

**COURSE 5
MORNING SESSION**

APPLICATION OF BASIC ACTUARIAL PRINCIPLES

SECTION A-WRITTEN ANSWER

****BEGINNING OF EXAMINATION 5****
MORNING SESSION

- 1.** (5 points) A large employer is considering offering a private pension plan.
- (a) Describe the reasons for offering such a plan.
 - (b) Describe the process involved in designing and implementing such a plan.
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- 2.** (5 points)
- (a) For basic group term life insurance, briefly describe each of the following items:
 - (i) Typical plan designs offered
 - (ii) Eligibility provisions
 - (iii) Continuity of coverage provisions
 - (b) Briefly describe how supplemental group term life insurance is different from basic group term life insurance with respect to:
 - (i) Typical plan designs offered
 - (ii) Eligibility provisions
 - (iii) Continuity of coverage provisions

3. (5 points)

- (a) Describe the reasons a life insurance company may reinsure its risk.
- (b) ABC Life Insurance Company has a 40% quota share reinsurance treaty on a first dollar basis. Its retention limit is \$500,000 per policy.

	<u>Policy 1</u>	<u>Policy 2</u>
Net Amount at Risk	\$750,000	X
Amount Retained	R	Y
Amount Reinsured on a First Dollar Basis	S	Z
Amount Reinsured on an Excess Basis	T	\$100,000

Calculate the missing values in the table above.
Show all work.

4. (5 points) Explain the U.S. laws and regulations with respect to market conduct that apply to a life insurance company and its agents.

5. (6 points) Mary and John, respectively 45 and 42 years old, are considering the purchase of a non-participating whole life, joint last-to-die policy, paid-up at first death with:

- a 5 year term individual rider life insurance convertible and renewable up to age 65 for Mary and John;
- a Critical Illness rider covering 50 illnesses for Mary and John;
- a Disability income rider providing a lifetime benefit with a 2 week waiting period for Mary and John.

- (a) Describe briefly the policy and its riders.
- (b) Describe alternatives to each coverage that could reduce the cost to Mary and John.

6. (7 points) For a defined benefit pension plan, you are given:

Pension plan formula:

1.5% of final year's salary for each year of service up to 10 years, plus
2.0% of final year's salary for each year of service after 10 years.

Interest Rate	6%
Salary Growth Rate	4%
Pre-retirement decrements	None
Assumed retirement age	65
$\ddot{a}_{65}^{(12)}$	12
Assets at 1/1/2003	300,000
Assets at 1/1/2004	320,000
Contribution made on 12/31/2003	5,000
Funding method	Projected unit credit

Employee	Age at Hire	Age on 1/1/2003	Salary on 1/1/2003
A	30	40	30,000
B	30	60	50,000

- (a) Calculate the unfunded accrued liability at 1/1/2003.
- (b) The actual accrued liability on 1/1/2004 is 350,000.
Calculate the total experience gain/loss as of that date.

Show all work.

7. (5 points) For a property and casualty insurance policy issued January 1, 2000, you are given:

<u>Effective Date</u>	<u>Rate Change</u>
May 1, 2000	+5%
November 1, 2000	+10%

<u>Calendar Year</u>	<u>Earned Premium</u>	<u>Expected effective incurred losses, trended and developed through December 31, 2002</u>
2000	120,000	100,000
2001	130,000	110,000
2002	140,000	120,000

Expense ratio: 30%

Present average manual rate: 45

Assume all policies have a one-year term and the premium is uniformly distributed.

Calculate the indicated average gross rate as of January 1, 2003.

Show all work.

8. (4 points) Describe the issues that must be considered for the design and pricing of:

- (a) Group vision and hearing benefits
- (b) Group legal benefits

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SECTION B-MULTIPLE CHOICE

1-7. Each of questions 1 through 7 consists of two lists. In the list at the left are two items, lettered X and Y. In the list at the right are three items, numbered I, II, and III. ONE of the lettered items is related in some way to EXACTLY TWO of the numbered items. Indicate the related items using the following answer code:

	<u>Lettered Item</u>	<u>Is Related to Numbered Items</u>
(A)	X	I and II only
(B)	X	II and III only
(C)	Y	I and II only
(D)	Y	I and III only
(E)	The correct answer is not given by (A), (B), (C) or (D).	

