

**COURSE 5
MORNING SESSION**

**APPLICATION OF BASIC ACTUARIAL
PRINCIPLES**

SECTION A-WRITTEN ANSWER

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

- 1.** (4 points) Describe the reasons an individual or a business would purchase:
- (a) life insurance
 - (b) property and casualty insurance
- 2.** (4 points) In developing medical claims costs for a group health plan:
- (a) Describe the factors to consider in selecting the appropriate data sources.
 - (b) List the considerations in assessing the quality of data obtained from outside sources.
 - (c) Describe considerations when normalizing historical data.

3. (6 points) Given the following information:

Annual Normal Retirement Benefit:	1.5% of final earnings times service from hire
Early Retirement Eligibility:	Age 60
Early Retirement Benefit:	Retirement Benefit accrued to date, reduced by 1/15 for each year before age 65
Normal form of Payment:	Life Annuity, payable monthly
Cost Method:	Projected Unit Credit
Actuarial Assumptions:	
Interest	6%
Salary Increases	4%
Pre-retirement death and terminations:	None
$\ddot{a}_{62}^{(12)}$:	11.61
$\ddot{a}_{65}^{(12)}$:	10.87

Participant data

<u>Employee</u>	<u>Birth date</u>	<u>Hire date</u>	<u>2004 earnings</u>
Brown	1/1/1965	1/1/2000	34,000
Smith	1/1/1940	1/1/1995	60,000

In prior years, the assumed retirement age was 65. Effective with the January 1, 2005 actuarial valuation, the assumed retirement age is changed to 62.

Calculate the change in the actuarial liability as of January 1, 2005 due to the change in the assumed retirement age.

Show all work.

4. (4 points) Describe the expense philosophies used in pricing individual life insurance.

5. (6 points)

- (a) Explain why mortality experience varies from company to company.
- (b) Describe how breaking a group of lives into risk classes affects assumptions other than mortality.
- (c) You are dividing an existing group into two risk classifications and are given the following information:

	Before Risk Classification	After Risk Classification	
	Total Group	Group A	Group B
Mortality ratio	Weight	Weight	Weight
50%	25.0	25.0	0.0
100%	42.5	36.5	6.0
150%	37.5	0.0	37.5
175%	26.0	0.0	26.0

Product: Two-year term life insurance policy
 Face amount: 100,000
 $q(50)$: 0.0035
 $q(51)$: 0.0039
 Interest: 6% per annum
 Expense loading: 0%

Calculate the single premium issued to a 50 year old from Group B before and after risk classification.

Show all work.

6. (7 points)

- (a) Explain why it is difficult to apply the general principles of income taxation to the life insurance industry and its products.
- (b) Describe the policyholder taxation of life products in Canada and the U.S.

7. (4 points)

- (a) Describe the typical approaches for providing old-age financial security.
- (b) Comment on the differences between pay-as-you-go and funded financing of public plans.

8. (5 points)

- (a) Describe the product features of accumulation annuities.
- (b) Describe the types of income annuities.

USE THIS PAGE FOR YOUR SCRATCH WORK

**COURSE 5
MORNING SESSION**

**APPLICATION OF BASIC ACTUARIAL
PRINCIPLES**

SECTION B-MULTIPLE CHOICE

1-6. Each of questions 1 through 6 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).	

- 1.**
- | | | | |
|----|---------------------------------|------|--|
| X. | Flexible Premium Universal Life | I. | Lower capital requirements |
| Y. | Variable Universal Life | II. | Competition has a major effect on the credited interest rate |
| | | III. | Priced with a lower profit margin |

- 2.**
- | | | | |
|----|----------------------------------|------|--|
| X. | Markov State Transition | I. | Designed for a data-poor environment. |
| Y. | Rational Artificial Intelligence | II. | Utilizes benchmark database future costs developed through a process of triangulation. |
| | | III. | Identifies patterns of underlying data to facilitate the prediction of future costs. |

