

November 2001
Society of Actuaries

COURSE 5
MORNING SESSION

APPLICATION OF BASIC ACTUARIAL PRINCIPLES

SECTION A-WRITTEN ANSWER

4. (5 points) You are given the following retirement plan information for an individual:

Current Age	40
Entry Age	30
Retirement Age	65
Social Security Benefit	\$11,700
Current Salary	\$80,000
Annual Salary Growth	3%
Personal Savings Accumulation Rate	7%
Final Salary (at age 64)	\$162,624
Retirement Benefit	1% of final 5-year average salary times years of service
Annuity Conversion Factor @ age 65	8.1958

The individual begins saving for retirement at his current age.

Calculate the level percent of salary that should be allocated to personal savings each year to provide this individual with a 70% full replacement ratio. Show all work.

5. (8 points) Describe the following reserve methods for life insurance products:

- (a) simplified net premium method;
- (b) realistic net premium method;
- (c) gross premium method; and
- (d) accumulation method.

6. (5 points) You are given the following information for a defined benefit plan:

Plan Effective Date: 01/01/2001

Plan Year = Calendar Year

Normal Retirement Benefit: 2% of final three-year average pay for each year of service

Actuarial Cost Method: Entry Age Normal

Actuarial Assumptions:

Interest:	8.00%
Salary Scale:	5.00%
Preretirement termination other than death:	None

Data for the 10 active participants as of 1/1/2001 (there are no inactive participants):

Age:	45
Past Service:	5 years
2001 Salary:	\$25,000
Plan Assets at 1/1/2001:	0

Selected annuity values:

$$\ddot{a}_{65}^{(12)} = 10$$

$$\ddot{a}_{10} = 7$$

Selected Commutation Functions:

X	D_X	$N_X - N_{65}$	S_X	${}^S N_X - {}^S N_{65}$
40	245	3200	1.0000	7100
45	180	2100	1.2763	5000
65	50	0	3.3864	0

The supplemental liability is amortized over 10 years.

Determine the annual cost as of December 31, 2001 for the 2001 plan year based on an initial valuation as of January 1, 2001.

Show all work.

7. (5 points) Describe key issues that should be addressed by an insurance company to establish the need for a new group insurance product.

****END OF WRITTEN ANSWER SECTION****

**COURSE 5
MORNING SESSION**

APPLICATION OF BASIC ACTUARIAL PRINCIPLES

SECTION B-MULTIPLE CHOICE

MULTIPLE CHOICE SECTION

Each of questions 1 through 2 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

- 1.** With respect to a large group health plan, net premiums can be a larger percentage of gross premiums than is the case for equivalent individual health insurance.

BECAUSE

State regulation does not impact large group health insurance pricing as heavily as it does individual health insurance pricing.

ASSERTION

REASON

- 2.** In Canada, it is expected that cost-sharing mechanisms will become more attractive to provincial health care plans.

BECAUSE

In Canada, provincial health plans with cost-sharing mechanisms will only be penalized to the amount of the federal health transfer they would otherwise receive.

Each of questions 3 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).	

- 3.**
- | | | | |
|----|---|------|---|
| X. | Group Term Life Insurance in the U.S. | I. | Can result in imputed taxable income |
| Y. | Group Accidental Death and Dismemberment Insurance (AD&D) in the U.S. | II. | Optional amounts are available without medical evidence |
| | | III. | Usually convertible to individual coverage |

- 4.**
- | | | | |
|----|---|------|--|
| X. | Short Term Disability (STD) in the U.S. | I. | Benefits are integrated with Social Security benefits |
| Y. | Long Term Disability (LTD) in the U.S. | II. | Benefits are paid weekly |
| | | III. | Benefit amount may be reduced to coordinate with state disability insurance (SDI) programs |

- 5.** X. Medicaid
- Y. Medicare
- I. The beneficiaries pay fixed fees for specified services
- II. The program pays a percentage of allowable charges
- III. No deductible

- 6.** X. Indemnity plan cancer policy
- Y. Scheduled plan cancer policy
- I. Specified benefits for each of the various types of expenses
- II. Paid regardless of the actual hospital charges
- III. Often no dollar limit on total benefits

7. Rank in ascending order (shortest to longest) the elimination periods usually found in the following types of individual health insurance policies:

- I. Overhead expense benefits
- II. Disability buy-out benefits
- III. Presumptive disability benefits

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

Each of questions 8 through 9 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. The use of a coinsurance clause in a homeowners insurance policy results in premiums that are inequitable among insureds.

