013	49,300	35,000	7,100

Total paid claims as of December 31, 2013	72,400
Total reported claims as of December 31, 2013	88,300
Selected ULAE ratio as a percent of claims	8%
ULAE multiplier	50%
Proportion of general expenses applicable to unearned premium	25%
Unearned premium as of December 31, 2013	32,600

- The selected ultimate claims include ALAE.
  - The provision for unpaid ULAE is determined using the classical paid-to-paid method.
- (a) (2 points) Calculate total unpaid claims as of December 31, 2013, including unpaid ULAE.
- (b) (1 point) State two points the actuary should consider when selecting claim ratios to be used for calculating premium liabilities.
- (c) (1.5 points) Calculate the premium liabilities as of December 31, 2013.
- (d) (0.5 point) Determine either the premium deficiency reserve or the equity in the unearned premium.



- 19.** (4 points) The city of Faultline is in an earthquake zone. CommCo insurance company covers over one-half of the commercial properties in Faultline, but does not offer homeowners insurance. HomeCo insurance company covers over one-half of the single-family homes in Faultline, but does not offer commercial property insurance. Both companies' policies provide comprehensive coverage of all perils.

Three of the components of a catastrophe model are:

- Hazard module
  - Inventory module
  - Vulnerability module
- (a) (1.5 points) Describe each of the components.
- (b) (1.5 points) Indicate similarities (if any) and differences (if any) between the CommCo and HomeCo implementations of an earthquake model for each component. Justify each of your answers.
- (c) (1 point) Compare the analyses required to establish the claims loading for hurricane and non-hurricane weather claims for HomeCo.

**20.** (4 points)

- (a) (1 point) Define the following forms of general insurance rating:
- (i) Manual
  - (ii) Schedule
  - (iii) Prospective experience
  - (iv) Retrospective experience
- (b) (1 point) Explain why retrospective experience rating is typically not appropriate for insureds with small premium size or poor claims experience.

Small Liability self-insurance pool has two members, Centre and Exurb. Both participants and the administrator have decided to change the formula for allocating retained claims and expenses:

- The experience component is currently historical ultimate claims excluding ALAE but prospectively will be historical ultimate claims including ALAE.
- The exposure component is the population estimate and will remain so.
- The pool determines credibility based on the square root rule with a full credibility population standard of 1,000,000.

- (c) (1.5 points) Determine allocation percentages for Centre and Exurb based on the agreed allocation procedure after the change in claims definition described above, given the additional information below:

<b>Pool Participant</b>	<b>Population Estimate</b>	<b>Ultimate Claims (Including ALAE)</b>
Centre	435,600	550,000
Exurb	250,000	700,000
Total	685,600	1,250,000

- (d) (0.5 point) Explain the importance of understanding the distribution of ALAE in the allocation of retained claims and expenses to participants in self-insurance pools.

21. (4 points) The following information was determined from your colleague's initial ratemaking analysis of one of your company's lines of business:

Direct Earned Premium at current rate level	125,000,000
Exposure counts	250,000
Weighted average trended pure premium	350
ULAE as a ratio to claims	9%
Initial total fixed expense per exposure	100
Variable expenses as a ratio to premiums:	
Initial general & other acquisition expenses (variable)	6%
Commissions, premium taxes & licenses	16%
Profit and contingencies as a ratio to premiums	5%

Your review of your colleague's analysis has found that the rate indication was calculated assuming 2/3 of general and other acquisition expenses are fixed and 1/3 are variable, but the split should have been 1/3 fixed and 2/3 variable.

- (a) (1 point) Explain the importance of recognizing the appropriate split between fixed and variable expenses in ratemaking.
- (b) (1 point) Calculate the indicated rate under the initial assumption for the split of general and other acquisition expenses.
- (c) (1 point) Calculate the revised fixed and variable general and other acquisition expenses.
- (d) (1 point) Calculate the revised rate indication using the revised fixed and variable general and other acquisition expenses in part (c).

**22.** (5 points) You are analyzing the claim trend for a line of business that you are pricing.

- (a) (1 point) Explain how portfolio changes in policy deductibles can affect both frequency and severity.
- (b) (1 point) Describe two options to consider when experience is not fully credible for trending.

You are given the following information:

- All policies are six-month policies.
  - New rates are to be effective June 1, 2014.
  - The new rates are expected to be unchanged for all six-month policies written between June 1, 2014 and May 31, 2015.
  - The selected annual frequency trend is  $-1.2\%$  and the selected annual severity trend is  $+5.8\%$ .
  - The experience period is accident years 2012 and 2013.
- (c) (2 points) Calculate the pure premium trend factors for each year in the experience period.
  - (d) (1 point) Explain how the trend factors calculated in part (c) would be calculated if you are pricing a single large policy that renews on June 1, 2014 for a two-year term.

**\*\*END OF EXAMINATION\*\***  
**Afternoon Session**

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**SOCIETY OF ACTUARIES**  
**Introduction to Ratemaking & Reserving**

# **Exam GIIRR**

## **MORNING SESSION**

**Date:** Tuesday, October 28, 2014

**Time:** 8:30 a.m. – 11:45 a.m.

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### **INSTRUCTIONS TO CANDIDATES**

#### **General Instructions**

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).
  - a) The morning session consists of 12 questions numbered 1 through 12.
  - b) The afternoon session consists of 9 questions numbered 13 through 21.

The points for each question are indicated at the beginning of the question.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

#### **Written-Answer Instructions**

1. Write your candidate number at the top of each sheet. Your name must not appear.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets since they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam GIIRR.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

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**\*\*BEGINNING OF EXAMINATION\*\***  
**Morning Session**

- 1.** (5 points) You are given the following information on two 12-month policies you are analyzing:

Policy #1 was originally written on April 1, 2010 for a premium of 900, was renewed each year, and was still in force on December 31, 2013.

Policy #2 was originally written on September 1, 2011 for a premium of 1,200, was renewed on September 1, 2012, and was cancelled on March 1, 2013.

- There was a premium level increase of 5% that was effective July 1, 2012 for each policy upon its renewal.
- All rating characteristics remained the same for each policy at each renewal.

- (a) (2 points) Calculate the 2012 and 2013 calendar year total earned premiums.
- (b) (1 point) Calculate the 2012 calendar year total written premiums.
- (c) (1 point) Calculate the total unearned premiums as of December 31, 2012.

You are adjusting premiums to current rate levels for a ratemaking analysis.

- (d) (1 point) Calculate the 2012 total earned premiums adjusted to current rate level.



2. (6 points) You are given the following information:

Accident Year	Cumulative Reported Claims			
	12	24	36	48
2010	44,200	62,600	79,200	82,000
2011	48,600	70,300	86,900	
2012	55,000	78,600		
2013	60,800			

The following two unusually large claims (one in 2011 and the other in 2013) are included in the above reported claims triangle:

Accident Year	Cumulative Reported Large Claims		
	12	24	36
2011	6,300	6,700	7,200
2013	8,200		

- (a) (3.5 points) Calculate the estimated ultimate claims for accident years 2011 and 2013, using the reported development method with the original Bondy method for the tail factor.

The 2011 paid claims evaluated at December 31, 2013 are 67,700.

- (b) (1 point) Estimate the accident year 2011 case estimate, IBNR, and total claim liability.
- (c) (0.5 points) Describe the axiomatic assumption that underlies Boor's algebraic method for determining paid claims tail factors.

The following age-to-age development factors based on paid claims have been selected:

Development Interval	Age-to-Age Factor
12-24	3.37
24-36	1.65
36-48	1.25

- (d) (1 point) Calculate the indicated paid claims tail factor for accident year 2011 using Boor's algebraic method with the results from part (a).

3. (5 points) You are given the following information:

Accident Year	Earned Exposures	Projected Ultimate based on Development Method	
		Claims	Counts
2011	5,440	333,900	370
2012	5,530	359,900	376
2013	5,690	401,600	404

- The annual severity trend is 5.0%.
- The annual frequency trend is 1.5%.

- (a) (3 points) Calculate the projected ultimate claims for all accident years using the development-based frequency-severity method.
- (b) (1 point) State two reasons to project ultimate frequencies and severities separately.

Earned exposures are projected to be 5,700 for accident year 2014.

- (c) (1 point) Calculate accident year 2014 projected ultimate claims for the development-based frequency-severity method.

4. (4 points) You are a regulator leading a group that is attempting to combine results from three commercial catastrophe models. Each model has produced three exceedance probability curves for a standard set of exposures. One of the curves is the model's best estimate of the probabilities and the other two form a 90% confidence interval. Your group's task is to produce three curves, one representing an average of the three models and two representing a confidence interval. The following table displays output from the three models.

Exceedance probabilities relate to a loss of 10 billion.

Model	Exceedance Probability			Return (in Years)		
	5%	Best Est.	95%	5%	Best Est.	95%
A	0.0022	0.0072	0.0114	455	139	88
B	0.0026	0.0080	0.0109	385	125	92
C	0.0031	0.0092	0.0117	323	109	85

For the best estimate, the combined value is a weighted average, with 50% weight on the middle of the three best estimates and 25% weight on the other two estimates.

- (a) (1 point) Calculate the combined best estimate for both the probability and the return period.

You have observed that the period calculated in (a) is not the reciprocal of the calculated probability. You are considering two approaches for your final recommendation. They are:

- Approach 1: Estimate the return period as the reciprocal of the calculated probability.
  - Approach 2: Retain the return period estimate from (a).
- (b) (1 point) Recommend one of the two approaches to calculate the best estimate of the return based on the combined models. Justify your choice.

#### 4. Continued

You are considering three options for combining the confidence interval estimates for the exceedance probability. They are:

- Option I: Use the same weights by model as used for combining the best estimates.
  - Option II: Apply the 50% weight to the middle value regardless of which model is in the middle.
  - Option III: Use the most extreme value from the three models.
- (c) *(1 point)* Calculate the interval using each of the three options.
- (d) *(1 point)* State the option that produces an interval that can most accurately be described as a 90% confidence interval. Justify your choice.

5. (4 points) You are estimating the premium liabilities for your company's financial statement, and are given the following information:

Line of Business	Unearned Premiums	Expected Claims Ratio
Gross of Reinsurance		
Property	350	80%
Liability	510	70%
Total	860	
Net of Reinsurance		
Property	320	80%
Liability	450	74%
Total	770	

- The unallocated loss adjustment expense ratio is 11%.
- The selected general expense ratio is 17%.
- The percent of general expenses applicable to unearned premiums is 25%.
- The selected incentive commission ratio is 2.8%.

- (a) (1.5 points) Calculate the premium liabilities, both gross and net of reinsurance.
- (b) (0.5 points) Determine the equity in unearned premiums.

Carried ceded unearned commissions are 40.

- (c) (1 point) Calculate the maximum deferred policy acquisition expense (DPAE) that your company could record as an asset.
- (d) (1 point) Explain the premium development component an actuary would consider when determining the premium liability for retrospectively-rated policies.

- 6.** (4 points) You are given the following information:
- ERR Insurance Company writes professional liability insurance for actuaries on both a claims-made and an occurrence coverage basis.
  - For policies effective January 1, 2015, the first-year claims-made pure premium is 100,000 and the occurrence pure premium is 235,000.
  - Annual pure premium trend is  $-10\%$  and there is a two-year reporting pattern.
- (a) (1.5 points) Define the following terms in relation to claims-made coverage:
- (i) Retroactive date
  - (ii) Mature claims-made coverage
  - (iii) Nose or prior acts coverage
- (b) (1 point) Calculate the pure premium for the following policies:
- (i) Mature claims-made coverage effective January 1, 2016
  - (ii) Tail coverage for a first-year claims-made policy effective January 1, 2014
- (c) (0.5 points) Calculate the step factor for first-year claims-made coverage.
- (d) (1 point) Explain how a longer claim payment pattern would affect the pricing of occurrence policies for ERR.

7. (7 points) KMR Insurance is investigating the potential reserving impact of changes in its claims handling processes. You are given the following information:

Accident Year	Closed Counts			Selected Ultimate Count
	12	24	36	
2011	120	240	288	300
2012	132	297		330
2013	160			320

Accident Year	Paid Claims		
	12	24	36
2011	13,440	27,984	36,242
2012	16,558	36,708	
2013	22,479		

Parameters for Two-Point Exponential Curve Fitting				
Accident Year	a		b	
	12&24	24&36	12&24	24&36
2011	6,455	7,681	0.006112	0.005387
2012	8,758		0.004825	

- The selected relationship between paid claims  $y$ , and closed counts  $x$ , is  $y = ae^{bx}$ .
  - The selected tail factor is the square root of the last development factor.
- (a) (1 point) Assess whether there is any evidence of changed claims settlement rates.
- (b) (5 points) Estimate total unpaid claims using a Berquist-Sherman adjustment to paid claims and simple age-to-age development factors.
- (c) (1 point) Explain whether you would expect this unpaid claims estimate to be higher or lower than that calculated from the unadjusted paid claims triangle.

**8.** (4 points) Architects Insurance Company (AIC) was recently formed to insure the professional liability exposure of a regional group of architects in the Americas. AIC invested 5,000,000 to develop and implement an integrated policy issuance and claim management system. AIC proposes establishing rates for all policies with a common effective date of January 1, 2015 using the following information:

- The initial 5,000,000 cost is to be amortized over a period of five years.
- The 2015 expected annual claim cost per insured is 10,000.
- The variable expense provision is 10% and there are no fixed expenses.
- The profit and contingency provision is 10%.
- The expected gross cost of reinsurance is 2,000 per insured.
- The expected benefit from reinsurance is 50% of gross cost.
- The 2015 expected number of insureds is 20,000, each purchasing the required policy limit of 2,000,000.
- There are no changes expected to the above assumptions over the next five years.

(a) (1 point) Explain whether you should include a provision for the cost of the management system in your premium rate calculation.

Regardless of your answer to part (a), AIC has decided to include the cost of the management system in its premium rate calculation.

(b) (2 points) Calculate AIC's indicated rate per insured for one-year policies effective January 1, 2015.

AIC management is considering a variable dividend of 5% to 10% of premium to policyholders based upon loss experience.

(c) (1 point) Explain the conditions under which AIC can or cannot include the expected policyholder dividend as an expense provision.