- 3.** X. Medicare – Hospital Insurance I. Deductible adjusted annually
Y. Medicare – Supplementary Medical Insurance II. Coinsurance
III. Payroll Tax
- 4.** X. HMO I. Covers a local service area
Y. PPO II. Does not take the insurance risk
III. Performs utilization reviews
- 5.** X. Preferred risks I. Higher placement rate
Y. Residual risks II. Higher lapse rates
III. Higher average policy size
- 6.** X. Normal cost I. Past service benefits
Y. Supplemental cost II. Future service benefits
III. Retroactive plan amendments

- 7.** To limit anti-selection on group supplemental life plans, insurers use all of the following EXCEPT:
- (A) Limited coverage amounts without evidence of insurability
 - (B) Suicide exclusion
 - (C) Statement of Good Health required for certain amounts
 - (D) Minimum participation requirements that are higher than for basic group term life
 - (E) Step-rated premium structure
-
- 8.** In Canada, the appointed actuary is required to file a report with the annual statements that provides the regulatory authorities with all of the following EXCEPT:
- (A) A description of any approximations used
 - (B) A signed statement that affirms compliance with the generally accepted accounting principles published by the Canadian Institute of Chartered Accountants (CICA)
 - (C) Any changes in the assumptions from the prior annual filing and the effect thereof
 - (D) A complete justification for each assumption
 - (E) A signed copy of the opinion of the appointed actuary

USE THIS PAGE FOR YOUR SCRATCH WORK

9-13. Each of questions 9 through 13 consist 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.

	<u>ASSERTION</u>		<u>REASON</u>
9.	The Canadian federal government cannot deter a province from allowing user fees and extra billing in its provincial health care plan.	BECAUSE	Under the Canadian Constitution, matters relating to health fall under provincial jurisdiction.

	<u>ASSERTION</u>		<u>REASON</u>
10.	Personal-producing general agents receive higher commissions than other agents.	BECAUSE	Unlike other general agents, personal-producing general agents have no agents reporting to them.

ASSERTION

- 11.** In the U.S., the usual procedure is to file policy forms in the state of domicile first.

REASON

BECAUSE Many states require prior approval of policy forms from the state of domicile.

ASSERTION

- 12.** For individual disability benefits, under the rehabilitation clause, an insured may not have to continue under the care of a physician to qualify for benefits.

REASON

BECAUSE For individual disability benefits, the rehabilitation clause provides that insureds who join an approved program will be considered totally disabled.

ASSERTION

- 13.** For a guaranteed insurability option on an individual disability policy, an option passed on one option date may be picked up at the next option date.

REASON

BECAUSE The guaranteed insurability option on an individual disability policy does not require completion of medical underwriting at a given option date in order for the insured to purchase the increased coverage amount.

14. You are given the following information on an accumulation annuity:

Issue date:	January 1, 1996
End of current interest guarantee period:	December 31, 2010
Current guaranteed interest rate:	7%
Additional margin:	0.25%

Interest rates available for new deposits:

Number of years	Interest rate guarantee
5	4.5%
10	5.0%
15	5.5%

Calculate the market value adjustment on December 31, 2005.

- (A) 88%
- (B) 99%
- (C) 108%
- (D) 111%
- (E) None of the above

USE THIS PAGE FOR YOUR SCRATCH WORK

15. You are given the following for the first policy year of a dynamic life insurance product:

Target Premium:		8
Premium Paid:		20
Commission Rate	High:	70%
	Low:	20%
	% Account Value:	5%
Sales Expenses:		10% of commissions
Year One SurvFactor:		0.90
End of Year One Account Value:		50

Calculate the total commission and sales expense for the first year.

- (A) 10.40
- (B) 11.05
- (C) 11.28
- (D) 11.55
- (E) 13.48

USE THIS PAGE FOR YOUR SCRATCH WORK

16-18. Each of questions 16 through 18 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).	

