COURSE 5
MORNING SESSION

APPLICATION OF BASIC ACTUARIAL PRINCIPLES

SECTION A-WRITTEN ANSWER

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

1. *(4 points)*

(a) Describe the coverage in a business overhead expense disability income policy.

(b) You are given the following information:

Maximum monthly benefit	30,000
Maximum multiple of monthly benefit	15
Maximum benefit period	24 months
Insured start of disability	January 1, 2003
Insured end of disability	March 1, 2005
Elimination period	90 days

Calculate the payout to the insured for each of the scenarios:

Scenario	Monthly Overhead Expense
I	36,000
II	18,000
III	22,500

Show all work.

2. *(6 points)* With respect to group health care benefits:

(a) Describe the various providers.

(b) Describe the various buyers.

3. *(4 points)*

(a) Describe the actions a life insurance company can take to limit the effect of policyholder misrepresentation.

(b) Given the following information for a company that offers life insurance with smoker and nonsmoker rates:

Actual smokers	30% of insured
Smokers premium rate	5 per 1,000
Non-smoker premium rate	3 per 1,000
Expenses	None

Calculate the amount of profit lost per 1,000 if 10% of smokers lied about smoking and were issued as non-smokers.

Show all work.

4. *(6 points)* For a defined benefit pension plan, you are given the following information:

Plan formula: 1% × 3-year Final Average Earnings × years of service from hire

Plan participants as of January 1, 2005:

Participant	Attained Age	Prior Year Earnings	Service to Date	Probability of surviving in service to age 65	Temporary employment-based life annuity of 1 per year
X	40	35,000	0	0.5040	11.8338
Y	50	50,000	10	0.6547	9.1844

Actuarial assumptions:

$\ddot{a}_{65}^{(12)}$	9.4131
Interest rate	7%
Assumed future annual salary increases	5%
Pay increases	Beginning of the year
Actuarial cost method	Entry age normal
Normal retirement age	65
Benefits payable for termination prior to normal retirement age	None

Calculate the plan's normal cost and accrued liability as of January 1, 2005.

Show all work.

5. *(3 points)* For variable annuities:

(a) Describe common death benefit options.

(b) Describe the effect of a decline in account value due to investment performance for each death benefit option.

6. *(7 points)* Describe the steps an insurance company takes to develop an individual life insurance product.

7. *(5 points)* For a current medical plan and a proposed change to that plan, you are given the following:

	Deductible	Coinsurance	Out-of-pocket maximum (excluding deductible)	Lifetime maximum
Current Plan	100	80%	1,000	None
Proposed Plan	200	75%	1,400	None

Manual cumulative probability distribution

<u>Range of Claims</u>	<u>Frequency</u>	<u>Average Annual Claims</u>	<u>Annual cost</u>	<u>Accumulated Frequency</u>	<u>Accumulated Annual Cost</u>
0	0.25	0	0.00	1.00	3,500
0.01–50.00	0.05	40	2.00	0.75	3,500
50.01-150.00	0.10	100	10.00	0.70	3,498
150.01-250.00	0.20	210	42.00	0.60	3,488
……	……	……	……	……	……
4,000.01-5,000.00	0.03	4,500	135.00	0.12	2,500
5,000.01-6,000.00	0.02	5,400	108.00	0.09	2,387

Assuming no change in utilization, calculate the percentage change on net medical claims for the proposed plan change.

Show all work.

8. *(5 points)* Describe the types of insurance company risk that are typically addressed by required capital formulas.