9. (6 points) You are calculating the indicated rate change for a personal property line of business written in Territory X, and are given the following information for Territory X:

Accident Year	Earned Premium	Earned Exposures	Ultimate Claims
2011	12,694,000	11,900	8,455,000
2012	13,489,000	12,100	9,092,000
2013	14,546,000	12,100	9,049,000

- All policies are annual policies.
  - The only historical rate change for this book of business was a 7% increase that was effective May 1, 2012.
  - Annual premium trend is 1.5%.
  - New rates will be in effect for one year, beginning April 1, 2015.
  - Ultimate claims exclude non-hurricane weather claims.
- (a) (2 points) Calculate the earned premium adjusted to the forecast period for each year.

You are including a loading for non-hurricane weather claims in your rating calculation, with the following information:

Territory X non-hurricane weather pure premium, trended to the average accident date in the forecast period	125
Region Y non-hurricane weather pure premium, trended to the average accident date in the forecast period (Region Y includes Territory X)	185
Credibility for Territory X non-hurricane weather claims	45%

- (b) (1 point) Calculate the Territory X loading for non-hurricane weather claims, stated as a claim ratio.

## 9. Continued

You are given the following additional information:

Selected ULAE to claim ratio	8%
Selected fixed expenses to premium ratio	4%
Selected variable expenses to premium ratio	17%
Selected profit and contingencies to premium ratio	5%
Countrywide ultimate claim ratio (trended, including ULAE)	74%

- The full credibility standard is based on 40,000 earned exposures, with partial credibility determined by the square root rule, and the complement of credibility is applied to the countrywide ultimate claim ratio.
- A weighting of 20%, 30% and 50% for accident years 2011, 2012 and 2013, respectively, is used to determine the weighted average trended claim ratio.

(c) (3 points) Calculate the indicated average rate for Territory X.

**10.** (5 points)

- (a) (0.5 points) State two principles underlying prospective experience rating.
- (b) (1 point) Explain how the concepts of stability and responsiveness are important in both experience rating and self-insurance cost allocation systems.

ABC Insurance Company writes general liability coverage for medium-sized manufacturers. XYZ manufacturer, in business for twenty years, has always self-insured its general liability exposure. In 2014, XYZ projected an occurrence basis claim cost between 0.40 and 0.70 per 1,000 of sales for the next three years, 2015-2017. Beginning January 1, 2015, XYZ wants to consider commercial insurance and received the following quotation from ABC, based on expected sales of 1,000,000,000 in 2015:

- The manual premium is 500,000.
  - The experience-rated premium is 490,000 (subject to exposure verification).
  - The schedule rating discount is 16%.
  - The paid loss retrospective premium is subject to a minimum of 300,000 and a maximum of 900,000.
- (c) (1 point) State two considerations that ABC likely made in preparing the quote.
- (d) (2.5 points) State and support your opinion as to whether XYZ should continue to self-insure or should insure its general liability exposure with ABC.

**11.** (5 points)

- (a) (1.5 points) Describe how the following company actions may affect claims trend:
- (i) Increasing the minimum deductible from 500 to 1,000.
  - (ii) Increasing the minimum policy limit from 200,000 to 500,000.
  - (iii) Expanding the perils covered for a particular line of business.
- (b) (1 point) Describe the overlap fallacy as it relates to development factors and trend factors.

You are provided with the following information regarding REV Insurance Company and the industry:

- Changes in deductibles, coverages and mix of business for REV policies are consistent with the industry.
- Limits on REV policies are significantly different from the industry.
- Tort reform occurred at the end of accident year 2008.
- Industry historical experience has not been adjusted to reflect the reform; REV historical experience has been adjusted to reflect the reform.

Time Period		Earned Vehicles	Frequency		Severity	
			Annual Trend	R <sup>2</sup>	Annual Trend	R <sup>2</sup>
REV Insurance	2004-2013	75,000	0.4%	0.22	4.5%	0.68
	2009-2013	43,000	0.9%	0.35	4.8%	0.81
Industry	2004-2013	750,000	0.5%	0.91	3.2%	0.62
	2009-2013	390,000	0.6%	0.94	4.0%	0.89

- (c) (1.5 points) Recommend the annual frequency trend and severity trend for REV to use. Justify your answers.

REV is revising its rates for all policies written on or after January 1, 2015. All policies are 6-month policies and the rates will be in effect for 12 months.

- (d) (1 point) Calculate the pure premium trend factor that will be applied to 2012 experience for the ratemaking analysis.

12. (5 points) You have been asked to develop projected ultimate claims using the Cape Cod method and have been given the following information:

Accident Year	Earned Premiums	Premium On-Level Factor
2011	20,000	1.035
2012	22,000	1.020
2013	23,000	1.000

Accident Year	Age-to-Ultimate Development Factor	Claims Paid as of Dec. 31, 2013	Claim Adjustment Factors	
			Trend	Tort Reform
2011	4.550	4,100	1.051	0.9
2012	8.750	1,900	1.025	1
2013	25.500	1,200	1.000	1

- (a) (1 point) Calculate the used-up on-level earned premiums for each accident year shown.
- (b) (1 point) Calculate the adjusted expected claims ratio.
- (c) (1 point) Calculate the expected claims for each accident year.
- (d) (1 point) Calculate the projected ultimate claims for each accident year.
- (e) (1 point) Explain the challenge reinsurance actuaries face when using the Cape Cod method to estimate ultimate claims.

**\*\*END OF EXAMINATION\*\***  
**Morning Session**

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**SOCIETY OF ACTUARIES**  
**Introduction to Ratemaking & Reserving**

**Exam GIIRR**

**AFTERNOON SESSION**

**Date:** Tuesday, October 28, 2014

**Time:** 1:30 p.m. – 3:45 p.m.

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**INSTRUCTIONS TO CANDIDATES**

**General Instructions**

1. This afternoon session consists of 9 questions numbered 13 through 21 for a total of 40 points. The points for each question are indicated at the beginning of the question.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
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**\*\*BEGINNING OF EXAMINATION\*\***  
**Afternoon Session**  
***Beginning with Question 13***

- 13.** (5 points) You are estimating ultimate claims for a book of business using the expected method and are given the following information:

<b>Accident Year</b>	<b>Earned Premiums</b>	<b>Projected Ultimate Claims from Development Method</b>	<b>Premium On-Level Factors at 2013 Level</b>
2010	8,500	8,390	1.08
2011	7,480	6,990	1.04
2012	8,890	7,080	1.03
2013	9,150	6,950	1.00

- Annual claim trend is 2.2%.
  - A tort reform was effective January 1, 2012, with the effect that claim severities were reduced by 20%.
- (a) (3 points) Calculate and select the 2013 expected claim ratio to be used to calculate expected claims.
- (b) (1 point) Calculate the 2012 expected claims.
- (c) (1 point) Explain whether a ratemaking analysis would overstate or understate the true rate change required if the above tort reform adjustment were not made when estimating each of the following:
- (i) Ultimate claims
  - (ii) Annual claim trend

14. (6 points) Two Dimensional Insurance Company uses only two rating variables for its automobile insurance policy. One is gender (male and female) and the other is location (urban, suburban, and rural). Rates are determined as

$$\text{base rate} \times \text{gender factor} \times \text{location factor}.$$

The base rate of 33.72 is the exposure-weighted average trended ultimate pure premium. The factors are to be determined using only experience data, with no credibility adjustments.

The exposures for the six rating class combinations are given in the following table:

Exposures			
Gender	Location		
	Urban	Suburban	Rural
Male	7	2	3
Female	2	6	5

- (a) (1 point) Determine if the exposures exhibit distributional bias. Support your conclusion.

The trended ultimate pure premiums are given in the following table:

Trended Ultimate Pure Premiums				
Gender	Location			Total
	Urban	Suburban	Rural	
Male	50	35	25	41.25
Female	40	28	20	26.77
Total	47.78	29.75	21.88	<b>33.72</b>

- (b) (2 points) Calculate the rebalanced pure premiums using one-way analysis relativities for each rating variable.

The minimum bias method is to be used to obtain the final relativities. The process starts with the one-way relativities for location.

- (c) (2 points) Calculate the revised relativities for gender that result from a single iteration of the minimum bias method.

## 14. Continued

In this case the converged results of the minimum bias method will be factors that reproduce all six trended ultimate pure premiums. Your actuarial intern Tiffany asks you if this will always be the outcome of the minimum bias method.

- (d) *(1 point)* Describe the conditions under which the minimum bias method reproduces the trended ultimate pure premiums and demonstrate that the conditions are met in this case.

**15.** (4 points) You are given the following information:

- Property with an insurable value of 100,000 is insured under a policy with an 80% coinsurance requirement.
- Claim sizes of 50,000 and 90,000 are equally likely; no other claim sizes are possible.
- There is no deductible.
- The expected claim cost for a policy with an amount of insurance of 80,000 is 520.

- (a) (1 point) Explain the benefit to the insured of purchasing a policy with an amount of insurance of 90,000.
- (b) (2 points) Calculate the expected claim cost for policies with each of the following amounts of insurance:
- (i) 70,000
  - (ii) 90,000

An insured purchases a policy with an amount of insurance of 60,000 and a deductible of 1,500.

- (c) (1 point) Calculate both the coinsurance penalty percentage and the amount retained by the insured for a claim of 50,000.

- 16.** (4 points) Your company writes business covering two distinct groups with stable characteristics. IBNR claim liabilities are currently set using historical information for all groups aggregated. During 2013, there was a shift in the proportion of business written by group. You are investigating whether this will affect the accuracy of your reserving process. You are given the following information:

Group	Percentage of Claims Reported at Age			
	12	24	36	48
A	40%	60%	80%	100%
B	50%	75%	100%	

Group	Premium Mix %	
	Historical 2000-2012	Actual 2013
A	50%	70%
B	50%	30%

Group	Ultimate Claim Ratio
A	60%
B	40%

- Your company charges the same premium rates for Groups A and B.
  - There were no changes in premium rates between 2012 and 2013.
  - There has been no trend in claims.
  - Assume 2013 experience was as expected and total 2013 premiums were 1,000.
- (a) (0.5 points) Calculate ultimate claims for accident year 2013 using both the historical and actual business mix.
- (b) (0.5 points) Calculate 2013 IBNR claim liabilities for accident year 2013 using the actual business mix.
- (c) (3 points) Calculate the percentage over- or under-estimate in 2013 IBNR claim liabilities for accident year 2013 under the following methods if the historical business mix is assumed:
- (i) Expected Claims
  - (ii) Reported Development
  - (iii) Reported Bornhuetter Ferguson

**17.** (5 points)

- (a) (0.5 points) Explain the consistency test for increased limits factors.
- (b) (1 point) Illustrate your answer to part (a) by means of a graph.

Claims are uniformly distributed between 0 and 100 and trend acts uniformly on claims of all sizes.

- (c) (2 points) Calculate the trend factor in the layer 20 to 60 resulting from a 50% inflationary trend.
- (d) (1.5 points) Explain why there is a difference between the effect of trend on claims capped by the basic limit and the effect of trend on claims excess of the basic limit.

- 18.** (4 points) You are estimating unpaid unallocated loss adjustment expenses (ULAE) using the Mango and Allen smoothing adjustment and are given the following information:

Accident Year	Selected Ultimate Claims
2010	8,750
2011	8,920
2012	9,040
2013	9,250

	Maturity Age in Months		
	12	24	36
Reported CDF	1.923	1.205	1.000

- (a) (1 point) State three circumstances where the Mango and Allen adjustment is particularly valuable.
- (b) (2 points) Calculate the expected reported claims in calendar years 2012 and 2013.

You are given the following additional information:

Calendar Year	Paid ULAE	Expected Paid Claims
2012	828	8,860
2013	808	9,022
<b>Total</b>	<b>1,636</b>	<b>17,882</b>

- (c) (1 point) Select the ULAE ratio using the Mango and Allen smoothing adjustment based on the average of expected paid and expected reported claims. Justify your selection.



19. (4 points) You are given the following information evaluated as of December 31, 2013 for a liability line of business:

Accident Year	Earned Premium	Paid Claims	Reported Claims
2010	12,700	3,700	7,650
2011	12,900	2,250	7,050
2012	12,400	1,570	5,200
2013	11,900	750	4,100
<b>Total</b>	<b>49,900</b>	<b>8,270</b>	<b>24,000</b>

Projected Ultimate Claims					
Accident Year	Development Method		Cape Cod Method		Frequency-Severity Closure Method
	Paid	Reported	Paid	Reported	
2010	9,300	10,500	9,400	9,850	9,100
2011	8,600	11,200	9,250	10,500	8,950
2012	9,600	11,600	9,300	11,200	8,800
2013	8,700	13,900	8,950	12,600	8,600
<b>Total</b>	<b>36,200</b>	<b>47,200</b>	<b>36,900</b>	<b>44,150</b>	<b>35,450</b>

Projected Ultimate Claim Ratios (for diagnostic purposes)					
Accident Year	Development Method		Cape Cod Method		Frequency-Severity Closure Method
	Paid	Reported	Paid	Reported	
2010	73%	83%	74%	78%	72%
2011	67%	87%	72%	81%	69%
2012	77%	94%	75%	90%	71%
2013	73%	117%	75%	106%	72%

Projected Ultimate Pure Premiums (for diagnostic purposes)					
Accident Year	Development Method		Cape Cod Method		Frequency-Severity Closure Method
	Paid	Reported	Paid	Reported	
2010	206	232	208	218	201
2011	199	259	214	243	207
2012	234	282	226	273	214
2013	223	356	229	323	221

- Earned premiums are adjusted to accident year 2013 rate levels.
- Rates have increased over the past five years consistent with indicated rate changes.
- Expected annual claims trend is estimated to be approximately 3%.

**19. Continued**

- (a) (3 points) Select the ultimate claims for each accident year. Justify each selection using the information from the diagnostic tables.
- (b) (1 point) Calculate the expected reported claims from December 31, 2013 through March 31, 2014 for accident year 2013 using the selections from part (a).

**20.** (4 points) You are part of a team at Cool Breeze Insurance Company that is setting rates for homeowners insurance catastrophe coverage with respect to hurricane losses in southern Florida.

Grossi and Kunreuther suggest that the base premium for a given county comprises three components.

(a) (2 points) Describe each of the three components and indicate how each may be determined for Cool Breeze.

Within a given county, Cool Breeze's rates may be adjusted based on attributes of the insured dwelling. Grossi and Kunreuther discuss two attributes that are of primary importance.