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|-----------|----|------------------------------------|------|--|
| 1. | X. | Canadian Employment Insurance (EI) | I. | Death benefits available |
| | Y. | Canadian Worker's Compensation | II. | Supplemental unemployment benefits |
| | | | III. | Employer premium reduction program |
| 2. | X. | Defined benefit pension plan | I. | Age neutral |
| | Y. | Defined contribution pension plan | II. | Golden handcuffs |
| | | | III. | Cash balance plan |
| 3. | X. | Captive agents | I. | Commission overrides |
| | Y. | Banks | II. | Streamlined underwriting and issue processes |
| | | | III. | Life insurance for estate planning |

- 4.** X. An employer with 5 employees I. Maternity coverage is mandatory.
 Y. An employer with 40 employees II. For active employees, Medicare is the secondary insurer.
 III. The health plan carrier is not likely to use a composite rating method.
- 5.** X. Distributable earnings I. Used in return on equity (ROE) calculation.
 Y. Shareholder earnings II. Independent of required capital.
 III. Better reflects owners' expected cash flows.
- 6.** X. Aggregate method I. Benefit allocation cost method
 Y. Projected unit credit method II. No unfunded actuarial liability
 III. Actuarial losses not explicitly recognized
- 7.** X. Income annuity products I. Lapses are a key assumption in pricing.
 Y. Accumulation annuity products II. Longevity risk is a key concern.
 III. In the U.S., the minimum solvency reserves are calculated using the Commissioners' Annuity Reserve Valuation Method (CARVM).

8-20. Each of questions 8 through 20 consists of an assertion in the left-hand column and a reason in the right-hand column. Code your answer to each question by blackening space:

- (A) If both the assertion and the reason are true statements, and the reason is a correct explanation of the assertion.
- (B) If both the assertion and the reason are true statements, but the reason is NOT a correct explanation of the assertion.
- (C) If the assertion is a true statement, but the reason is a false statement.
- (D) If the assertion is a false statement, but the reason is a true statement.
- (E) If both the assertion and the reason are false statements.

ASSERTION

REASON

8. Personal-producing general agents receive higher commissions than captive agents.

BECAUSE

Personal-producing general agents typically provide training and office space for captive agents.

ASSERTION

REASON

9. In Canada, the licensing of physicians falls under federal jurisdiction.

BECAUSE

In Canada, the Federal government sets national standards for the provision of health care.

ASSERTION

REASON

10. For individual health insurance, the loss ratio method is the most common method of determining premium rate changes.

BECAUSE

For individual health insurance, under the loss ratio method, the policyholder's original rating class does not have to be preserved.

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- (D) If the assertion is a false statement, but the reason is a true statement.
- (E) If both the assertion and the reason are false statements.

<u>ASSERTION</u>		<u>REASON</u>
15. For dynamic life insurance products, the calculation of policy values is independent of the partial withdrawal assumptions.	BECAUSE	For dynamic life insurance products, partial withdrawals of the account values are often allowed.

<u>ASSERTION</u>		<u>REASON</u>
16. The U.S. DAC Tax results in a company losing investment income.	BECAUSE	The U.S. DAC Tax accelerates taxes.

ASSERTION

- 17.** Under a defined benefit pension plan, the plan termination liability is usually less than the plan continuation liability.

REASON

- BECAUSE** Under a defined benefit pension plan, the plan termination valuation omits salary projections.

ASSERTION

- 18.** Yearly Renewable Term (YRT) reinsurance is commonly used with annuities.

REASON

- BECAUSE** YRT reinsurance removes the insurer's investment risk.

ASSERTION

- 19.** In the U.S., manual rates developed for large group health plans do not depend on the group's specific gender mix.

REASON

- BECAUSE** In the U.S., the federal government restricts the use of gender-based employee contribution rates for large group health plans.

ASSERTION

- 20.** Incurred loss-development factors may be greater than one.

REASON

- BECAUSE** Final loss development in a claim file may be negative.