- 16.**
- | | | | |
|----|------------------------|--|---------------------------------|
| X. | Dynamic products | | I. Dividends |
| Y. | Pre-scheduled products | | II. Partial withdrawal benefits |
| | | | III. Pure endowment benefits |

- 17.**
- | | | | |
|----|--------------------|--|--|
| X. | Joint last-to-die | | I. Variations of this type of policy can pay double the death benefit if both lives die within a short time of each other. |
| Y. | Joint first-to-die | | II. Frasierized mortality rates |
| | | | III. Common to increase mortality for risk of joint accidental death. |

- 18.** X. Factor method for determining claim reserves
- Y. Tabular method for determining claim reserves
- I. Usually used for reserves that are easily estimated due to a short lag or run off period.
- II. More recently, method has begun to include sex and elimination period as variables.
- III. Usually used for long-term disability claims where regulatory standards have established minimum reserves.

19. You are given the following:

Accident year	Development Year				Paid to Date as of 12/31/2005
	0	1	2	3	
2002	260	330	360	390	390
2003	300	360	400		380
2004	330	430			420
2005	350				150

	0/1	1/2	2/3
Incurred loss development factor	1.25	1.1	1.1

Calculate the gross IBNR as of 12/31/2005.

- (A) 230
- (B) 337
- (C) 540
- (D) 1,490
- (E) None of the above

USE THIS PAGE FOR YOUR SCRATCH WORK

20. You are given the following for a group life contract:

Employee	Amount	Expected Annual Mortality Rate per thousand
A	50,000	0.11
B	80,000	0.16
C	100,000	0.23

In the prior year, this group had an actual annual claim rate of 0.28 per thousand, which is 20% credible.

Calculate the expected claim cost for the following year.

- (A) 41
- (B) 46
- (C) 60
- (D) 64
- (E) None of the above

USE THIS PAGE FOR YOUR SCRATCH WORK

21-22. Each of questions 21 through 22 consists of two lists. In the list at the left are two items, lettered X and Y. In the list at the right are four items, numbered I, II, III and IV. EACH of the lettered items is related in some way to EXACTLY TWO of the numbered items. Match the lettered items (X and Y) with the numbered items (I, II, III, and IV) shown below.

Indicate the related items using the following answer code:

	<u>X</u>	<u>Y</u>
(A)	I and II	III and IV
(B)	I and III	II and IV
(C)	I and IV	II and III
(D)	II and III	I and IV
(E)	II and IV	I and III

- 21.**
- | | | | |
|----|---|------|--|
| X. | Deferred tax liabilities created by timing differences between U.S. solvency and tax standards | I. | Different carrying value for real estate |
| Y. | Deferred tax liabilities created by permanent differences between U.S. solvency and tax standards | II. | Estimation of incurred but not reported claims |
| | | III. | Research and development tax credits |
| | | IV. | Non-taxable investment income |

- 22.**
- | | | | |
|----|----------------------------------|------|----------------------|
| X. | Canadian federal jurisdiction | I. | Workers compensation |
| Y. | Canadian provincial jurisdiction | II. | Employment insurance |
| | | III. | Automobile insurance |
| | | IV. | Maternity benefit |

- 23.** A homeowner insurance coverage is provided with a uniform loss distribution over the interval $0 < X < 200$.

Calculate the deductible amount if the desired expected loss is 50.

- (A) 43
- (B) 50
- (C) 59
- (D) 69
- (E) None of the above

- 24.** Given a joint last-to-die life insurance policy on lives x and y with estimated mortality rates of:

t	$q_x(t)$	$q_y(t)$
1	0.110	0.050
2	0.150	0.070

Determine the probability of a payment in year two.