(b) (1 point) Describe each of the two attributes.

Friedland notes that when estimating expected claims from a catastrophe it is important to account for post-event inflation.

(c) (1 point) Define post-event inflation and provide an example that relates to hurricane losses.

**21.** (4 points) You are given the following information about a liability book of business:

<b>Accident Year</b>	<b>Actual Reported Claims as of Dec. 31, 2013</b>	<b>Expected Claims</b>	<b>Cumulative Development Factors</b>
2011	5,830	9,540	1.64
2012	4,650	9,750	2.27
2013	3,270	10,100	3.85

- (a) (1 point) Calculate ultimate claims for accident years 2011, 2012 and 2013 using the Bornhuetter Ferguson method.
- (b) (1 point) Assess the reasonableness of the inputs for the Bornhuetter Ferguson method using this data.

The Bornhuetter Ferguson method could also be described as a credibility weighting of the claim development and expected methods.

- (c) (1 point) Critique the interpretation of the Bornhuetter Ferguson method as a credibility weighting of the claim development and expected methods.
- (d) (1 point) Explain why the expected method is likely more appropriate than the development method for analyzing a new line of business.

**\*\*END OF EXAMINATION\*\***  
**Afternoon Session**

**USE THIS PAGE FOR YOUR SCRATCH WORK**

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**SOCIETY OF ACTUARIES**  
**Financial and Regulatory Environment – U.S.**

# **Exam GIFREU**

## **MORNING SESSION**

**Date:** Friday, May 2, 2014  
**Time:** 8:30 a.m. – 11:45 a.m.

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### **INSTRUCTIONS TO CANDIDATES**

#### **General Instructions**

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).
  - a) The morning session consists of 13 questions numbered 1 through 13.
  - b) The afternoon session consists of 9 questions numbered 14 through 22.

The points for each question are indicated at the beginning of the question.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

#### **Written-Answer Instructions**

1. Write your candidate number at the top of each sheet. Your name must not appear.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam GIFREU.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.







**\*\*BEGINNING OF EXAMINATION\*\***  
**Morning Session**

**1.** (5 points)

- (a) (1 point) Describe the difference between cash accounting and accrual accounting.
- (b) (2 points) Define the following accounting concepts and describe how they should be disclosed in statutory financial statements:
  - (i) Change in accounting principle
  - (ii) Change in accounting estimate
- (c) (0.5 points) Describe the Deferred Policy Acquisition Cost (DPAC) asset under GAAP.

An insurer issues a one-year catastrophe policy on July 1, 2013 covering hurricane claims. The hurricane season is assumed to be September and October. Acquisition expenses are 1,200 and the discount rate is zero.

- (d) (1.5 points) Calculate the DPAC as of the following dates under both statutory accounting and IFRS 4:
  - (i) August 1, 2013
  - (ii) October 1, 2013
  - (iii) December 1, 2013

**2.** (4 points)

- (a) (1 point) Explain why the “10% - 10% rule” is not considered appropriate for determining the existence of sufficient risk transfer.

The expected reinsurer deficit (ERD) is recognized as a better risk metric for measuring risk transfer.

- (b) (1 point) Describe the ERD method for measuring risk transfer.

You are given the following information regarding an excess of loss reinsurance agreement:

- The loss layer is 500 million excess of 250 million.
- Losses are assumed to be settled one year after inception of the agreement.
- The annual investment yield is 3%.
- The reinsurance premium of 16 million is paid at the inception of the agreement.

Layer loss amount	Probability
0	94%
100,000,000	3%
250,000,000	2%
500,000,000	1%

- (c) (2 points) Calculate the ERD.

**3.** (6 points)

- (a) (0.5 points) Describe a benefit that rating agencies provide to insurance company policyholders.
- (b) (0.5 points) Explain why an insurance company may want to receive a rating from more than one rating agency.

Many general insurers use the rating agency A.M. Best to obtain ratings. The A.M. Best Capital Adequacy Ratio (BCAR) has a formula for net required capital that is similar to the NAIC risk-based capital (RBC) formula.

- (c) (0.5 points) Identify two differences between the BCAR formula for net required capital and the RBC formula.

Cheap Commercial Insurance (CCI) writes Products Liability - Occurrence (PL) and Allied Lines (AL) insurance. You are given the following information for CCI, with amounts in millions:

	<b>Total</b>	<b>PL</b>	<b>AL</b>
Net written premium 2013	16.0	12.0	4.0
Net written premium 2012	14.0	10.0	4.0
Net written premium 2011	14.0	10.0	4.0
Net written premium 2010	12.5	10.0	2.5
Net written premium 2009	10.0	8.0	2.0
Ten-year average net loss and loss expense (L&LAE) ratio as of Dec. 31, 2013	81.0%	80.0%	85.0%
Underwriting expense ratio 2013	20.0%	20.0%	20.0%
Total adjusted capital as of Dec. 31, 2013	6.0		
2013 RBC charge for off-balance-sheet items and investments in insurance company subsidiaries	0.0		
2013 RBC charge for credit risk	0.0		
2013 RBC charge for fixed-income securities risk	0.1		
2013 RBC charge for equities risk	0.5		
2013 RBC charge for reserves risk	10.0		
Industry average net L&LAE ratio for 2013 RBC		70.0%	75.0%
Industry adverse scenario L&LAE ratio for 2013 RBC		105.0%	90.0%
Investment income factor for 2013 RBC written premium charge		0.90	0.95

### **3. Continued**

- There is no assumed or ceded reinsurance.
  - CCI qualifies for the company adjustment in the RBC calculation.
- (d) *(3 points)* Calculate CCI's 2013 RBC written premium risk charge.
- (e) *(0.5 points)* Calculate CCI's 2013 RBC ratio.
- (f) *(1 point)* Identify the action level indicated by the RBC ratio calculated in part (e) and specify any actions that are required of CCI and the regulator.

4. (5 points) An insurance policy is considered to be a *contract of adhesion*.

(a) (0.5 points) Define *contract of adhesion*.

Products liability policies generally have an aggregate limit on coverage. Some courts have, with respect to asbestos coverage, interpreted the policies as premises liability policies. One possible reason for this is that the policy is a *contract of adhesion*.

(b) (0.5 points) Explain how an interpretation of the policy as a premises liability policy may lead to increased payments by the insurer.

(c) (0.5 points) Explain how interpreting the policy as a *contract of adhesion* may lead to such an interpretation.

(d) (1.5 points) Identify three major differences between asbestos and other mass torts that have led to significant asbestos claims.

One possible defense against a products liability lawsuit is compliance with statutes and regulations.

(e) (0.5 points) Describe this defense.

(f) (1.5 points) Describe the situation in the case *Wyeth v. Levine*, state the ruling and provide the reasoning for that ruling.

**5.** (6 points)

- (a) (1 point) Identify the type of organization that the South-Eastern Underwriters Association (SEUA) was and describe its market conduct that led to the landmark SEUA decision in 1944.

One of the goals of market conduct regulation is to prevent unfair discrimination.

- (b) (1 point) Define fair discrimination in an insurance context and provide an example.

The European Court of Justice has banned the use of gender in pricing insurance products in the European Union.

- (c) (2 points) Critique this decision and provide a concurring or dissenting opinion.
- (d) (1 point) Recommend two responses that an automobile insurer in the European Union should consider in response to the European Court of Justice ban on the use of gender in insurance pricing.

Insurers in the U.S. are periodically subject to market conduct examinations.

- (e) (1 point) Identify two aspects of an insurer's operations, other than potential unfair discrimination in rating or underwriting, that may be within the scope of an examination.

6. (4 points) You are given the following information about an insurer's retrospectively rated policies:

Retro Adjustment Period	Loss Evaluation Point in Months	Percentage of Loss Emerged Since Prior Evaluation	Selected Premium Development to Loss Development (PDL) Ratio
First	18	50%	1.75
Second	30	30%	0.75
Third	42	20%	0.50

Policy Year	Completed Retro Adjustments as of 12/31/13	Expected Loss Emergence after Last Completed Retro Adjustment
2010	2	20,000
2011	1	50,000
2012	0	100,000

No premium has been booked after the last completed retro adjustments for the 2010 and 2011 policy years. Premium in the amount of 122,500 has been booked for the 2012 policy year.

- (a) (0.5 points) Explain why premium booked through 42 months should or should not be used to calculate the results of third retro adjustments.
- (b) (0.5 points) Explain why the first PDL ratio is generally greater than unity and why the PDL ratios tend to decrease with later adjustments.
- (c) (3 points) Calculate the premium asset on retrospectively rated policies as of December 31, 2013 arising from policy years 2010, 2011 and 2012.

7. (4 points) You have recently opened your own consulting business after having worked for a number of years heading the reserving department at Chain Ladder Insurance Company. The chief actuary at Chain Ladder has hired you to peer review the estimate of the company's unpaid claims made by your successor.

The chain ladder method always figured prominently in your reserving methodology while at Chain Ladder, but your successor has relied heavily on software that applies a new method that has just been published in a peer-reviewed actuarial journal. When you apply the chain ladder method to the data you have been provided, you obtain a significantly higher estimate of unpaid claims than that estimated by the software.

The tight timeframe provided for the assignment does not permit you to figure out why the two estimates differ. While you are contemplating what to put in your report, you read in the trade press that Chain Ladder is considered an attractive takeover target.

Describe the issues raised by this scenario. Include references to:

- (i) Materiality
- (ii) Actuarial Standard of Practice No. 41, *Actuarial Communications*



8. (4 points) You are given the following accounting items for Nola Insurance Company (NIC):

Accounting Item	Amount (000)
Unearned Premium Reserve as of Dec. 31, 2012	4,000
Unearned Premium Reserve as of Dec. 31, 2013	4,200
Statutory Underwriting Gain (Loss) 2013	(400)
Taxable Interest Income 2013	400
Municipal Bond Interest Income 2013	600
Dividends Received 2013	200
Realized Capital Gains 2013	100
Statutory Loss and Loss Adjustment Expense Reserve as of Dec. 31, 2012	4,000
Statutory Loss and Loss Adjustment Expense Reserve as of Dec. 31, 2013	4,600

- NIC operates in the U.S. and only writes allied lines business.
  - The annual discount rate set by the Treasury Department for 2012 is 2.5%.
  - The annual discount rate set by the Treasury Department for 2013 is 4.0%.
  - The tax basis average reserve discount factor for the loss and loss adjustment expense reserve as of Dec. 31, 2012 is 0.98.
  - For the loss and loss adjustment expense reserve as of Dec. 31, 2013, 1.2 million is for accident year 2012 and 3.4 million is for accident year 2013.
  - Assume that the tax basis loss payment pattern for this line of business is 50% in the year of the loss occurrence, 30% in the first year following the year of occurrence and 20% in the second year following the year of occurrence (using mid-year loss payments).
- (a) (1 point) Calculate the tax basis average reserve discount factor for the loss and loss adjustment expense reserve as of Dec. 31, 2013.
- (b) (2 points) Calculate regular taxable income for NIC in 2013.

General insurers tend to include a greater proportion of municipal bonds in their investment portfolios than other investors.

- (c) (1 point) Explain the rationale for this.

9. (4 points) Consider a scenario in which two primary insurers, AA Insurance and BB Insurance, each have a claim ceded to a single reinsurer, Faulty Re, with the following details:

- AA believes that each claim has a 50% probability of having a zero loss payment and a 50% probability of having a 60 million loss payment (recoverable from Faulty Re).
- The claims are independent of each other.
- Faulty Re is financially distressed with assets of 100 million held in cash deposits.
- The two claims from AA Insurance and BB Insurance are the only potential reinsurance claims against Faulty Re. These claims are Faulty Re's only liabilities.
- Assume that Faulty Re remains solvent if its net worth is greater than zero.
- Assume that both claims will be settled in the near future so that the time value of money can be ignored.

(a) (1 point) Determine the likely range of values that AA should be willing to accept for the loss commutation.

(b) (1 point) Determine the likely range of values that AA should be willing to accept for the loss commutation if:

- AA now believes that its ceded claim has a 30% probability of a zero loss payment and a 70% probability of a 60 million loss payment.
- AA continues to believe BB's ceded claim has a 50% probability of a zero loss payment and a 50% probability of a 60 million loss payment.

(c) (1 point) Explain the merits of AA being the first to commute in the scenario described in part (b) versus waiting for either claim to settle first before making a decision.

As noted in the NAIC Statement of Statutory Accounting Principles No. 62, *Property and Casualty Reinsurance*, "A commutation of a reinsurance agreement, or any portion thereof, is a transaction which results in the complete and final settlement and discharge of all, or the commuted portion thereof, present and future obligations between the parties arising out of the reinsurance agreement."

(d) (1 point) Describe the statutory accounting treatment of the commutation transaction for the cedent, making reference to the effect on assets and income.

**10.** (5 points)

- (a) (1 point) Identify the implicit risk margins for reserving risk and written premium risk used in statutory accounting in the U.S.
- (b) (1 point) Describe one advantage and one disadvantage of using implicit risk margins in statutory accounting.

Internal capital models are useful for enterprise risk management but present some concerns for insurance supervisors. The International Association of Insurance Supervisors recommends three tests that internal capital models must pass in order to be permitted for setting regulatory capital standards.

- (c) (2 points) Identify and describe these tests including any applicability to Solvency II.
- (d) (1 point) Describe two differences between Solvency II and U.S. financial regulation with respect to the use of internal capital models.

**11.** (4 points) The NAIC has developed a number of Core Principles for U.S. Insurance Financial Solvency in its Solvency Modernization Initiative.

(a) (2 points) Compare the following Core Principles, including the purpose of the assessment, the type of information assessed, and the frequency of the assessment:

- (i) Off-site Monitoring and Analysis
- (ii) On-site Risk-focused Examinations

Development of Solvency II in the European Union has suggested a number of enhancements to insurance regulation in the United States.

(b) (0.5 points) Identify a potential (or planned) enhancement to NAIC RBC suggested by Solvency II with respect to:

- (i) Calibration of the RBC system
- (ii) Catastrophe risk

Both Solvency II and the NAIC now include an Own Risk and Solvency Assessment (ORSA) as a part of the regulatory framework.

(c) (1 point) Describe two ways in which an actuary can assist a general insurance company with its NAIC ORSA.

