

November 2000
Society of Actuaries

**COURSE 5
MORNING SESSION**

APPLICATION OF BASIC ACTUARIAL PRINCIPLES

SECTION A—WRITTEN ANSWER

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

- 1.** (5 points)
- (a) With respect to Group Accidental Death and Dismemberment insurance, describe the different types of coverage and outline typical plan provisions.
 - (b) With respect to Group Long Term Disability insurance, outline the definitions of disability and describe typical limitations and exclusions.
- 2.** (9 points) ABC.Life.com will market individual life insurance exclusively through the internet. The company will offer two products:
- (i) 10-year level term life insurance; and
 - (ii) flexible premium universal life insurance.
- (a) Describe pricing strategies which could be used by ABC.Life.com.
 - (b) Explain the sensitivity and scenario testing that should be performed before launching these products.
 - (c) Outline pricing pitfalls commonly encountered when pricing insurance products.

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

Normal retirement benefit: 1% final one-year salary for each year of service

Actuarial assumptions:

Interest rate: 6% per year
Salary increase: 3% (for Projected Unit Credit Cost Method only)
Preretirement deaths and terminations: None
Retirement age: 65
Annuity factor (a_{65}): 10

Data for sole participant as of January 1, 2001:

Age at hire: 30
Age at January 1, 2001: 45
Year 2001 annual salary: 50,000
Year 2002 annual salary: 52,500

- (a) Under each of the Traditional Unit Credit Cost Method and the Projected United Credit Cost Method, calculate the following:
- (i) the actual liability as of January 1, 2001;
 - (ii) the expected liability as of January 1, 2002;
 - (iii) the actual liability as of January 1, 2002; and
 - (iv) the liability gain or loss at January 1, 2002.
- (b) Compare and explain the difference between the liability gain or loss under the Traditional Unit Credit Cost Method and the Projected Unit Credit Cost Method.

Show all work.

4. (4 points)

- (a) Explain the reasons for using deductibles and the problems associated with them.
- (b) Describe different types of deductibles commonly used today.
- (c) Explain the reasons for placing a limit on policy coverage.

5. (5 points) Describe the characteristics of the life insurance industry and its products that make the application of taxation a very difficult task.

6. (6 points) You are a consulting actuary for ABC, a multi-line P&C insurance company. You are given the following information regarding the current ratemaking practices in the organization.

- Due to current market conditions, rates are being held below expected claims on auto liability policies so that sales projections can be met. This shortfall will be covered by increasing homeowner property insurance rates where there is less competition.
- ABC used to give premium discounts to owners of the auto collision policies that were accident free for three years in a row but have recently stopped this practice as it was felt to be too expensive.
- A major earthquake in the previous year required ABC to pay out substantial claims. Management would like to increase rates on property insurance by 50% this year to recover those losses. Rates would be returned to their expected levels afterwards.
- Data is collected and analyzed on a policy year basis.
- The following credibility formula is used for all lines of business:
$$Z = \sqrt{n/10000} \quad 0 \leq Z \leq 1$$
Where n is the number of claims.

Analyze ABC's current ratemaking practices and recommend changes where appropriate.

7. (8 points) Describe the following distribution channels used for individual life and health insurance:

- (i) career agents;
- (ii) worksite marketing;
- (iii) direct marketing; and
- (iv) banks.

**COURSE 5
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APPLICATION OF BASIC ACTUARIAL PRINCIPLES

SECTION B—SHORT WRITTEN ANSWER*

***These questions are worth 1 point each.**

SHORT WRITTEN-ANSWER QUESTIONS

8. (1 point) Given the following:

- Mr. Fixit owns a cottage valued at \$125,000.
- The cottage is insured for \$75,000.
- The insurance company requires 75% of full coverage for full reimbursement of the insured amount. When coverage is less than 75%, reimbursement is on a pro-rata basis of what would have been paid if the 75% requirement had been met.
- The deductible is \$1,000.
- Lightning causes \$12,000 worth of damage.

Calculate the benefit Mr. Fixit will receive from his policy. Show all work.

SHORT WRITTEN-ANSWER QUESTIONS

9. (1 point) List the cost control strategies that are commonly used for group dental insurance plans.

10. (1 point) Briefly describe the motivations for a life insurance company to switch from a heaped commission structure to a level commission structure.

11. (1 point) Briefly describe the impact of paying “Yearly Renewable Term” reinsurance premiums annually versus quarterly.