BECAUSE

In a homeowners insurance policy with a coinsurance clause, persons who purchase small amounts of insurance would bring a disproportionate amount of risk to the pool if losses were skewed to smaller claims.

ASSERTION

REASON

9. A cash balance plan is a defined contribution pension plan.

BECAUSE

In a cash balance plan, the benefit is expressed in terms of an account balance.

Each of questions 10 through 11 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).	

- 10.**
- | | | | |
|----|-----------------------------------|------|--|
| X. | Defined Contribution Pension Plan | I. | Usually favors employees hired at younger ages |
| Y. | Defined Benefit Pension Plan | II. | Contributions higher for female employees |
| | | III. | Employer assumes investment risk |

- 11.**
- | | | | |
|----|----------------------|------|--|
| X. | GAAP financials | I. | Match incidence of revenues and expenses |
| Y. | Statutory financials | II. | Value insurer on a going concern basis |
| | | III. | More conservative standards for liability valuations |

Each of questions 12 through 13 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.

<u>ASSERTION</u>		<u>REASON</u>
12. Most life insurance companies adjust prices when they are out of line with the competition.	BECAUSE	Most buyers of life insurance shop around and compare prices.

<u>ASSERTION</u>		<u>REASON</u>
13. Skim pricing is rare for life insurance products.	BECAUSE	Skim pricing is usually done with products that are in short supply and high demand.

14. Rank in ascending order (smallest to largest) the following products according to how much investment risk is transferred to the policyholder:

- I. Universal life insurance
- II. Variable universal life insurance
- III. Term insurance

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

15. Rank in ascending order (smallest to largest) the premium level of the following life insurance policies.

- I. Participating Whole Life Insurance
- II. Level Term to 100 Insurance
- III. Non-participating Whole Life Insurance

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

16. Rank in ascending order (lowest to highest) the price level of a product resulting from the following strategies:

I. Opportunistic pricing

II. Adaptive pricing

III. Predatory pricing

(A) I < II < III

(B) I < III < II

(C) II < III < I

(D) III < I < II

(E) III < II < I

Each of questions 17 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).	

- 17.** X. Penetration pricing
- Y. Segmented pricing
- I. Different price levels for buyers with different behaviors
- II. Works best with commodity-like products
- III. Price set to generate high level of sales

- 18.** X. Low lapse rates
- Y. Selective lapse rates
- I. Cause an increase in the average mortality of the remaining group
- II. Tend to decrease the percentage of unhealthy insureds
- III. Result in mortality at older ages that increase more slowly by policy year

Each of questions 19 through 23 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.

	<u>ASSERTION</u>		<u>REASON</u>
19.	In Canada, a variable life insurance product is taxed annually on the “inside buildup” of cash value.	BECAUSE	In Canada, a life insurer’s segregated fund is not treated as a trust for income tax purposes.

	<u>ASSERTION</u>		<u>REASON</u>
20.	The amount of depreciation taken for tax purposes usually exceeds depreciation taken for regular financial statements.	BECAUSE	Governments often use depreciation allowances to stimulate the general economy.

ASSERTION

- 21.** In life insurance, the trend has been towards fewer risk classifications

REASON

- BECAUSE** In life insurance, the increased cost of underwriting tests and requirements have not made it cost effective to create additional risk classifications.

ASSERTION

- 22.** In the U.S., large employers often use administration services only (ASO) arrangements for health plans.

REASON

- BECAUSE** In the U.S., ASO arrangements are exempt from the provisions of ERISA.

ASSERTION

- 23.** In the U.S., individual underwriting is used for small groups.