(d) (0.5 points) Contrast the approaches of the NAIC ORSA and the Solvency II ORSA with respect to required capital.

12. (4 points) You are given the following information for Actuarial General Insurance (AGI):

Calendar /Accident Year	Earned Premiums	Paid Losses in 2013	Reported Claims in 2013	Claims Closed in 2013 with payment	Claims Closed in 2013 with no payment	Claims Outstanding as of year end 2013
2010	1,000,000	0	0	0	0	0
2011	2,000,000	150,000	1	2	0	0
2012	2,400,000	550,000	15	19	0	2
2013	2,800,000	1,300,000	170	151	8	11
Total	8,200,000	2,000,000	186	172	8	13

- Premiums in the table are by calendar year while losses and claim counts are by accident year.
  - AGI began operations in 2010.
  - AGI only writes direct Homeowners business.
  - Adjusting and Other (AAO) expenses paid in calendar year 2013 amounted to 240,000.
  - There is no reinsurance or pooling.
- (a) (1.5 points) Calculate the allocation by accident year of AGI's paid AAO expenses in calendar year 2013 using the old statutory procedure for Schedule P reporting.
- (b) (2 points) Calculate the allocation by accident year of AGI's paid AAO expenses in calendar year 2013 using the method of distributing AAO by claim counts. Assume the following relativities of AAO expense by type of claim for the application of this method:

Reported claim	4
Claim closed with payment	3
Claim closed with no payment	2
Outstanding claim	1

- (c) (0.5 points) Explain why an AAO allocation method using claim counts should be more accurate than the old statutory procedure for Schedule P reporting.

**13.** (5 points)

- (a) (1 point) Identify two common reasons for insurer insolvency.
- (b) (1.5 points) Describe two regulatory actions that an insurance commissioner may take if fact-finding reveals that policyholders or the general public may be adversely affected by an insurer's financial condition.
- (c) (2 points) Describe the characteristics of the U.S. regulatory system that may have contributed to the relatively strong performance of insurance companies in the recent financial crisis.
- (d) (0.5 points) Identify how the Dodd-Frank Act changes the regulation of reinsurer solvency.

**\*\*END OF EXAMINATION\*\***  
**Morning Session**

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**SOCIETY OF ACTUARIES**  
**Financial and Regulatory Environment – U.S.**

# **Exam GIFREU**

## **AFTERNOON SESSION**

**Date:** Friday, May 2, 2014

**Time:** 1:30 p.m. – 3:45 p.m.

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### **INSTRUCTIONS TO CANDIDATES**

#### **General Instructions**

1. This afternoon session consists of 9 questions numbered 14 through 22 for a total of 40 points. The points for each question are indicated at the beginning of the question.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

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**\*\*BEGINNING OF EXAMINATION\*\***  
**Afternoon Session**  
***Beginning with Question 14***

**14.** (5 points)

- (a) (1 point) Identify two reasons for government involvement in the provision of workers compensation insurance.

State governments in the U.S. and provincial governments in Canada have a role in the provision of workers compensation.

- (b) (1 point) Compare the roles of U.S. state governments with those of Canadian provincial governments in the provision of workers compensation.

- (c) (0.5 points) Identify the primary reason why the National Flood Insurance Program (NFIP) was created in 1968.

- (d) (0.5 points) Identify one purpose of the NFIP, other than providing flood insurance.

- (e) (1 point) Describe two key differences between private-sector insurance and the NFIP.

The Biggert-Waters Flood Insurance Reform Act of 2012 made changes to the NFIP that may improve its financial position.

- (f) (1 point) Explain two of these changes.

**15.** (5 points) The first essential element of negligence is a legal duty of care owed by a defendant to a plaintiff.

- (a) (1 point) Identify the three other essential elements of negligence.
- (b) (1 point) Provide an example of a situation where three of the four essential elements are present, but the fourth is not.

Legal duties of care are created by statutes, contracts and common law.

- (c) (1 point) Contrast the role of a judge in a common law system with the role of a judge in a civil law system.

A motorist runs a red light and collides with a truck carrying gasoline. The resulting explosion seriously injures the motorist and the truck driver. Gasoline runs off into a nearby river.

- (d) (1 point) Evaluate the liability of the motorist and the truck owner.

Negligence is the term used for unintentional torts. All other torts are intentional.

- (e) (1 point) Provide two examples of intentional torts.

- 16.** (4 points) You are given the following reinsurance information for Big Z Insurance Company's (BZIC) two reinsurers, Blades Reinsurance Company (BRC) and Matrix Re (MRE):

	<b>BRC</b>	<b>MRE</b>
Authorized status	Unauthorized	Authorized
Total reinsurance recoverables	200	200
Funds held by reporting company under reinsurance treaties	15	15
Letters of credit	50	0
Recoverables on paid loss & ALAE over 90 days past due, not in dispute	60	10
Recoverables on paid loss & ALAE, total	80	70
Amount in dispute included above	15	10
Amount company received from reinsurers in last 90 days of statement year	8	8

All amounts are in millions.

- (a) (3.5 points) Calculate BZIC's total Schedule F provision for reinsurance.

Statutory accounting uses a set formula (Schedule F provision for reinsurance) to estimate the potential uncollectibility of reinsurance recoverables. The Schedule F provision is a liability on the statutory balance sheet.

- (b) (0.5 points) Describe the GAAP approach to estimating the potential uncollectibility of reinsurance recoverables with respect to the balance sheet.

**17.** (4 points)

- (a) (1.5 points) Identify three assets that are classified as non-admitted assets in statutory accounting and for each of the three assets identified explain why statutory accounting treats them as non-admitted.

Insurers have the option of using one of two methods for the recording of some non-admitted assets in statutory accounting. One method is to set up the asset in the balance sheet but classify the asset as non-admitted with a direct charge to surplus.

- (b) (0.5 points) Describe the other method.
- (c) (0.5 points) Explain why an increase in non-admitted assets decreases statutory surplus.
- (d) (0.5 points) Identify two direct charges (or credits) to statutory surplus, other than the change in non-admitted assets.
- (e) (0.5 points) Describe the relationship between invested capital and statutory surplus for a general insurance company.
- (f) (0.5 points) Describe the accounting treatment of policyholder dividends in statutory accounting with respect to their recognition as a liability and when they are recognized in the statement of income.

- 18.** (4 points) You are given the following information for Grizzly Insurance Company (GIC):

	Commercial Auto Liability		Fire	
	2012	2013	2012	2013
<b>Balance Sheet</b>				
Loss and loss adjustment expense reserves as of year end	2,200	3,000	550	450
Agents' balances as of year end	300	500	200	150
Unearned premium reserves as of year end	1,000	1,300	500	600
<b>Income Statement</b>				
Earned premium during the year	2,000	2,600	1,000	1,200
Incurred loss and loss adjustment expense during the year	1,400	2,000	650	700

- Amounts in the table above are in thousands.
  - Net investment income was 400,000 in 2012 and 525,000 in 2013.
  - There was a realized capital gain of 20,000 in 2012 and a realized capital loss of 10,000 in 2013.
  - Unrealized capital gains were 30,000 in 2012 and 10,000 in 2013.
  - Policyholders' surplus was 1.9 million as of year end 2012 and 2.5 million as of year end 2013.
  - Prepaid expense ratios are 20% for both lines of business.
- (a) (1 point) Calculate GIC's investment gain ratio for the 2013 Insurance Expense Exhibit (IEE).
- (b) (1.5 points) Calculate GIC's allocated mean surplus by line of business using the IEE method of allocation.
- (c) (1.5 points) Calculate GIC's allocated investment gain by line of business for the 2013 IEE.



19. (4 points) Just-E-Nuff Reserved Insurance (JENRI) is a general insurance company that began operations at the beginning of 2008. You are given the following information on JENRI:

Schedule P - Part 2 - Summary							
Years in Which Losses Were Incurred		Incurred Net Losses and Defense and Cost Containment Expenses Reported at Year End (000 omitted)					
		5	6	7	8	9	10
		2008	2009	2010	2011	2012	2013
6.	2008	560	380	450	420	435	450
7.	2009	XXX	1,355	1,560	1,505	1,540	1,580
8.	2010	XXX	XXX	1,295	1,250	1,340	1,800
9.	2011	XXX	XXX	XXX	1,460	1,700	1,850
10.	2012	XXX	XXX	XXX	XXX	2,300	2,525
11.	2013	XXX	XXX	XXX	XXX	XXX	2,270

Year End	Policyholders' Surplus (000 omitted)
2008	4,100
2009	4,500
2010	4,600
2011	4,750
2012	5,400
2013	5,500

- (a) (1.5 points) Calculate JENRI's 2013 IRIS ratio for P/C Reserve Ratio 12 (Two-Year Reserve Development to Policyholders' Surplus).
- (b) (1.5 points) Assess the results of the ratio calculated in part (a) making reference to the usual range for the ratio, areas for further analysis and the Statement of Actuarial Opinion (SAO).

Adverse results on the IRIS reserve ratio tests can be an indication of inadequate reserves. However, there are other possible reasons for adverse results.

- (c) (0.5 points) Identify two other possible reasons.

Loss reserve discounts are disclosed in both Schedule P and the SAO.

- (d) (0.5 points) Explain why a disclosure of loss reserve discounts is also required in the Notes to Financial Statements of the NAIC Annual Statement.

- 20.** (5 points) General insurance companies can be sued by policyholders for acts of bad faith.
- (a) (0.5 points) Define the term bad faith in a tort context.
  - (b) (0.5 points) Provide an example of a situation in which a general insurer can be alleged to have acted in bad faith.
  - (c) (0.5 points) Identify two defenses to suits alleging bad faith.
  - (d) (1.5 points) Compare the treatment of bad faith claims against insurers in the U.S. court system with their treatment in the Canadian court system with respect to punitive damages.
  - (e) (0.5 points) Identify a type of tort reform that should lessen the financial impact on U.S. insurers found responsible for acting in bad faith.
  - (f) (1.5 points) Explain how the type of tort reform you identified in part (e) would lessen the financial impact on insurers found responsible for acting in bad faith. Use an actual state-enacted tort reform law as the basis for the explanation.

21. (5 points) The Appointed Actuary for Olde Insurance Company (OIC) has made the following estimates:

Point estimate for the reserves	100 million
Range of reasonable estimates for the reserves	85 million to 120 million
Range of possible outcomes for the reserves	75 million to 140 million
Selected materiality standard	10 million

In addition to the Appointed Actuary's estimates, the following information is available:

OIC's carried reserves	115 million
Involuntary pool reserves included in carried reserves	12 million

- OIC's actuary believes that there exists a risk of adverse deviation greater than the selected materiality standard due to rapid growth in two lines of business.
- The reserves assumed from an industry involuntary pool are from within OIC's jurisdiction and represent OIC's share of the pool's reserves as estimated by the pool's Qualified Actuary. OIC's actuary includes this amount in the point and range estimates for the reserves.
- There is no ceded reinsurance.
- The only amount assumed is that from the industry involuntary pool.
- OIC has not entered into any intercompany pooling agreements.
- All amounts noted above as reserves include both unpaid loss and unpaid loss adjustment expenses.

OIC's Appointed Actuary is responsible for the Statement of Actuarial Opinion (SAO).

- (0.5 points) Explain which category of opinion the Appointed Actuary for OIC should provide in the SAO.
- (1 point) Identify the amounts listed in the tables above that are required to be disclosed in the SAO and which amounts are not to be disclosed in the SAO. Provide an explanation.
- (1 point) Describe any disclosures that need to be included in the SAO regarding the risk of material adverse deviation, making reference to any applicable Actuarial Standards of Practice.
- (0.5 points) Explain which category of opinion the Appointed Actuary for OIC should provide if OIC's carried reserves were 135 million.

## 21. Continued

In addition to the SAO, the Appointed Actuary is also responsible for the Actuarial Opinion Summary.

- (e) (1 point) Describe the purpose of the Actuarial Opinion Summary and identify the amounts listed in the tables above that are required to be disclosed in it.

Consider the situation in which OIC and OIC's Appointed Actuary did not receive an estimate from the industry involuntary pool for the pool's reserves. Also assume that OIC and OIC's Appointed Actuary do not have sufficient information to make an independent estimate of OIC's share of the pool's reserves. The prior year's estimate of OIC's share of the pool's reserves was 11 million.

- (f) (0.5 points) Explain which category of opinion the Appointed Actuary for OIC should provide for the SAO in this situation where an estimate from the industry involuntary pool is not available.

Actuarial Standard of Practice No. 36, *Statements of Actuarial Opinion Regarding Property/Casualty Loss and Loss Adjustment Expense Reserves*, states that the "actuary should only make use of another's analyses or opinions when, in the actuary's professional judgment, it is reasonable to do so."

- (g) (0.5 points) Describe two factors the actuary should consider in judging whether or not to make use of another's analyses or opinions.

**22.** (4 points)

- (a) (1 point) State two benefits of a Pay-As-You-Drive system of insurance.
- (b) (1 point) Describe two ways a Pay-How-You-Drive system of insurance can be useful to either policyholders or insurance companies, other than providing more refined insurance pricing.
- (c) (1 point) Explain how anti-selection can occur when the introduction of a usage-based insurance (UBI) telematics program is optional in a jurisdiction.
- (d) (1 point) Explain how premiums will be affected for UBI telematics policies as well as for non-UBI telematics policies when there is anti-selection.

**\*\*END OF EXAMINATION\*\***  
**Afternoon Session**

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**SOCIETY OF ACTUARIES**  
**Financial and Regulatory Environment – U.S.**

# **Exam GIFREU**

## **MORNING SESSION**

**Date:** Thursday, October 30, 2014

**Time:** 8:30 a.m. – 11:45 a.m.

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### **INSTRUCTIONS TO CANDIDATES**

#### **General Instructions**

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).
  - a) The morning session consists of 13 questions numbered 1 through 13.
  - b) The afternoon session consists of 9 questions numbered 14 through 22.

The points for each question are indicated at the beginning of the question.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

#### **Written-Answer Instructions**

1. Write your candidate number at the top of each sheet. Your name must not appear.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam GIFREU.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.





**\*\*BEGINNING OF EXAMINATION\*\***  
**Morning Session**

**1.** (5 points) Much of the recent work in insurer solvency supervision has been characterized as a movement from a rules-based approach to a principles-based approach.