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**COURSE 5
MORNING SESSION**

APPLICATION OF BASIC ACTUARIAL PRINCIPLES

SECTION C—MULTIPLE CHOICE

1-15. Each of questions 1 through 15 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>
1.	Income tax rates for large corporations are generally progressive.	BECAUSE	The ability to pay income taxes usually increases with the size of the company.

	<u>ASSERTION</u>		<u>REASON</u>
2.	A trust can exhibit substantial asset growth without incurring a current income tax.	BECAUSE	A trust is allowed an income tax deduction for amounts distributed to beneficiaries.

- | | <u>ASSERTION</u> | | <u>REASON</u> |
|-----------|--|---------|--|
| 3. | The inside build-up of cash surrender value of life insurance products has historically received favorable income tax treatment. | BECAUSE | Income tax is collected from the cash value portion of life insurance benefits at the time of death. |
| | <u>ASSERTION</u> | | <u>REASON</u> |
| 4. | In a defined benefit pension plan, there is no opportunity for post-retirement benefit increases. | BECAUSE | Automatic increases to pension benefits paid to retired participants tend to be expensive. |
| | <u>ASSERTION</u> | | <u>REASON</u> |
| 5. | In Canada and the U.S., partnerships are tax-reporting entities. | BECAUSE | In Canada and the U.S., partnerships are tax-paying entities. |

1-15.

Each of questions 1 through 15 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:

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- (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

6.

Most flexible benefit plans in Canada use a modular approach rather than a pure cafeteria approach.

BECAUSE

Employers feel they should provide a minimum safety net to their employees in most types of benefits.

ASSERTION

REASON

7.

Most companies have removed normal pregnancy as an exclusion from their long term disability contracts.

BECAUSE

There is little additional expected cost to a long term disability contract by inclusion of disability arising from normal pregnancy.

ASSERTION

- 8.** Self-insured medical plans are popular with smaller employers.

REASON

BECAUSE Administrative Services Only plan services and consulting services may be purchased independently.

ASSERTION

- 9.** Poor investment returns do not reduce benefits under a defined contribution plan.

REASON

BECAUSE The Pension Benefit Guarantee Corporation guarantees a minimum level of benefits under a defined contribution plan.

ASSERTION

- 10.** The primary insolvency risk for a life insurance company centers on amounts and types of its liabilities.

REASON

BECAUSE A life insurance company's liabilities tend to be unpredictable.

1-15. Each of questions 1 through 15 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:

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- (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>
11.	A risk-averse individual will not pay a gross premium for an insurance contract which exceeds the expected value of the loss.	BECAUSE	For a risk-averse individual, as extra units of wealth are added, the utility derived from such units decreases.

	<u>ASSERTION</u>		<u>REASON</u>
12.	In a pension plan, decrements include death and retirement.	BECAUSE	The probability of death is independent of the probability of retirement.

ASSERTION

- 13.** The benefit cost method is typically used by indemnity type plans to estimate medical claim costs.

REASON

BECAUSE The benefit cost method is most useful to estimate medical claim costs where there are co-pays and limits that apply to specific services.

ASSERTION

- 14.** A gross premium valuation of life insurance policy liabilities does not use provisions for adverse deviations.

REASON

BECAUSE With respect to life insurance policy liabilities, provisions for adverse deviations cause most earnings to be recognized at issue.

ASSERTION

- 15.** The traditional accrued benefit cost method is generally used for the funding requirements for final average pay plans.

REASON

BECAUSE Under the traditional accrued benefit cost method for final average pay plans, the normal cost increases as a percentage of salary as age increases.

16-22. Each of questions 16 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 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. Managed Care | I. Reduced benefit costs |
| | Y. Self Insurance | II. Increased claims administrative expense |
| | | III. Exempt from state mandated benefits |
| 17. | X. HMO | I. Does not take insurance risk |
| | Y. PPO | II. Can provide care through its own hospitals |
| | | III. Often offers two levels of benefits |

- 18.** X. Automatic Reinsurance Treaty I. First in, best offer
Y. Facultative Reinsurance Treaty II. First dollar quota share
III. Excess of retention
- 19.** X. Creditor under a Group Credit Life Insurance Policy I. Beneficiary of policy
Y. Debtor under a Group Credit Life Insurance Policy II. Generally pays premium
III. Receives dividends
- 20.** X. With-profits products in the U.K. I. Backed primarily by bonds and mortgages
Y. Participating products in the U.S. II. Lower cash value guarantees
III. Generally higher premiums

16-22. Each of questions 16 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 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).	