- (A) 0.011
- (B) 0.019
- (C) 0.023
- (D) 0.028
- (E) None of the above

25. All of the following are major considerations in financial reporting for group insurance EXCEPT:

- (A) Alternative funding methods
- (B) Policyholder accounting
- (C) Excess surplus
- (D) Regulatory requirements
- (E) Administrative arrangements

26. All of the following are common purposes of performing an actuarial valuation of a company pension plan in the U.S. EXCEPT:

- (A) To determine the maximum contribution that the company can deduct in any one year for federal income tax purposes.
- (B) To complete the annual filing required under state law.
- (C) To establish plan costs and liabilities in connection with corporate mergers and spin-offs.
- (D) To provide a basis for the allocation of the assets of a terminated plan.
- (E) To provide information to plan participants concerning the funding status of their benefits.

27. For guaranty associations, all the following are true EXCEPT:

- (A) They provide for the indemnification of losses suffered by policyholders of insolvent companies.
- (B) They give the public confidence in the ability of the insurance industry to deliver on obligations.
- (C) The guaranty association in the insolvent insurer's state of domicile pays all covered claims.
- (D) They assess companies in proportion to premiums received.
- (E) They generally avoid assuming the business of an insolvent company.

28. All of the following statements are true for a defined contribution plan EXCEPT:

- (A) Employee assumes investment risk.
- (B) Value of benefit increases with age.
- (C) Benefit level directly affected by investment performance.
- (D) Has high perceived value.
- (E) Limited capacity to improve past service benefits.

29. You are given the following with respect to three U.S. domiciled companies:

- Company Y is a non-controlled corporation with 25% of its common shares owned by Company X.
- Company Z is an unrelated corporation to both Company X and Company Y.
- The corporate tax rate is 40%.
- Company X pays \$100 in dividends to company Y.
- Company Y then pays 100% of after-tax dividend revenue to Company Z.

Calculate the total income tax payable on these two dividend transfers.

- (A) 0
- (B) 19
- (C) 58
- (D) 64
- (E) None of the above

30-35. Each of questions 30 through 35 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

30. In the U.S., self-insured group medical plans are regulated at both the federal and state levels.

BECAUSE

In the U.S., federal regulations apply to employer sponsored benefit plans and state law applies to the business of insurance.

ASSERTION

REASON

31. Individual risk assessment techniques are no longer used to underwrite small group medical insurance plans.

BECAUSE

HIPAA does not allow a carrier to single out individual employees for special rating treatment due to their health.

ASSERTION

- 32.** Nonmedical underwriting is typically used for underwriting large groups of life insureds.

REASON

- BECAUSE Nonmedical underwriting usually only requires that the insureds are actively working with no significant medical absences.

ASSERTION

- 33.** In collecting medical claim data to develop manual rates, an experience period of at least twelve months is needed.

REASON

- BECAUSE November and December often have fewer incurred medical claims than average.

ASSERTION

- 34.** In the U.S., with respect to large group health insurance, gender cannot be used as a rating characteristic.

REASON

- BECAUSE The U.S. government restricts the use of gender-based employee contribution rates for large groups.

ASSERTION

- 35.** In most countries, tax reserves are identical to solvency reserves.

REASON

- BECAUSE Solvency reserves produce the smallest tax deductions for insurance companies.

36-40. Each of questions 36 through 40 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).	

- 36.**
- | | | | |
|----|--------------------------|------|---|
| X. | Cash basis accounting | I. | Method usually used to determine non-business income. |
| Y. | Accrual basis accounting | II. | Produces more accurate measurement of income over an accounting period. |
| | | III. | Cost of capital assets amortized over their useful life. |

- 37.**
- | | | | |
|----|-----------------|------|---|
| X. | No-fault system | I. | Subrogation of auto insurance claims |
| Y. | Tort system | II. | Significantly higher personal injury protection premium |
| | | III. | Workers compensation |