(a) (2 points) Compare the rules-based approach to the principles-based approach regarding the establishment of regulatory capital requirements and financial oversight. Include one strength and one weakness of each approach.

Vaughan notes in “The Implications of Solvency II for U.S. Insurance Regulation” that “insurance supervision should reflect a careful balance of rules-based and principles-based approaches to supervision.”

(b) (2 points) Describe and justify an approach to insurance supervision that is a combination of principles-based and rules-based regulation.

A guaranty fund is a state fund that provides a system to pay the claims of insolvent insurers.

(c) (1 point) Explain how guaranty funds can reduce market discipline and increase the amount of risk assumed by insurers.

2. (4 points) An insurer begins 2014 with an investment in 4% coupon bonds with a total value of 200,000,000. The bonds mature on December 31, 2017 and are intended to be held to maturity. Bond income is paid semiannually on June 30th and December 31st. You are given the following information:
- The tax rate is 35% and taxes are paid when cash is received.
  - After-tax investment income is paid to the insurer's shareholders as it is received.
  - There are no liabilities and no expenses to consider.
  - The bonds are the only assets and source of income to consider.
- (a) (1.5 points) Provide the insurer's statutory accounting entries on June 30, 2014 showing:
- (i) Credits and debits to balance sheet accounts
  - (ii) Credits and debits to income statement accounts
  - (iii) Direct charges and credits to surplus
- (b) (1.5 points) Explain why U.S. statutory accounting requires assets to be segmented into admitted assets and non-admitted assets.
- (c) (1 point) Determine the admitted value for each of the following assets under U.S. statutory accounting for a general insurance company:
- (i) Common stock purchased at 500,000 currently valued at 1,000,000
  - (ii) Building, for use as office space by the general insurance company, purchased at 200,000, depreciated by 25%, with a market value of 400,000
  - (iii) An agent's balance of 100,000, 95 days past due

**3.** (5 points) One of the key principles of a successful residual market for automobile insurance is to maintain a relatively small residual market population.

(a) (0.5 points) Explain the relationship between rate regulation and residual market population level.

The province of Ontario has instituted a “take all comers” rule as a non-monetary entry barrier to the automobile insurance residual market.

(b) (3 points) Describe the “take all comers” rule and critique its effectiveness in Ontario.

Fraudulent claims activity affects many lines of business in general insurance.

(c) (1 point) Identify and describe two types of fraudulent claims activity that affect general insurers.

(d) (0.5 points) Identify and describe one antifraud effort initiated by some states.

**4.** (4 points)

- (a) (2 points) Describe two tort reforms enacted in the United States. Include the purpose of each in the description.

There are direct and indirect costs of the tort system related to general insurance. Direct costs include legal expenses, administrative expenses of managing torts, and amounts paid to compensate claimants.

- (b) (1 point) Describe two indirect costs of the tort system related to general insurance.

In *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, the Supreme Court ruled that federal judges are to examine the method or reasoning underlying the admission of expert evidence and to admit only evidence that was reliable and relevant.

- (c) (1 point) Identify two of the five factors, known as the “Daubert factors,” that judges take into account when evaluating the reliability, or scientific validity, of evidence.

**5.** (4 points)

- (a) (1 point) Explain the rationale for government involvement in the provision of agriculture insurance.
- (b) (1 point) Describe the main provision in the U.S. agricultural program that encourages producers to purchase agriculture insurance.
- (c) (2 points) Compare government involvement in the provision of terrorism insurance in the United States and France.

- 6.** (6 points) You are the only fully qualified actuary in a small actuarial consulting firm that you own. Your current clientele consists of several small personal lines general insurance companies.

It is early December 2013 and your firm has been offered an assignment where you would be the appointed actuary for a major publicly traded general insurer in your state, BSG Insurance Company. The contract is for a minimum of three years beginning with the actuarial report for the current year. This assignment will increase your firm's annual revenue significantly. The contract stipulates that 20% of the amount to be billed for the three years is to be paid in advance upon acceptance of the assignment. There is an option for the advance payment to be in the form of stock options for BSG.

The filing deadline is March 1, 2014 but the presentation to BSG's Board of Directors is during the first week of February. BSG management attempts to alleviate your concerns regarding the timing of the assignment by noting that the Board is only interested in a quick summary of the actuarial opinion and that it does not need to see the full report.

The prior year's report indicates that the carried reserves were at the lower end of the actuary's range of reasonable estimates. The actuary used several methods but relied on a highly complex stochastic model. You will not have the time to adequately review the stochastic model or replicate the analysis from it.

BSG management produces a letter outlining why the prior actuary is no longer the appointed actuary. In this letter, BSG states that it believes the prior actuary was overly conservative.

BSG carries a material amount of environmental impairment liabilities (EIL). In a review of third quarter 2013 data provided to you by the management of BSG, you note that there was a significant increase in the calendar year payments for EIL claims from prior accident years.

Assess your professional responsibilities in this scenario. Include in your assessment any applicable Actuarial Standards of Practice and guidance from the American Academy of Actuaries practice note on "Statements of Actuarial Opinion on Property and Casualty Loss Reserves." Your assessment should address four issues.

7. (4 points)

- (a) (0.5 points) Describe the purpose of deferred tax assets and liabilities (DTA/L) in financial reporting.
- (b) (0.5 points) Compare the treatment of DTAs and DTLs in statutory accounting.
- (c) (0.5 points) Describe the proration provision of the 1986 Tax Reform Act.
- (d) (0.5 points) Describe the Dividends Received Deduction (DRD). Include the purpose of the DRD in your response.

Tax accounting uses discounted reserves. The loss reserve discount factors are derived from Schedule P data and a methodology set by the Internal Revenue Service (IRS). You are given the following table of data for a line of business with information from Schedule P - Part 1 of an insurer's 2011 Annual Statement. This data is to be used to compute the loss reserve discount factors for accident year 2013.

Accident Year	Losses & LAE Paid	Losses & LAE Incurred
Prior	200,000	200,000
2002	220,000	220,000
2003	240,000	240,000
2004	300,000	300,000
2005	294,000	300,000
2006	279,000	300,000
2007	272,000	320,000
2008	270,000	360,000
2009	234,000	360,000
2010	190,000	380,000
2011	100,000	400,000

- (e) (2 points) Calculate the IRS loss reserve discount factor that applies to accident year 2013 at 48 months of development (i.e., as of December 31, 2016). Assume a 5% annual discount rate.



**8.** (5 points)

- (a) (1 point) Explain how the Dodd-Frank Act affects the state regulation of reinsurer solvency.

Looch General Insurance (LGI) has three reinsurers, Strong Re (Strong), Power Re (Power) and Forward Re (Forward). You are given the following reinsurance information for LGI:

	<b>Strong</b>	<b>Power</b>	<b>Forward</b>
Status	Unauthorized, Not Certified	Authorized	Unauthorized, Certified
Total reinsurance recoverables	150	150	100
Securing funds / collateral	70	10	25
Recoverables on paid loss & ALAE over 90 days past due, not in dispute	24	20	10
Recoverables on paid loss & ALAE, total	80	70	65
Amounts in dispute included above	11	10	5
Amounts company received from reinsurer in last 90 days of statement year	4	3	5
S&P Rating	AA+	A-	BBB+
A.M. Best Rating	A+	B++	A-

All amounts are in millions.

You are also given the financial rating/required collateral guide for certified reinsurers in the state of domicile for LGI:

<b>State Rating Category</b>	<b>Required Collateral</b>	<b>A.M. Best Rating</b>	<b>S&amp;P Rating</b>
Secure-1	0.00	A++	AAA
Secure-2	0.10	A+	AA+ to AA-
Secure-3	0.20	A	A+, A
Secure-4	0.50	A-	A-
Secure-5	0.75	B++, B+	BBB+ to BBB-
Vulnerable-6	1.00	B to F	BB+ to R

- (b) (4 points) Calculate LGI's total Schedule F provision for reinsurance.

- 9.** (4 points) You have been hired as a consultant by the risk manager of Vandelay Manufacturing, Inc. (Vandelay), a company that manufactures self-defense products such as pepper spray canisters and stun guns. Vandelay manufactures its products in the United States and sells its products internationally, wherever such products are legal.

Over the past five years, the risk manager of Vandelay has noted that its liability insurance costs have quadrupled in the conventional insurance market due to increased claim activity for Vandelay and for the self-defense product industry. The risk manager seeks your advice on whether or not a captive insurer could meet Vandelay's liability insurance coverage needs and control its liability insurance costs.

Write a memo to the risk manager of Vandelay that assesses the plan for using a captive insurer. Your memo should consider the following issues:

- (i) Selection of the type of captive
- (ii) Selection of the jurisdiction of the captive
- (iii) Financial costs and benefits
- (iv) Tax implications

**10.** (6 points) Solvency II in the European Union uses a three-pillar system.

- (a) (1.5 points) Describe each of the three pillars of Solvency II.
- (b) (1.5 points) Compare the method of computation and regulatory purpose for the following levels of required capital in Solvency II:
- (i) Solvency Capital Requirement (SCR)
  - (ii) Minimum Capital Requirement (MCR)
- (c) (1 point) Compare the treatment of correlation of risk charges between categories of risk under NAIC RBC and the Solvency II SCR Standard Formula.

You are given the following information for a U.S.-based general insurer, Borr Insurance (Borr):

Item	Amount (millions)
2013 RBC charge for off-balance-sheet items	4.0
2013 RBC charge for fixed-income securities risk	3.5
2013 RBC charge for equities risk	5.0
2013 RBC charge for reinsurance credit risk	6.0
2013 RBC charge for non-invested assets credit risk	2.0
2013 RBC charge for reserves risk	14.0
2013 RBC charge for written premium risk	13.5
Policyholders' surplus as of Dec. 31, 2013	22.0
Nontabular discounts included in reserves	1.0
Tabular discounts included in reserves	5.0

- The RBC risk charges in the table above are before any credit risk charge adjustments.
  - All of the tabular discounts are for workers compensation reserves.
- (d) (2 points) Calculate the RBC ratio for Borr and identify the action level that results from this. Specify any actions of Borr and the regulator that are indicated at this action level.

**11.** (5 points) Total income by line of business is needed to measure performance, compute returns on capital, and regulate premium rates.

- (a) (1.5 points) Describe two items that complicate the derivation of total income by line of business for general insurers.
- (b) (1.5 points) Compare the allocation of surplus and capital to a line of business in the Insurance Expense Exhibit (IEE) procedure with that used in pricing a line of business.

You are given the following data for Nifty General Insurance Company (Nifty) from Part II of its past two IEEs (Allocation to Lines of Business Net of Reinsurance) for the Homeowners Multiple Peril (Homeowners) line of business. Amounts in the table below are in thousands.

<b>Balance Sheet Items</b> (amounts as of Dec. 31)	<b>2012</b>	<b>2013</b>
Unpaid Losses	1,500	1,640
Loss Adjustment Expense, Defense and Cost Containment Expenses Unpaid	80	90
Loss Adjustment Expense, Adjusting and Other Expenses Unpaid	250	290
Agents' Balances	600	650
Unearned Premium Reserves	3,200	3,300

- The investment gain ratio was 7.0% for 2013.
- The prepaid expense ratio is 20% for Homeowners.
- The Investment Gain Attributable to Capital and Surplus for Homeowners was 520,000 for 2013.

- (c) (2 points) Calculate the following amounts for Nifty's 2013 IEE:
  - (i) Investment Gain on Funds Attributable to Insurance Transactions for Homeowners
  - (ii) Capital and Surplus allocated to Homeowners

**12.** (4 points) The NAIC establishes statutory accounting principles for insurers in the NAIC Accounting Practices and Procedures Manual through a number of Statements of Statutory Accounting Principles (SSAP).

- (a) (2 points) Define Type I and Type II material subsequent events as noted in SSAP No. 9, *Subsequent Events*, and compare their treatments in statutory financial statements.
- (b) (1 point) Describe two methods that can be used for the computation of the unearned premium reserve as noted in SSAP No. 53, *Property Casualty Contracts-Premiums*.

Paragraph 13 of SSAP No. 53 notes that “advance premiums result when the policies have been processed, and the premium has been paid prior to the effective date.”

- (c) (1 point) Describe the statutory financial treatment of advance premiums.

**13.** (4 points)

- (a) (1 point) Explain the difference between a representation and a warranty on an insurance application.
- (b) (2 points) Explain the difference between an express warranty and an implied warranty in product liability law and provide an example of each of them.
- (c) (1 point) Explain the difference between public international law and private international law.

**\*\*END OF EXAMINATION\*\***  
**Morning Session**

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**SOCIETY OF ACTUARIES**  
**Financial and Regulatory Environment – U.S.**

# **Exam GIFREU**

## **AFTERNOON SESSION**

**Date:** Thursday, October 30, 2014

**Time:** 1:30 p.m. – 3:45 p.m.

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### **INSTRUCTIONS TO CANDIDATES**

#### **General Instructions**

1. This afternoon session consists of 9 questions numbered 14 through 22 for a total of 40 points. The points for each question are indicated at the beginning of the question.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

#### **Written-Answer Instructions**

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2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam GIFREU.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.



**\*\*BEGINNING OF EXAMINATION\*\***

**Afternoon Session**  
***Beginning with Question 14***

- 14.** (5 points) You are the consulting actuary for Gemini General Insurance (GGI). GGI's auditor has asked for your opinion on methods to determine if GGI's reinsurance contracts meet the risk transfer requirements to be accounted for as reinsurance. GGI's auditor is aware of three different risk measures (the 10-10 rule, expected reinsurer deficit and a measure based on a multiple of right-tailed deviation) but is unsure as to which is appropriate.

GGI's reinsurance coverage includes a catastrophe excess-of-loss treaty and a quota share treaty with a sliding scale commission. The sliding scale commission feature of the quota share treaty slides the commission from a maximum of 35% at a loss ratio of 50% (or lower) to a minimum of 25% at a loss ratio of 60% (or higher). Neither treaty includes a payment schedule.

- (a) (2.5 points) Explain the appropriateness of each of the three risk measures noted above and select a preferred risk measure for GGI. Justify your selection.
- (b) (1 point) Select the appropriate statutory accounting treatment of GGI's quota share treaty if it had included a loss payment schedule that defers loss recoverable payments for several years. Justify your selection.
- (c) (0.5 points) Explain how quota share treaties, accounted for as reinsurance, provide statutory surplus relief.