REASON

- BECAUSE** In the U.S., the use of individual underwriting for small groups allows the carrier to decline individuals who would pose an unacceptable health risk.

Each of questions 24 through 25 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).	

- 24.**
- | | | | |
|----|---|------|--|
| X. | Balance Sheet treatment of policy loans. | I. | Policy loans shown as a reduction in liabilities. |
| Y. | Income Statement treatment of policy loans. | II. | Policy loans shown as an asset. |
| | | III. | Policy loan interest shown as a reduction in benefits. |

- 25.**
- | | | | |
|----|--------------------------------------|------|---|
| X. | The 1960 Basic Group Mortality Table | I. | Useful in estimating annual improvements in mortality |
| Y. | Population Statistics | II. | Principally used as a tabular base when comparisons of actual to expected experience are made |
| | | III. | Useful in developing rates for the very young and very old |

26. Rank in ascending order (smallest to largest), the assumed mortality rate in the year of annuitization for the following, using typical mortality tables for a given person:

- I. Individual annuitant
- II. Group annuitant
- III. Structured settlement annuitant

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

Each of questions 27 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.

	<u>ASSERTION</u>		<u>REASON</u>
27.	Nonexistent returns on investment are common when profits are based upon stockholder earnings.	BECAUSE	Required capital has no bearing on stockholder earnings except for investment income earned on the assets backing required capital.

	<u>ASSERTION</u>		<u>REASON</u>
28.	Under most group life insurance policies, if the group coverage terminates, insureds can convert to an individual life insurance policy only if they provide evidence of insurability.	BECAUSE	Any additional claim costs resulting from a conversion from a group life insurance policy to an individual life insurance policy are usually reflected in the standard rates for the individual policy.

ASSERTION

- 29.** Given an individual with five years of service, the entry-age normal cost method will produce a smaller initial actuarial liability than the traditional accrued benefit cost method.

REASON

BECAUSE Under the entry-age normal cost method, the use of average entry ages will produce a supplemental liability for individuals entering the plan after its establishment at ages above the assumed entry age.

ASSERTION

- 30.** In valuing a defined benefit pension plan, if benefits are related to compensation, the allowance for inflation is typically ignored.

REASON

BECAUSE In valuing a defined benefit pension plan, the inflation assumption used in the interest assumption is offset by the inflation assumption used in the salary scale.

ASSERTION

- 31.** Disability buy-out insurance is made available where a formal buy/sell agreement is not in place.

REASON

BECAUSE Buy/sell agreements cover only the contingency of death.

Each of questions 27 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.

	<u>ASSERTION</u>		<u>REASON</u>
32.	A defined benefit cost method with relatively high future normal costs will have a low actuarial liability	BECAUSE	The present value of expected pension benefits varies by defined benefit cost method

	<u>ASSERTION</u>		<u>REASON</u>
33.	The amount of DAC tax is calculated as a percent of expense related to sales.	BECAUSE	The DAC tax is essentially a requirement that insurers delay the recognition of certain expenses when calculating current taxable income.

ASSERTION

- 34.** Policy reserves are generally less significant for group health insurance policies than for individual health insurance policies.

REASON

BECAUSE In many alternative funding methods for group health insurance policies, the policyholder participates in the insurance risk to some degree.

ASSERTION

- 35.** With respect to group medical costs, industries that have high turnover tend to have above average medical costs.

REASON

BECAUSE Groups that have the same demographic characteristics generally have similar medical costs.

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. Actuarial loss for retirement benefits
- Y. Actuarial gain for retirement benefits
- I. Fewer participants die than expected
- II. Fewer withdrawals than expected
- III. Slower salary increases than expected

- 37.** X. Spread gain cost method
- Y. Immediate gain cost method
- I. Gains and losses affect the future normal costs
- II. Entry age normal cost method
- III. Gains and losses amortized by a supplemental cost