21. For a property and casualty product, you are given:

Expected effective incurred losses (trended and developed)	50,000,000
Earned exposure units	2,000,000
Earned premium at current rates	66,000,000
Current average manual rate	33
Expense ratio	30%

Calculate the new average gross rate that should be charged.

- (A) 25
- (B) 30
- (C) 36
- (D) 47
- (E) 83

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22. For a variable income annuity, you are given:

Initial annual income benefit = 10,000

AIR = 4%

Policy Year	Net Investment Return
1	5%
2	3%
3	1%
4	7%
5	2%

Calculate the annual income benefit in policy year 5.

- (A) 9,799
- (B) 9,991
- (C) 10,009
- (D) 10,205
- (E) 11,699

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23. All of the following are criteria for a risk to be insurable EXCEPT:

- (A) The loss is definite.
- (B) The loss is random.
- (C) The exposure units are dependent.
- (D) The economic value of insurance is calculable.
- (E) It is economically feasible.

24. The administration of life insurance policies is similar to health insurance policies for all of the following EXCEPT:

- (A) Use of medical examination
- (B) Premium collection
- (C) Policy issue
- (D) Application
- (E) Claims administration

- 25.** For overhead expense benefit policies, all the following are true EXCEPT:
- (A) Elimination periods usually exceed 60 days.
 - (B) Benefit periods usually exceed two years.
 - (C) Actual expenses incurred are covered up to a maximum amount.
 - (D) Benefits are independent of other disability income policies replacing earned income.
 - (E) Surrogate salary benefit is available.

- 26.** Rank in ascending order (smallest to largest) the mortality assumptions under the following underwriting approaches.

- I. Simplified issue
 - II. Nonmedical
 - III. Guaranteed issue
-
- (A) I < II < III
 - (B) I < III < II
 - (C) II < I < III
 - (D) III < I < II
 - (E) III < II < I

- 27.** For dynamic life insurance products, all of the following are true EXCEPT:
- (A) Premiums are flexible.
 - (B) Commissions are a low percentage of premiums up to a “target premium.”
 - (C) Surrender charges reduce to zero over a number of years.
 - (D) Expense charges are usually a percentage of premiums plus a flat amount per month.
 - (E) Death benefits are usually greater than or equal to the account value.

- 28.** Rank in ascending order (smallest to largest) the following products according to the level of investment risk transferred to policyholders.

- I. Two-tiered annuity
- II. Equity-indexed annuity
- III. Variable universal life insurance

- (A) I < II < III
- (B) I < III < II
- (C) II < I < III
- (D) III < I < II
- (E) III < II < I

29. A company may segment assets for all of the following reasons EXCEPT:

- (A) To allow different lines of business to make independent investment choices.
- (B) To simplify accounting.
- (C) To back liabilities with assets of similar terms.
- (D) To credit “new money” interest rates to policies.
- (E) To back products that offer cash surrender values with liquid assets.

30. For a defined benefit pension plan, you are given:

Actuarial cost method:	Traditional unit credit
Normal retirement benefit:	30 per month per year of service
Interest rate:	7.0%
Pre-retirement decrement other than death:	None
Retirement age:	65
Participants as of January 1, 2002:	50 active participants, all age 55
Selected mortality value:	$q_{55} = 0.02$
Normal cost for 2002:	150,000

All 50 participants are still active as of January 1, 2003.

Calculate the normal cost for 2003.

- (A) 153,061
- (B) 157,290
- (C) 160,500
- (D) 163,775
- (E) 167,250

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31. For a prescription drug plan, you are given:

All prescriptions cost at least \$10.

The average prescription is \$75.

The current plan has a \$5 per prescription copay.

The current utilization is 8,500 annual prescriptions per 1,000 members.

The utilization will drop to 7,800 annual prescriptions per 1,000 members if the per prescription copay is increased from \$5 to \$10.

Calculate the estimated change in the gross cost per member per month (PMPM) if the copay is increased from \$5 to \$10.

- (A) -\$3.40
- (B) -\$3.90
- (C) -\$4.40
- (D) -\$4.60
- (E) -\$7.30

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32. A product has a 6% profit margin and a premium margin of 90%.