In the Notes to Financial Statements, the note on Reinsurance Assumed and Ceded includes information that allows one to determine the amount of surplus relief provided by reinsurance.

- (d) (1 point) Describe the information included in this note that allows one to determine the surplus relief provided by reinsurance.

- 15.** (5 points) You are an actuarial analyst working for a state department of insurance. Your supervisor asks you to research some IRIS ratios for InsureMyStuff Insurance Company (IMSIC), an automobile and property insurer.

You are given the following table compiled from IMSIC's Annual Statement. Amounts in the table are in thousands.

<b>Annual Statement Data</b>	<b>2012</b>	<b>2013</b>
From Page 3, Liabilities, Surplus and Other Funds		
Line 37: Surplus as regards policyholders	33,350	37,550
From Page 4, Statement of Income		
Line 1: Premiums earned	116,100	128,200
Line 2: Losses incurred	75,800	100,000
Line 3: Loss adjustment expenses incurred	15,750	23,550
Line 4: Other underwriting expenses incurred	29,550	20,000
Line 5: Aggregate write-ins for underwriting deductions	350	100
Line 7: Net income of protected cells	0	0
Line 9: Net investment income earned	11,200	8,400
Line 11: Net investment gain (loss)	12,300	26,500
Line 15: Total other income	0	0
Line 17: Dividends to policyholders	400	150
From Page 8, Underwriting and Investment Exhibit, Part 1B, Premiums Written, Line 35 Totals		
Column 1: Premiums Written - Direct Business	224,000	225,000
Column 2 + Column 3: Premiums Written - Reinsurance Assumed	8,200	6,000
Column 4 + Column 5: Premiums Written - Reinsurance Ceded	117,500	108,000

- (a) (2 points) Calculate IMSIC's Two-Year Overall Operating Ratio (IRIS Ratio 5) for 2013.

Other key IRIS ratios for IMSIC are included in the following table:

<b>IRIS Ratio</b>	<b>IMSIC Result for 2013 (%)</b>
Ratio 1 - Gross Premiums Written to Policyholders' Surplus	615
Ratio 2 - Net Premiums Written to Policyholders' Surplus	328
Ratio 11 - One-Year Reserve Development to Policyholders' Surplus	24
Ratio 12 - Two-Year Reserve Development to Policyholders' Surplus	30
Ratio 13 - Estimated Current Reserve Deficiency to Policyholders' Surplus	32

**15. Continued**

- (b) (3 points) Propose a recommendation to your supervisor regarding the results of IMSIC's IRIS ratios as calculated in part (a) and as provided in the table of ratios. Include with your recommendation an assessment of the results, potential reasons for the results and any potential revisions to the ratios.

- 16.** (4 points) Mutual of Keith County (Keith) sold a subsidiary, Hawk Indemnity Insurance Company (Hawk), to the Mutual Group of Seabrook (Seabrook). The closing was as of December 31, 2010. The purchase agreement contained a loss reserve development clause and established an escrow account. Two years after the purchase, the agent for the escrow account is required to pay Seabrook for any adverse loss reserve development on losses up to a maximum of \$1,000,000. Hawk's reserves do not include any discounting.

You are given the following excerpt from Hawk's 2012 Annual Statement, Schedule P – Part 2 – Summary:

Year in Which Losses were Incurred	INCURRED NET LOSSES AND DEFENSE AND COST CONTAINMENT EXPENSES REPORTED AT YEAR END (\$000 OMITTED)									
	1	2	3	4	5	6	7	8	9	10
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1. Prior	1,860	1,734	1,625	1,448	1,398	1,326	1,298	1,285	1,285	1,289
2. 2003	7,211	6,179	6,175	6,199	6,246	6,318	6,355	6,368	6,375	6,377
3. 2004	xxx	5,970	5,965	5,950	5,830	5,850	5,861	5,901	5,913	5,919
4. 2005	xxx	xxx	4,795	4,810	4,800	4,807	4,813	4,822	4,830	4,831
5. 2006	xxx	xxx	xxx	5,085	5,096	5,109	5,129	5,172	5,224	5,225
6. 2007	xxx	xxx	xxx	xxx	6,185	6,196	6,255	6,387	6,400	6,419
7. 2008	xxx	xxx	xxx	xxx	xxx	7,004	7,104	7,120	7,192	7,294
8. 2009	xxx	xxx	xxx	xxx	xxx	xxx	7,237	7,231	7,408	7,562
9. 2010	xxx	xxx	xxx	xxx	xxx	xxx	xxx	8,016	8,537	8,778
10. 2011	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	9,567	9,941
11. 2012	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	8,945

- (a) (1 point) Evaluate how the escrow account should be settled.
- (b) (0.5 points) Describe any issues that might occur in an evaluation of the escrow account if Hawk's reserves included nontabular discounting. If there are no issues, explain why that is so.
- (c) (0.5 points) Describe any issues that might occur in an evaluation of the escrow account if Hawk's reserves included tabular discounting. If there are no issues, explain why that is so.
- (d) (1 point) Describe any issues that might occur in an evaluation of the escrow account if, after Seabrook's purchase of Hawk, Hawk was included in an inter-company pooling arrangement with Seabrook. If there are no issues, explain why that is so.

**16. Continued**

Schedule P of the Annual Statement contains many parts, each with its own purpose.

(e) (1 point) Describe the purpose of the following Schedule P parts:

(i) Schedule P - Part 6

(ii) Schedule P - Part 7



**17.** (5 points) In a negligence lawsuit, it is generally required that the plaintiff prove all the elements of negligence. This requirement is relaxed in situations where the following apply:

I. *Negligence per se*

II. *Res ipsa loquitor*

(a) (1 point) Explain how *negligence per se* modifies the proof of negligence concept.

In 1986, a Court of Appeals case set forth the three elements that a plaintiff must prove to establish a *res ipsa loquitor* situation:

I. The event must be of a kind which ordinarily does not occur in the absence of someone's negligence.

II. It must be caused by an agency or instrumentality within the exclusive control of the defendant.

III. It must not have been due to any voluntary action or contribution on the part of a plaintiff.

In 2003, the Court of Appeals in *States v. Lourdes Hospital* addressed one of these elements.

(b) (0.5 points) Identify which of these three elements was addressed. Include in your response the reason it was addressed.

(c) (0.5 points) Explain the modification to this element in the 2003 Court of Appeals ruling.

You are given the following details of a potential negligence case:

- Shady Shale Corporation (SSC) is an energy company that extracts natural gas from shale rock layers deep within the earth, a process commonly referred to as fracking.
- Fracking involves drilling long distances into and across the earth's surface for the injection of highly pressurized fluids into the shale area.
- Fluids used in fracking contain a number of chemicals including methanol.
- Fracking has been linked to methane gas leaks.
- SSC conducts fracking operations several miles from the town of Clearview.

## 17. Continued

- Drinking water in Clearview is provided by wells.
- After several months of fracking by SSC, Clearview notes that its water supply has increased levels of methane and toxic chemicals that have made the water unsafe for drinking.
- Dozens of people in Clearview have developed illnesses that are alleged to be due to the contamination of the water supply.
- Clearview files suit against SSC alleging that its fracking operations have contaminated its water wells.
- SSC contends that the well contaminants are naturally occurring and not associated with the fracking process.

(d) (3 points) Describe the issues regarding proof of negligence in the case described. Include in your response the potential applicability of:

- (i) *Negligence per se*
- (ii) *Res ipsa loquitur*

**18.** (4 points) The U.S. Supreme Court affirmed the right of states to regulate insurance in the case *Paul v. Virginia* in 1869. The McCarran-Ferguson Act had a similar effect in 1945.

- (a) (1 point) Explain why the McCarran-Ferguson Act was necessary to affirm the right of states to regulate insurance.

One of the goals of underwriting regulation is to prevent unfair discrimination against insureds or insurance applicants.

- (b) (1 point) Describe two ways that regulation can accomplish this.

Rate regulation approaches can vary from prior-approval at one extreme to no-file at the other with different approaches in between.

- (c) (0.5 points) Identify a rate regulation approach between these two extremes.
- (d) (1.5 points) Select one approach to rate regulation and provide an argument in favor of it. Include a rebuttal to at least one common criticism of the approach selected.

**19.** (5 points)

- (a) (1 point) Explain what is required of the appointed actuary regarding the Actuarial Opinion Summary if the five-year historical exhibit reveals one-year loss development in excess of 5% of surplus in at least three of the past five calendar years.

You are a consulting actuary and the appointed actuary for your client, Bulwark Insurance, a personal lines general insurer writing property and automobile insurance. In preparing your Statement of Actuarial Opinion and Actuarial Report, you notice that the data in Schedule P - Part 1 is inconsistent with data in Schedule P - Part 2. You have relied on Schedule P - Part 2 data for your loss reserve analysis. There is no discounting included in any of Bulwark's reserves. The inconsistency is greater than the materiality standard selected by you for your actuarial report but less than the materiality standard selected by the auditor of the Annual Statement.

- (b) (2.5 points) Explain your professional responsibilities regarding the Statement of Actuarial Opinion in this situation giving consideration to any applicable Actuarial Standards of Practice and the American Academy of Actuaries practice note on "Statements of Actuarial Opinion on Property and Casualty Loss Reserves."

The auditor for Bulwark Insurance has requested details on your calculation of the materiality standard. Your calculation includes some confidential information.

- (c) (0.5 points) Explain your responsibilities regarding this request from the auditor.
- (d) (1 point) Explain the reasons why the auditor's materiality standard can be different from the actuary's materiality standard.

- 20.** (4 points) You have recently started working at a company that specializes in private passenger automobile insurance. Your manager expects your company to be subject to a market conduct examination in the near future and has asked you to quickly look at the use of credit in your company's rating and underwriting process to see if there is anything that might invite regulatory scrutiny. He has asked for a response by the end of the next day.

In the limited time that you have been given, you find that your company's standard procedure is to obtain a credit-based insurance score on each adult member of the household of each insurance applicant. The scores are primarily based on each individual's payment history, income, and outstanding debt. They are used for rating purposes and updated every three years. If a score is not available for any adult member of the applicant's household, the application is automatically declined. For purposes of efficient data storage, the scores are coded in the address record of each applicant.

Write a memo to your manager describing any concerns that you have and any additional information about the process that you would need in order to draw more definitive conclusions.

**21.** (4 points) In estimating the premium asset on retrospectively rated policies, there are two methods for calculating the Premium Development to Loss Development (PDL) ratios.

(a) (1 point) Describe the two methods for calculating PDL ratios and identify the preferred method when the retrospective rating parameters change significantly over time.

You are given the following information on an insurer's retrospectively rated policies:

Policy Year	Ultimate Losses	Losses Reported at Prior Retro Adjustment	Premiums Booked from Prior Adjustment	Premium Booked as of 12/31/13	Completed Retro Adjustments as of 12/31/13
2010	105,000	93,000	151,000	152,000	2
2011	103,000	81,000	147,000	149,000	1
2012	126,000	0	0	191,000	0

Retro Adjustment Period	Selected PDL Ratio
First	1.8
Second	0.7
Third	0.4

No losses are reported after the third retro adjustment.

(b) (3 points) Calculate the premium asset on retrospectively rated policies as of December 31, 2013 arising from policy years 2010, 2011 and 2012.

**22.** (4 points)

- (a) (1 point) Determine whether the following conditions are typically sufficient for the insurer to cancel a personal automobile policy that has been in force for more than 60 days.
- (i) The policyholder did not pay the premium.
  - (ii) The policyholder made a misrepresentation in the policy application.
  - (iii) The license of the policyholder's spouse was suspended.
  - (iv) The policyholder relocated to a state in which the insurer is not licensed.

An insurance department is conducting an examination of an insurer and the following situations have been observed:

- Different premium rates are offered to individuals from different regions with otherwise similar risks.
  - The amount of insurance available varies by marital status.
  - It has refused to issue or renew a homeowners policy based on the applicant's mental impairment.
  - It has refused to insure a risk because another insurer has refused to insure that risk.
- (b) (1 point) Determine whether the situations are considered unfair trade practices with respect to underwriting.
- (c) (1 point) Describe two factors that a state insurance department should consider when deciding which major insurers to schedule for a market conduct examination.
- (d) (1 point) Describe the process used by the team of examiners in performing a market conduct examination.

**\*\*END OF EXAMINATION\*\***  
**Afternoon Session**

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**SOCIETY OF ACTUARIES**  
**Advanced Topics in General Insurance**

# **Exam GIADV**

**Date:** Thursday, May 1, 2014

**Time:** 2:00 p.m. – 4:15 p.m.

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## **INSTRUCTIONS TO CANDIDATES**

### **General Instructions**

1. This examination has a total of 40 points.  
  
This exam consists of 8 questions, numbered 1 through 8.  
  
The points for each question are indicated at the beginning of the question.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

### **Written-Answer Instructions**

1. Write your candidate number at the top of each sheet. Your name must not appear.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate Exam GIADV.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Tournez le cahier d'examen pour la version française.





**\*\*BEGINNING OF EXAMINATION\*\***

**1.** (4 points) Property R Us Insurance Company is a small insurer that insures commercial buildings of all sizes. It has purchased surplus share reinsurance with a retained line of 100,000.

(a) (0.5 point) Explain why Property R Us may have purchased surplus share reinsurance instead of quota share reinsurance.

The surplus share treaty has a sliding scale commission with terms as follows:

Minimum Commission	20% at a 70% loss ratio
Sliding 1:1 to	30% at a 60% loss ratio
Sliding 0.5:1 to a Maximum	40% at a 40% loss ratio

There is a 20% probability of a loss ratio below 40%, a 20% probability of a loss ratio above 70%, and the loss ratio is uniformly distributed in the range from 40% to 70%.

(b) (1.5 points) Calculate the expected commission.

(c) (1 point) State whether the expected commission will increase or decrease as Property R Us grows its business and writes more risks. Support your conclusion.

Property R Us wishes to purchase a 50,000 excess of 50,000 property per risk excess treaty. The surplus share reinsurance will inure to the benefit of the property per risk treaty.

(d) (1 point) Explain how an exposure curve can be used to price risks with an insured value of 1,000,000 for the property per risk treaty.