- 38.** X. Waiver of premium benefit for group life insurance. I. Insured receives monthly installment benefit.
- Y. Total and permanent disability benefit for group life insurance. II. Insured must remain continuously disabled until death.
- III. Insured is typically paid a reduced death benefit at time of death.
-
- 39.** X. Multiple Employer Welfare Association (MEWA) I. Collectively bargained
- Y. Purchasing alliance II. Self-insured
- III. Typically small average employer size (<50)
-
- 40.** X. Canadian MCCSR Tier 1 capital I. Contributed capital
- Y. Canadian MCCSR Tier 2 capital II. Deduction for 100% of negative reserves
- III. Subordinated debt

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

**COURSE 5
AFTERNOON SESSION**

**APPLICATION OF BASIC ACTUARIAL
PRINCIPLES**

SECTION A – WRITTEN ANSWER

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

9. (4 points) Describe the objectives of ratemaking in Property and Casualty insurance.

10. (5 points)

- (a) Describe the difference between:
- i. yearly renewable term (YRT) reinsurance
 - ii. coinsurance
- (b) Describe the difference between:
- i. coinsurance
 - ii. modified coinsurance
 - iii. coinsurance with funds withheld
- (c) Describe the difference between:
- i. automatic reinsurance
 - ii. facultative reinsurance
- (d) A life insurance company has:
- an excess reinsurance agreement with a \$1,000,000 retention limit
 - a 40% first-dollar quota share reinsurance agreement

Calculate the excess and quota share reinsurance amounts for:

- i. \$800,000 term policy
- ii. \$2,000,000 term policy

Show all work.

11. (6 points) You are given the following data for a proposed life insurance product:

t	AftTax SolvEarn	Req Cap	Solv Res	Ben Res	DAC	Tax	InvInc RC	TaxInvInc RC
1	-50	10	12	19	100	-40	0	0
2	10.2	9.8	25	31	92	6.8	0.6	0.24
3	10.2	9.5	33	38	84	6.8	0.59	0.24

After Tax Interest Rate Earned on Assets: 3.6%

Hurdle Rate: 10%

ReqCap(0): 0

- (a) Describe the considerations in determining which accounting basis should be used to determine the profits of this product.
- (b) Calculate Embedded Value (3) using distributable earnings as profits.
- (c) Calculate the return on assets for the first three years using distributable earnings as profits and discounting at the after tax earnings rate.

12. (6 points) With respect to a life insurance company:

- (a) Describe the objectives of investment regulation and how they can be achieved.
- (b) Describe the NAIC regulation for:
 - i. the valuation of assets
 - ii. the valuation of reserves

13. (6 points) With respect to U.S. medical benefit plans, describe the various provisions that may be used for cost sharing:

- (a) with the insured
- (b) with the provider

14. (4 points)

- (a) Describe the typical and alternate methods of disclosing policy loans on a life insurance company's balance sheet and income statement.
- (b) You are given the following:

End of Year Invested Assets	3,000
End of Year Policy Loans In-Force	500
End of Year Reserves	3,500
Beginning of Year Reserves	3,300
Premiums	300
Interest on Invested Assets	180
Interest on Policy Loans	25
Benefits Paid	215
Expenses	30
Tax Rate	35%

Prepare a balance sheet and an income statement using a valid method of reflecting policy loans.

15. (5 points) Regardless of accounting basis, describe the four widely used reserve methods for individual life insurance.

- 16.** (4 points) You are given the following information regarding a long-term disability insurance product:

Benefit: \$5,000 payable mid-month for 3 months
Elimination period: 1 month
Monthly interest rate: 1%
Pending factor: 70% for all claims

Claim Duration (months)	
0	100
1	90
2	80
3	70
4	60

*Continuance table values for the middle of a month can be computed through averaging

- (a) Explain the reserve methodology for open claims.
- (b) Calculate the tabular reserves at the end of month 1.
- (c) Explain the reserve methodology for pending claims.
- (d) Calculate the pending reserve for a claim reported at the end of month 3.

Show all work.

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