Calculate the breakeven sales percentage change needed to offset a 2% price reduction.

- (A) 43% decrease
- (B) 30% decrease
- (C) 21% increase
- (D) 30% increase
- (E) 43% increase

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33. For the Canadian annual statement, each of the following is true EXCEPT:

- (A) Claims in course of settlement are separately reported.
- (B) Group life insurance in force is split by type of group covered.
- (C) Group life insurance in force is split between term and permanent.
- (D) Income is separately developed by line of business.
- (E) Gross reserves are exhibited separately by line of business.

34. In Canada, for federal tax calculations related to one-year group term life insurance, each of the following is true, EXCEPT:

- (A) Acquisition expenses must be amortized over the term period.
- (B) The reserve for known claims generally cannot exceed 95% of the statutory reserve.
- (C) The reserve for IBNR claims cannot exceed 95% of the statutory reserve.
- (D) The actuarial reserve is limited to the equally apportioned unearned premium.
- (E) The provision for experience refunds cannot exceed 25% of the annual premium.

35. In the U.S., for a group insurance minimum premium plan, all of the following are true EXCEPT:

- (A) Claims paid by the policyholder are exempt from premium tax in most states.
- (B) It can be used with retrospective refunds.
- (C) The accounting for claims is similar to that for reserveless arrangements.
- (D) Premium equivalents are reported on the NAIC annual income statement.
- (E) Policyholder funds the claim portion of the policy.

36. For a property and casualty insurance product, you are given the following accident year 2000 information:

- (i) Under Expected Loss Ratio method, the estimated ultimate losses are 500,000
- (ii) The following paid loss-development factors from the Chain-Ladder method

	Ratio of Successive Development Years					
	<u>1/0</u>	<u>2/1</u>	<u>3/2</u>	<u>4/3</u>	<u>5/4</u>	<u>6/5</u>
average	1.51	1.43	1.22	1.05	1.03	1.00

Calculate the year-end 2002 estimated loss reserve using the Bornhuetter-Ferguson method.

- (A) 121,048
- (B) 175,497
- (C) 234,999
- (D) 324,503
- (E) 378,952

****END OF EXAMINATION****
MORNING SESSION

**COURSE 5
AFTERNOON SESSION**

**APPLICATION OF BASIC ACTUARIAL
PRINCIPLES**

WRITTEN ANSWER

****BEGINNING OF EXAMINATION 5****
AFTERNOON SESSION
Beginning with Question 9

- 9.** (6 points) Describe the assumptions used in the valuation of a defined benefit pension plan.
- 10.** (6 points) For a life insurance company:
- (a) Describe the components of interest rate risk that should be reflected in required capital.
 - (b) Describe the treatment of interest rate risk in the required capital formulas for Canada and the U.S.

11. (4 points) With respect to a large block of group major medical business that has been in force for a number of years:

- (a) Define each type of claim reserve and claim liability needed to establish reserves for this business.
- (b) Describe the primary considerations in establishing these reserves.
- (c) Describe the most appropriate claim reserve method for this type of business and explain why you chose this method.

12. (7 points) Describe the product features that impact the cost of group long term disability (LTD) benefits.

13. (7 points) For an insurance company:

- (a) Describe solvency reserves, earnings reserves, and tax reserves.
- (b) Describe the differences between taxable earnings and pre-tax solvency earnings.

14. (5 points) For a life insurance product, you are given:

Year	Distributable Earnings	After Tax Stockholder Earnings	Solvency Reserves	Required Capital	Stock Liabilities	DAC
1	-6.00	0.10	1.00	0.40	5.30	10.00
2	1.50	0.30	1.20	0.50	3.80	7.00
3	2.30	0.45	0.00	0.00	0.00	0.00

- (a) Describe the return on investment (ROI) and the return on equity (ROE).
- (b) Calculate the ROE in the Year 1 using the average equity base.
- (c) Calculate the 3 year weighted average ROE using the average equity base and a 9.5% discount rate.

Show all work.

15. (5 points) With respect to estimating expected claims for group life insurance, describe the adjustments that can be made to a manual claims table, and the reasons for making such adjustments.

****END OF EXAMINATION****
AFTERNOON SESSION