2. (4 points) You are setting the premium for a one-year policy using the following assumptions:

- The premium will be collected when the policy becomes effective.
- Expenses of 20 will be paid when the policy becomes effective.
- Losses are expected to be 80 and will be paid at policy expiration.
- The tax rate on all income is 35% and taxes will be paid at policy expiration.
- Equity of 50 supports the policy.
- The risk-free rate is 1%.
- The risk-adjusted rate for losses is -2%.

(a) (2.5 points) Calculate the premium for this policy using the Risk Adjusted Discount Technique.

Your actuarial student Rocky has proposed using the target total rate of return model with an underwriting profit margin of  $(S/P)[R_f + RP - (IA/S)(IR)]$ , where:

$S$  = shareholders' equity

$P$  = premium

$R_f$  = risk-free rate

$RP$  = insurer's risk premium

$IA$  = investable assets

$IR$  = investment return

Rocky has pointed out that the required underwriting profit margin could be decreased by paying an immediate dividend to shareholders, thus reducing  $S$ . He has suggested that this would enhance your company's competitive position.

(b) (1 point) Evaluate Rocky's suggestion.

(c) (0.5 point) Explain the purpose of the funds generating coefficient in the Capital Asset Pricing Model applied to insurance.



3. (9 points) You are interested in determining the variability of reserve estimates. The triangle of data you are working with is presented below (AY = accident year). The shaded cells have been completed using the standard chain ladder method. It is assumed that all claims are fully developed after ten years.

AY	Development Year									
	1	2	3	4	5	6	7	8	9	10
1	358	1,125	1,735	2,218	2,746	3,320	3,466	3,606	3,834	3,901
2	352	1,236	2,170	3,353	3,799	4,120	4,648	4,914	5,339	5,432
3	291	1,292	2,219	3,235	3,986	4,133	4,629	4,909	5,285	5,378
4	311	1,419	2,195	3,757	4,030	4,382	4,588	4,835	5,206	5,297
5	443	1,136	2,128	2,898	3,403	3,873	4,207	4,433	4,773	4,857
6	396	1,333	2,181	2,986	3,692	4,075	4,427	4,665	5,022	5,110
7	441	1,288	2,420	3,483	4,089	4,513	4,902	5,166	5,562	5,659
8	359	1,421	2,864	4,174	4,900	5,408	5,875	6,191	6,665	6,782
9	377	1,363	2,382	3,471	4,075	4,498	4,886	5,149	5,543	5,640
10	344	1,200	2,098	3,057	3,589	3,961	4,303	4,534	4,882	4,967

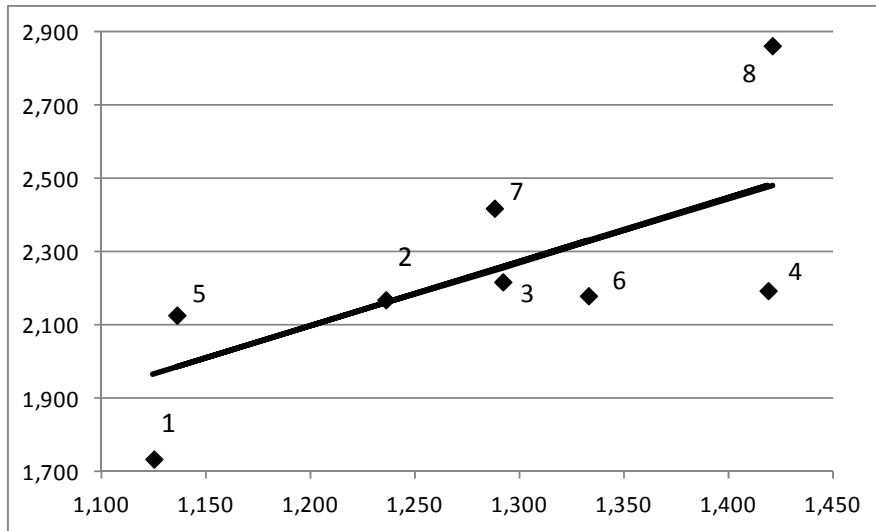
In his paper “Measuring the Variability of Chain Ladder Reserve Estimates,” Mack states that there are three statistical assumptions that are implicit in the chain ladder method.

One of the assumptions is that  $E(C_{i,k+1} | C_{i,1}, \dots, C_{i,k}) = C_{i,k} f_k$  for all  $i$  and  $k$ .

- (a) (0.5 point) Describe this assumption in words.
- (b) (0.5 point) Describe a reserving situation in which this assumption may not hold.

Mack suggests a regression test to evaluate this assumption. A plot is constructed for each lag. For the above triangle, the following plot was made to assess the development from lag 2 to lag 3. The chain ladder estimate of  $f_2$  is 1.75.

### 3. Continued



Plot of  $C_{i,3}$  (vertical axis) against  $C_{i,2}$  (horizontal axis) with the line  $y = 1.75x$  added. The numbers indicate the accident year for that plotted value.

- (c) (1 point) Determine if this plot provides evidence that this assumption holds. Support your answer.
- (d) (1.5 points) Describe, using words and/or formulas as appropriate, the other two statistical assumptions identified by Mack.

You now wish to continue checking the same chain ladder assumption you tested with the scatterplot and regression line, this time using ideas from “Testing the Assumptions of Age-to-Age Factors” by Venter. Your assistant has analyzed four models that describe the development pattern. For each model he determined the parameter estimates along with the estimated ultimate values (both not shown) and the sum of squared errors. The notation used in the models is:

$c(w, k)$  = cumulative claims for accident year  $w$  at development year  $k$

$q(w, k)$  = incremental claims for accident year  $w$  at development year  $k$

The results are in the table on the next page.

### 3. Continued

Model Number	Model Description	Sum of Squared Errors
1	$q(w, k + 1) = c(w, k)f(k)$	1,869,591
2	$q(w, k + 1) = c(w, k)f(k) + g(k)$	1,120,615
3	$q(w, k + 1) = g(k)$	1,696,523
4	$q(w, k + 1) = f(k + 1)h(w)$	1,029,484

- (e) (2 points) Rank the four models from best fitting to worst fitting using one of the three methods Venter suggests for accounting for the number of estimated parameters when comparing sums of squared errors. Indicate if your results support Mack's assumption.
- (f) (1.5 points) Describe two other tests Venter recommends for determining the viability of using the chain ladder method.

The following table provides the development factors ( $f_k$  in Mack's paper) and the variance estimates ( $\alpha_k^2$  in Mack's paper, using one of the methods from the paper for the final value).

$k$	1	2	3	4	5	6	7	8	9
$f_k$	3.489	1.748	1.457	1.174	1.104	1.086	1.054	1.077	1.017
$\alpha_k^2$	159.63	37.79	41.90	15.18	13.69	8.21	0.44	1.13	0.44

- (g) (2 points) Calculate the variance of the chain ladder estimate of the reserve for claims from accident year 3.

4. (4 points) You are calculating a risk margin for claim liabilities using the methodology set out in “A Framework for Assessing Risk Margins.”

The risk margin is to be calculated at the 75% adequacy level and is to be based on the following sources of uncertainty, which are considered independent of one another:

	Source of Uncertainty		
	Independent Risk	Internal Systemic Risk	External Systemic Risk
Coefficient of Variation	5%	8%	15%

The central estimate of claim liabilities is 100,000,000.

Claims are assumed to be normally distributed.

The z-value of the 75<sup>th</sup> percentile of the normal distribution is 0.674.

- (a) (1.5 points) Describe the following sources of uncertainty:
- (i) Independent Risk
  - (ii) Internal Systemic Risk
  - (iii) External Systemic Risk
- (b) (0.5 point) Identify the source of uncertainty in part (a) to which each of the following belongs:
- (i) Random Claim Fluctuations
  - (ii) Unexpected Future Legal Changes
  - (iii) Parameter Selection Error
- (c) (0.5 point) Calculate the combined coefficient of variation for all sources of uncertainty.
- (d) (0.5 point) Calculate the amount of the risk margin.
- (e) (1 point) Describe two areas of additional analysis that you may conduct to provide further comfort regarding the outcomes from the deployment of this framework.

5. (6 points) You are given the following triangle of cumulative paid losses:

	Months of Development		
Accident Year	12	24	36
2011	4,000	7,000	8,000
2012	5,000	7,000	
2013	6,000		

The function  $\sum_i c_i \ln(\mu_i) - \mu_i$  must be maximized to obtain maximum likelihood estimates of the parameters needed to apply Clark's stochastic reserving model.

- (a) (1 point) Provide the term within this function corresponding to 0-12 months of development in accident year 2011, using Clark's LDF method and an exponential distribution with cumulative distribution function  $G(x) = 1 - e^{-\frac{x}{\theta}}$ .

The fitted triangle of cumulative paid losses is:

	Months of Development		
Accident Year	12	24	36
2011	4,343	7,340	8,000
2012	4,142	7,000	
2013	6,000		

- (b) (1 point) Provide the two terms associated with accident year 2012 in the estimate of the scale factor,  $\sigma^2$ .
- (c) (0.5 point) Identify the number of degrees of freedom associated with the estimate of  $\sigma^2$ .

The maximum likelihood estimates of  $\theta$  and  $\sigma^2$  are 7.94 and 318, respectively.

- (d) (1 point) Calculate the maximum likelihood estimate of accident year 2011 ultimate losses,  $ULT_{2011}$ .
- (e) (1 point) Estimate the process standard deviation of the accident year 2011 reserve.

## 5. Continued

The covariance matrix of the estimates of  $ULT_{2011}$ ,  $ULT_{2012}$ ,  $ULT_{2013}$ , and  $\theta$ , respectively, is:

$$\begin{pmatrix} 2,694,151 & 75,960 & 281,183 & 295 \\ 75,960 & 2,987,786 & 795,678 & 834 \\ 281,183 & 795,678 & 9,732,843 & 3,088 \\ 295 & 834 & 3,088 & 3.24 \end{pmatrix}$$

- (f) (1 point) Provide an expression for the estimate of the parameter variance of the 2011 reserve using matrix notation. (Do not compute the result.)
- (g) (0.5 point) Compare Clark's stochastic reserving model to the chain ladder model with respect to the assumption of independence of incremental losses within an accident year.

6. (4 points) You are an actuary at Orange Rock Insurance Company (ORCo). One of ORCo's products is sold in 32 jurisdictions and ratemaking has been done using seven years of experience. ORCo's current methodology is to estimate next year's pure premium for a given jurisdiction by taking a credibility-weighted average of the observed pure premium for that jurisdiction and the observed pure premium averaged over all jurisdictions. Bühlmann-Straub empirical Bayes credibility has been used to determine the credibility factors.

There is a belief within the pricing unit that because there are changes over time, more recent observations should receive more weight than older observations. Your manager recalled that there may be a methodology that leads to decreasing weights on each jurisdiction's past observations along with some remaining weight on the overall observed pure premium.

An ARIMA(0,1,1) model with no constant term produces weights that are geometrically decreasing when applied to each jurisdiction separately.

- (a) (1 point) Explain why the ARIMA(0,1,1) model cannot be extended to a Bühlmann-Straub credibility framework.

Models with only AR or MA terms can be directly extended to a Bühlmann-Straub credibility framework. For ORCo's data, the following estimates of the autocorrelations at each of the first four lags were obtained:

Lag	1	2	3	4
Estimated autocorrelation	0.040	0.237	0.026	0.062

- (b) (1 point) Explain why this pattern of autocorrelations suggests that neither an MA(1) nor an AR(1) model is likely to be appropriate.

## 6. Continued

You decide to use a random effects model as described in Klugman. You further decide that the covariance structure should have non-zero values only at lag two. REML estimates of the required parameters are  $\widehat{\sigma^2 + \delta_0} = 100$ ,  $\hat{\delta}_2 = 25$ , and  $\hat{\tau}^2 = 10$ . Also assume that the exposures for all jurisdictions and all years are equal to 1.

- (c) (1.5 points) Set up, but do not solve, the matrix equation for the vector of credibility weights,  $Z_1, \dots, Z_7$ , to apply to the seven annual observations where the goal is to forecast the pure premium two years ahead (year 9).

Suppose the exposures differed by year.

- (d) (0.5 point) Explain why separate parameter estimates would now be required for  $\sigma^2$  and  $\delta_0$ .



7. (4 points) Your company is renewing two accounts, X and Y, which are exposed to two possible independent claim events, 1 and 2. You are given the following information:

Event ( <i>i</i> )		Loss for Account ( <i>L</i> )			$L^2 p(1-p)$		
<i>i</i>	<i>p(i)</i>	X	Y	X + Y	X	Y	X + Y
1	2%	25,000	2,000	27,000	12,250,000	78,400	14,288,400
2	1%	15,000	1,000	16,000	2,227,500	9,900	2,534,400

- $p(i)$  represents the probability of Event  $i$ .
  - The risk load multiplier,  $\lambda$ , is 0.000025.
- (a) (1 point) Explain why neither the Marginal Variance nor Marginal Surplus methods for calculating risk load are renewal additive.
- (b) (2.5 points) Calculate the risk load for each account using the Shapley method.
- (c) (0.5 point) Explain how the Covariance Share method differs from the Shapley method.

8. (5 points) Casualty R Us Reinsurance Company has been presented with an opportunity to write a casualty per occurrence excess treaty covering the layer 500,000 excess of 500,000 on a swing plan. The following limits profile has been provided:

Subject Premium	Underlying Limit	Policy Limit
5,000,000	0	500,000
5,000,000	0	750,000
15,000,000	0	1,000,000
10,000,000	0	1,500,000
2,000,000	500,000	1,000,000

- (a) (3 points) Calculate the expected losses in the layer using an exposure rating approach with an expected loss ratio of 60% and the following increased limits factors:

Policy Limit	Increased Limits Factor
500,000	1.00
750,000	1.20
1,000,000	1.35
1,500,000	1.56

ALAE on the underlying business is expected to be 20% of losses, and ALAE is allocated to each layer in proportion to losses.

- (b) (0.5 point) Explain why applying a loading of 20% of layer losses to account for ALAE in the layer is problematical.
- (c) (1 point) Explain one method for calculating probabilities when using a collective risk model approximation to the aggregate distribution to set the terms of the swing plan.
- (d) (0.5 point) Recommend whether or not this ceding company should purchase any other casualty per occurrence excess coverage. Justify your answer.