- 21.**
- | | | | |
|----|-----------------------------|------|-------------------------------------|
| X. | Group Long Term Disability | I. | Higher percentage of self insurance |
| Y. | Group Short Term Disability | II. | High claim frequency |
| | | III. | High amount of claim |

- 22.**
- | | | | |
|----|---------------------------|------|---|
| X. | Defined contribution plan | I. | Implicitly emphasizes termination benefits over retirement benefits |
| Y. | Defined benefit plan | II. | Plan sponsor's contribution reflects actual experience |
| | | III. | One type is a profit-sharing plan |

- 23.** This question 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

- 23.** X. “Spread Gain” pension funding cost methods
- Y. “Immediate Gain” pension funding cost methods
- I. Entry Age Normal
- II. Frozen Initial Liability
- III. Individual Aggregate
- IV. Unit Credit

24. Rank in increasing order of restrictiveness (least restrictive to most restrictive) the following definitions of disability:

I. Activities of daily living

II. Own occupation

III. Any occupation

(A) I < II < III

(B) I < III < II

(C) II < III < I

(D) III < I < II

(E) III < II < I

The following questions relate to asset defaults.

25. Investment yield assumptions are normally net of expected asset defaults.

(A) True

(B) False

26. There is no asset default risk associated with policy loans.

(A) True

(B) False

27. There is no asset default risk associated with required capital.

(A) True

(B) False

The following questions relate to utilization management for managed care.

28. Utilization management can take place after care is delivered.

(A) True

(B) False

29. The cost savings associated with utilization management programs are well documented.

(A) True

(B) False

The following questions relate to methods used to estimate medical plan claim costs.

- 30.** Community rating is a process where a group's utilization and cost experience are used to establish estimated claim costs.
- (A) True
- (B) False
-
- 31.** The budgetary method is not an appropriate method for estimating claim costs.
- (A) True
- (B) False
-
- 32.** In developing the cost per service, an actuary must reflect provider arrangements under the aggregate method.
- (A) True
- (B) False

**** END OF EXAMINATION 5 ****
MORNING SESSION

**** BEGINNING OF EXAMINATION 5 ****
AFTERNOON SESSION
Beginning With Question 12

12. (5 points)

- (a) Describe the reasons for extensive regulation of life and health insurance.
- (b) Outline the arguments for centralized regulation of life and health insurance.
- (c) Outline the arguments for decentralized regulation of life and health insurance.

13. (7 points) Describe the major underwriting considerations for the small group life and health insurance market.

- 14.** (4 points) Describe the compensation arrangements typically used by managed care organizations with hospitals and physicians.
- 15.** (4 points) Describe the factors involved in developing the expense component of the gross premiums for group insurance products.

- 16.** (5 points) For a 10-year level premium life insurance policy, you are given the following:

Death benefit per unit = \$1,000 in all years

Annual gross premium per unit = \$6.50

Reserve interest rate = 5.0% in all years

$q_x^d(1) = 0.0045$ (mortality is the only decrement considered)

Year	Present Value of Future Premiums	Present Value of Future Benefits
1	47.47	46.80
2	43.23	44.43

- (a) Using the full preliminary term method, calculate:
- (i) the initial expense; and,
 - (ii) the reserve per unit in-force at the end of the second policy year.
- (b) Compare solvency reserves to earnings reserves and tax reserves.

Show all work.

17. (7 points)

- (a) Describe the following considerations and how they are used when developing profit goals:
 - (i) risk;
 - (ii) rate of return; and
 - (iii) accounting basis.

- (b) Explain and differentiate each of the following profit measures:
 - (i) embedded value;
 - (ii) return on investment; and
 - (iii) weighted average return on equity.

18. (8 points) For a newly established plan, you are given the following data:

Normal retirement benefit:	\$10 per month per year of service
Normal retirement age:	65
Interest rate:	6%
Pre-retirement terminations other than by death:	None
Pre-retirement death benefit:	None
Selected annuity values:	$\ddot{a}_{65}^{(12)} = 10$
Amortization of frozen initial liability:	Level dollar amount over 20 years
Plan effective date:	January 1, 2001
Plan assets as of January 1, 2001:	0

Selected commutation factors:

Age	D_x	N_x
32	1,468	23,018
33	1,382	21,550
62	215	2,287
65	171	1,689

Data for sole participant:

Name	Date of Hire	Date of Birth
Jones	1/1/1970	1/1/1938

For Jones, calculate the normal cost under the following methods as of January 1, 2001:

- (i) Frozen Initial Liability (Attained Age Normal);
- (ii) Frozen Initial Liability (Entry Age Normal); and
- (iii) Aggregate.

Show all work.

**** END OF EXAMINATION ****