- 38.** X. Factor method for determining claim reserves
- Y. Average size claim method for determining claim reserves
- I. Long payout periods
- II. Appropriate for group life insurance
- III. Incurred but not reported (IBNR) reserve needed
-
- 39.** X. Aggregate method of estimating medical claim costs
- Y. Benefit cost method of estimating medical claim costs
- I. Most useful where there are co-pays and limits which apply to a specific service
- II. Typically used for traditional indemnity type plans
- III. Estimated medical claim costs are determined from a claim probability distribution using an established database
-
- 40.** X. Variable accumulation annuities
- Y. Fixed accumulation annuities
- I. Generally backed by an insurance company's general portfolio
- II. Equity-indexed annuity
- III. Spread for pricing purposes is fixed

****END OF COURSE 5 EXAMINATION****

MORNING SESSION

**COURSE 5
AFTERNOON SESSION**

APPLICATION OF BASIC ACTUARIAL PRINCIPLES

SECTION C-WRITTEN ANSWER

****BEGINNING OF EXAMINATION 5****
AFTERNOON SESSION

- 8.** (5 points) Your company, Delta Life, is entering into a treaty with two reinsurers, Alpha Life and Beta Life. The treaty will cover a Term to Attained Age 95 product with level premiums for the first 20 years and annually increasing premiums thereafter.

You are given the following information:

Reinsurance Type	Automatic First Dollar Quota Share
Policy Face Amount	\$1,200,000
Current Year Reserve for Policy	\$ 100,000
Delta Life Retention Limit	\$ 500,000
Quota Share for Alpha Life	24%
Quota Share for Beta Life	36%

- (a) Describe the reasons a company may wish to reinsure its business.
- (b) Calculate the following:
- (i) the amount retained by Delta Life;
 - (ii) the amount ceded to Alpha Life; and
 - (iii) the amount ceded to Beta Life.

9. (6 points)

- (a) Describe the major considerations involved in underwriting large group life insurance plans.
- (b) Describe the major considerations involved in underwriting large group disability income plans.
- (c) Describe how past experience data is evaluated for group life insurance and group disability income plans.

10. (5 points) Describe how employee benefit plans are taxed in Canada and the U.S. for the following:

- (i) Medical expense insurance;
- (ii) Group term life insurance; and
- (iii) Disability income payments.

11. (7 points) Describe considerations in the determination of the pricing assumptions for:

- (a) Income annuities; and
- (b) Accumulation annuities.

12. (3 points) Explain the calculations for the normal cost and actuarial liability for the following cost methods:

- (i) Traditional accrued benefit; and
- (ii) Projected accrued benefit.

Define all terms.

- 13.** (9 points) You are given the following information for a Property and Casualty insurance company:

TERRITORY 1			
Risk class for Territory 1	Number of earned Exposure Units (number of lives)	Existing Rate	Expected losses
A (Base class)	50,000	\$40.00	\$1,100,000
B	30,000	50.00	1,200,000
C	20,000	75.00	400,000

TERRITORY 2			
Risk class for Territory 2	Number of earned Exposure Units (number of lives)	Existing Rate	Expected losses
A (Base class)	60,000	\$ 80.00	\$2,640,000
B	40,000	100.00	2,600,000
C	20,000	150.00	2,400,000

A rate change is proposed that will result in a permissible loss ratio of 60%.

- Calculate the new rates for each class in Territory 1 using the loss cost method, assuming the company operates in Territory 1 only.
- Calculate new rates using the loss ratio method for each class in Territory 1 and Territory 2 if Territory 2 is added and class differentials do not change. Assume the company operates in Territories 1 and 2. Use existing rates for Territory 1.

Show all work.

- 14.** (5 points) Describe required capital and the risks covered in the required capital calculation for a life insurance company.

****END OF COURSE 5 EXAMINATION**
AFTERNOON SESSION**

Course 5
Nov. 2001
Final Multiple Choice Key

<i>Question #</i>	<i>Answer</i>
1	B
2	E
3	E
4	B
5	E
6	C
7	D
8	E
9	D
10	E
11	A
12	C
13	A
14	D
15	C
16	D
17	B
18	B
19	C
20	A
21	E
22	C
23	C
24	A
25	D
26	A
27	B
28	E
29	D
30	E
31	E
32	C
33	D
34	A or B
35	C
36	A
37	E
38	D
39	B
40	C