**\*\*END OF EXAMINATION\*\***

**USE THIS PAGE FOR YOUR SCRATCH WORK**

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**SOCIETY OF ACTUARIES**  
**Advanced Topics in General Insurance**

# Exam GIADV

**Date:** Wednesday, October 29, 2014

**Time:** 2:00 p.m. – 4:15 p.m.

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## INSTRUCTIONS TO CANDIDATES

### General Instructions

1. This examination has a total of 40 points.  
  
This exam consists of 8 questions, numbered 1 through 8.  
  
The points for each question are indicated at the beginning of the question.
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3. The answer should be confined to the question as set.
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Tournez le cahier d'examen pour la version française.



**\*\*BEGINNING OF EXAMINATION\*\***

- 1.** (4 points) Property R Us Reinsurance Company uses the following exposure factors to price its commercial property per risk excess treaties:

<b>Percent of Insured Value</b>	<b>Exposure Factor</b>
0%	0%
10%	37%
20%	49%
30%	57%
40%	64%
50%	70%
60%	76%
70%	81%
80%	85%
90%	89%
100%	93%
110%	97%
120%	100%

- (a) (0.5 points) Explain why the exposure curve allows for exposure above 100% of the insured value.

Property R Us has received a submission requesting 400,000 excess of 100,000 property per risk coverage for insured values and subject premium as follows:

<b>Insured Value</b>	<b>Subject Premium</b>
200,000	1,000,000
500,000	1,000,000
1,000,000	1,000,000

- (b) (2 points) Calculate the expected loss in the requested layer assuming an expected loss ratio of 60%.
- (c) (0.5 points) State the key assumption underlying the use of a single exposure curve to price this treaty.

The submission is revised to reflect the purchase of surplus share reinsurance with a retained line of 500,000, which will inure to the benefit of the property per risk treaty.

- (d) (1 point) Calculate the revised expected loss in the layer.

**2.** (4 points) You are calculating the underwriting profit margin for a one-year earthquake insurance policy using the Capital Asset Pricing Model and you determine that both the underwriting beta and the risk-free rate are zero.

- (a) (0.5 points) Explain what it means for the underwriting beta to be zero.
- (b) (0.5 points) Identify any other information you might need to calculate the underwriting profit margin for this policy.
- (c) (1 point) Evaluate whether it would be appropriate to use the Capital Asset Pricing Model to calculate the underwriting profit margin for this policy.

As a possible alternative, you turn to the Risk Adjusted Discount Technique with the following assumptions:

- The premium will be collected when the policy is effective.
  - Expenses of 20 will be paid when the policy is effective.
  - Losses are expected to be 72 and will be paid at the end of the year.
  - The risk-free rate is 0%.
  - The risk-adjusted rate for losses is -10%.
- (d) (1.5 points) Calculate the underwriting profit margin.
  - (e) (0.5 points) Identify two drawbacks to the Risk Adjusted Discount Technique.

3. (4 points) You are calculating a risk margin for claim liabilities using the methodology set out in “A Framework for Assessing Risk Margins.” The following information is provided:

Line of Business	Claim Liabilities	Coefficients of Variation		
		Independent Risk	Internal Systemic Risk	External Systemic Risk
Motor	600	6.0%	5.0%	4.0%
Property	400	8.0%	7.0%	3.0%
<b>Total</b>	<b>1,000</b>			<b>2.9%</b>

The correlation between lines for internal systemic risk was assessed at 25%.

- (a) (1.5 points) Describe the following sources of internal systemic risk:
- (i) Specification Error
  - (ii) Parameter Selection Error
  - (iii) Data Error
- (b) (1 point) Calculate the aggregate coefficient of variation for both lines combined.
- (c) (1.5 points) Explain the likely effect, if any, of each of the following items on each of independent risk, internal systemic risk, and external systemic risk:
- (i) New legislation increasing the statute of limitations for motor claims
  - (ii) Reduced correlation between motor and property claims
  - (iii) More accurate underwriting systems



4. (7 points) You are interested in determining the variability of unpaid claim estimates. The triangle of data you are working with is presented below. The shaded cells have been completed using the standard chain ladder method. It is assumed that all claims are fully developed after six years.

Mack's method of estimating reserve variability has been applied to this triangle. The key results are provided in the table.

	Development Year						
AY	1	2	3	4	5	6	Standard error
1	8,600	12,221	13,221	14,317	14,784	14,815	0
2	8,306	13,049	13,455	13,768	14,034	14,063	50
3	7,709	13,847	15,300	15,619	16,027	16,060	183
4	8,623	14,159	15,096	15,717	16,128	16,161	632
5	8,791	16,224	17,380	18,095	18,568	18,607	888
6	9,021	14,917	15,980	16,638	17,072	17,108	2080
$f_k$	1.65362	1.07125	1.04117	1.02610	1.00210		
$\alpha_k^2$	250.8709	12.8207	16.8267	1.2412	0.0916		

AY = accident year

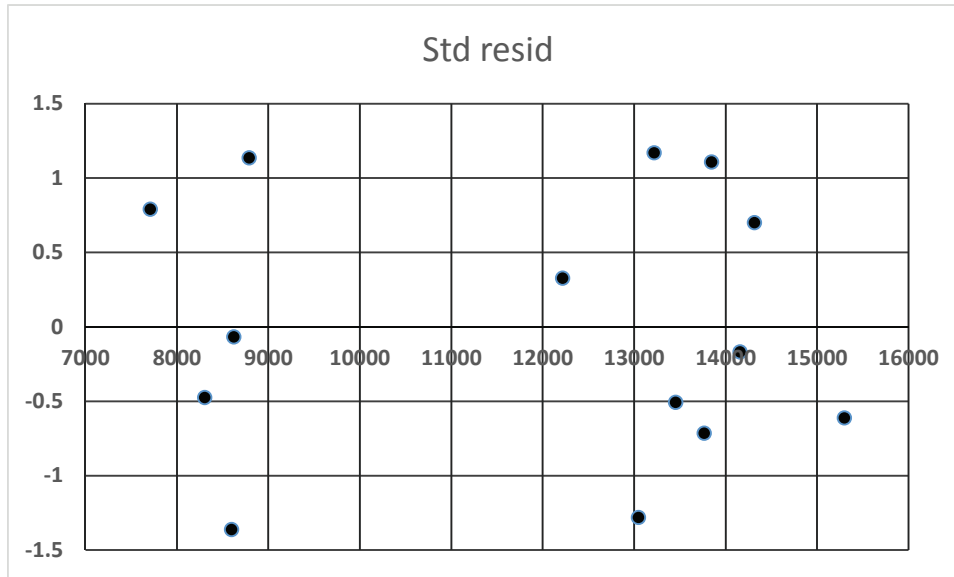
- (a) (1.5 points) Demonstrate that the value of  $\alpha_4^2$  was correctly calculated. (Your calculation need not match to all four decimal places.)
- (b) (1.5 points) Demonstrate that the standard error for accident year 3 was correctly calculated.
- (c) (0.5 points) Calculate the upper limit of a 95% confidence interval for outstanding claims for accident year 3 using a normal distribution. The 97.5<sup>th</sup> percentile of the standard normal distribution is at 1.96.
- (d) (1 point) Propose a method for constructing an improved confidence interval. Justify your proposal.

The total developed claims over the six accident years is 96,815.

- (e) (0.5 points) Explain why the variance of this estimate is greater than the sum of the six variances by accident year.

#### 4. Continued

Venter suggests that a test of the assumptions underlying Mack's method is to plot the residuals of the estimated versus actual increments. The following plot has the residuals standardized by dividing by the standard errors.



- (f) (1 point) Indicate whether this plot supports the Mack assumptions. Justify your answer.

Another suggestion of Venter is to calculate the correlation between the ratios of the incremental claims to the cumulative claims for successive development years. For this data, the estimated correlation coefficient of the ratios from development year 1 to 2 with the ratios from development year 2 to 3 is 0.391 based on four observations.

- (g) (1 point) Indicate whether this calculation supports the Mack assumptions. Justify your answer.

5. (6 points) You are given the following triangle of cumulative paid losses:

	Months of Development		
Accident Year	12	24	36
2011	4,000	7,000	8,000
2012	5,000	7,000	
2013	6,000		

On level premium for each year is 12,000.

The function  $\sum_i c_i \ln(\mu_i) - \mu_i$  must be maximized to obtain maximum likelihood estimates of the parameters needed to apply Clark's stochastic reserving model.

- (a) (1 point) Provide the term within this function corresponding to 0-12 months of development in accident year 2011, using Clark's Cape Cod method and an exponential distribution with cumulative distribution function  $G(x) = 1 - e^{-x/\theta}$ .

The maximum likelihood estimates of  $ELR$  and  $\theta$  are 71.15% and 7.293, respectively.

- (b) (1.5 points) Provide the fitted triangle of cumulative paid losses.
- (c) (0.5 points) Estimate ultimate losses for accident year 2011.
- (d) (0.5 points) Identify the number of degrees of freedom associated with the estimate of the scale factor,  $\sigma^2$ .

The maximum likelihood estimate of  $\sigma^2$  is 273.

- (e) (1 point) Estimate the process standard deviation of the accident year 2011 reserve.

The covariance matrix of the estimates of  $ELR$  and  $\theta$ , respectively, is:

$$\begin{pmatrix} 0.00770 & 0.0444 \\ 0.0444 & 1.75 \end{pmatrix}$$

- (f) (1 point) Provide an expression for the estimate of the parameter variance of the accident year 2011 reserve using matrix notation. (Do not compute the result.)
- (g) (0.5 points) Explain whether you would expect the parameter variance to be larger, smaller, or about the same as the parameter variance obtained using the LDF method.

6. (4 points) Your company is renewing three accounts, X, Y, and Z. You are given the following information:

<b>Account</b>	<b>X</b>	<b>Y</b>	<b>Z</b>
Expected Losses	10,000	1,400	1,500
Variance of Losses	200,000	12,000	10,000
Correlation with X	1.0	0.8	0.4

- Losses from accounts Y and Z are uncorrelated.
  - The risk load multiplier,  $\lambda$ , is 0.0025.
- (a) (3 points) Calculate the risk load for each account using the Shapley method.
- (b) (1 point) Explain how your answer to part (a) would have been different if the Covariance Share method had been used.

7. (6 points) You are an actuary at MEB Insurance Company and have just been given a new assignment. One of the company's actuaries had been working on an application of credibility before he abruptly quit to join the front office of a Major League Baseball team. All that he left were the following notes:

- The application is based on the Klugman study note.
- The application is to 50 large accounts, each with 10 years of experience data.
- For each account ( $i = 1, \dots, 50$ ) and year ( $t = 1, \dots, 10$ ) there is a measure of exposure ( $w_{i,t}$ ) and trended observed pure premium ( $Y_{i,t}$ ).
- For account  $i$  the vector of trended observed pure premiums is modeled as follows:

$$\begin{bmatrix} Y_{i,1} \\ Y_{i,2} \\ \vdots \\ Y_{i,10} \end{bmatrix} = \begin{bmatrix} \mu \\ \mu \\ \vdots \\ \mu \end{bmatrix} + \begin{bmatrix} \alpha_i \\ \alpha_i \\ \vdots \\ \alpha_i \end{bmatrix} + \begin{bmatrix} \gamma_{i,1} \\ \gamma_{i,2} \\ \vdots \\ \gamma_{i,10} \end{bmatrix} + \begin{bmatrix} \epsilon_{i,1} \\ \epsilon_{i,2} \\ \vdots \\ \epsilon_{i,10} \end{bmatrix}$$

where  $\mu$  is a constant, the vector of alphas has a normal distribution with mean 0 and a covariance matrix where each of the 100 elements is  $\tau^2$ , the vector of gammas has a normal distribution with mean 0 and the covariance matrix

$$\begin{bmatrix} \delta & \delta\rho & \dots & \delta\rho^9 \\ \delta\rho & \delta & \dots & \delta\rho^8 \\ \vdots & \vdots & \ddots & \vdots \\ \delta\rho^9 & \delta\rho^8 & \dots & \delta \end{bmatrix}$$

and the vector of epsilons has a normal distribution with mean 0 and a diagonal covariance matrix with diagonal elements  $\sigma^2 / w_{i,1}, \sigma^2 / w_{i,2}, \dots, \sigma^2 / w_{i,10}$ .

- Once REML estimates of the parameters are obtained, the credibility weights can be obtained in two ways. One is to minimize the mean squared error and the other is to minimize the mean squared error but subject to constraints on the credibility weights.

Before investing additional company time in developing this model, your supervisor has asked you to respond to some questions.

- (1.5 points) Describe each of the components in the model.
- (0.5 points) Explain how this model differs from the Bühlmann-Straub model.

## 7. Continued

The covariance matrix of the gammas implies something specific about the structure of the observations, possibly a standard time series relationship.

- (c) *(0.5 points)* Identify the time series model represented by this matrix.
- (d) *(1.5 points)* Explain what that model means with regard to the evolution of pure premiums over time.
- (e) *(1 point)* State the appropriate restriction to place upon the credibility weights that is consistent with the time series model in part (c).
- (f) *(1 point)* Explain the relative merits of the two approaches to obtaining the credibility weights.

8. (5 points) Casualty R Us Reinsurance Company has been presented with an opportunity to write a casualty per occurrence excess treaty covering the layer 500,000 excess of 500,000. The following limits profile has been provided:

Subject Premium	Underlying Limit	Policy Limit
5,000,000	0	500,000
5,000,000	0	1,000,000
4,000,000	0	1,500,000
2,000,000	500,000	500,000
3,000,000	500,000	1,000,000

- (a) (2 points) Calculate the expected losses in the layer using an exposure rating approach with an expected loss ratio of 60% and the following increased limits factors:

Policy Limit	Increased Limit Factor
500,000	1.00
1,000,000	1.35
1,500,000	1.56

- (b) (1.5 points) Identify the two methods for handling trend and policy limits when an experience rating approach is used to calculate the expected losses. State the assumption that underlies each method.

Individual losses of 600,000 and 750,000 are incurred.

- (c) (1 point) Identify, for each loss, the range of ALAE amounts for which allocating ALAE to the layer in proportion to losses would result in Casualty R Us paying more than it would if ALAE were included with losses.
- (d) (0.5 points) Identify any additional casualty per occurrence excess coverage that the ceding company should consider purchasing. Justify your answer.

**\*\*END OF EXAMINATION\*\***

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