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COURSE 5
MORNING SESSION

APPLICATION OF BASIC ACTUARIAL PRINCIPLES

SECTION B-MULTIPLE CHOICE

1. Under Medicaid, all of the following services are mandatory EXCEPT:

(A) Prosthetic devices

(B) Lab and x-ray

(C) Vaccines for children

(D) Home health care

(E) Family planning

2. In the U.S., all of the following entities pay income taxes EXCEPT:

(A) Mutual funds

(B) Non-qualified trusts

(C) Common-law partnerships

(D) Legal partnerships

(E) Large corporations

3. With respect to market value adjustments, all of the following are true EXCEPT:

(A) Allows the company to reflect the market value of the liabilities when the policy is surrendered

(B) Works in the policyowner’s favor when interest rates decline

(C) Adds equity and stability for the company

(D) Adds equity and stability for the policyholder

(E) Offsets the effect of adverse cash flows

4. For the traditional unit credit cost method, all of the following statements are true EXCEPT:

(A) Would be used to determine plan termination liability

(B) Is a benefit allocation cost method

(C) Increase in accumulated plan benefit due to plan amendment increases normal cost

(D) For a participant, the normal cost for a level benefit is likely to rise from year to year

(E) Actuarial liability is equal to the actuarial value of the participant’s cumulative benefit on the valuation date

5. All of the following are bases for insurance company taxes EXCEPT:

(A) Earnings

(B) Capital

(C) Premiums

(D) Reserves

(E) Investment income less expenses

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6. Each of questions 6 through 11 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.

	ASSERTION		REASON
6.	Term to 100 is permanent insurance.	BECAUSE	Term to 100 cash values are similar to those of whole life insurance.

	ASSERTION		REASON
7.	The cost of a 31-day grace period provision in an individual health insurance policy is relatively more than the cost of a similar provision in an individual life insurance policy.	BECAUSE	Modal premium loadings for individual health insurance are higher than those for individual life insurance.

	ASSERTION		REASON
8.	During the lifetime of the debtor, group credit life insurance can be very profitable to the debtor.	BECAUSE	Dividends payable under a group credit life insurance policy are paid to the debtor.

	ASSERTION		REASON
9.	For small group health business, many states have risk pooling programs.	BECAUSE	For small group health business, it is necessary to distribute additional risks associated with the guaranteed issue requirement.

	ASSERTION		REASON
10.	In a life insurance company, there is a strong tendency to favor solvency earnings as the primary driver of pricing.	BECAUSE	In a life insurance company, solvency earnings drive stockholder investments in the business.

	ASSERTION		REASON
11.	Under the individual aggregate actuarial cost method, there is never an unfunded actuarial liability.	BECAUSE	Under the individual aggregate actuarial cost method, at inception of the plan, there is no actuarial liability for past service.

12. Rank the following pricing strategies in ascending order (lowest to highest) of price:

I. Predatory pricing

II. Skim pricing

III. Neutral pricing

IV. Penetration pricing

(A) I < IV < III < II

(B) II < I < III < IV

(C) II < III < IV < I

(D) IV < I < II < III

(E) IV < II < I < III

USE THIS PAGE FOR YOUR SCRATCH WORK

13. For a block of one-year term policies you are given:

Earned premium for 2004	3,401
Rate increase November 1, 2003	7%
Rate increase September 1, 2004	5%
Policies	Uniformly distributed

Calculate the earned premium at current rates for 2004 using the parallelogram method.

(A) 3,458

(B) 3,561

(C) 3,564

(D) 3,644

(E) None of the above.

USE THIS PAGE FOR YOUR SCRATCH WORK

14. For a pension plan you are given the following:

Actuarial cost method:	Traditional unit credit
Normal retirement benefit:	\$30 per month per year of service
Early retirement benefit:	Accrued benefit reduced by 5% for each year before age 65

Actuarial assumptions:

Interest rate	7%
Pre-retirement decrement other than early retirement	None
$\ddot{a}_{64}^{(12)}$	9.25
$\ddot{a}_{65}^{(12)}$	8.75

Retirement age assumption

Age *x*	**Retiring rate at age *x***
64	0.4
65	1.0

Data for the sole participant

Age at hire	40
Age at January 1, 2004	62

Calculate the actuarial liability as of January 1, 2004.

(A) 58,257

(B) 59,537

(C) 60,633

(D) 65,095

(E) 80,885

USE THIS PAGE FOR YOUR SCRATCH WORK

15. For an insured with group long-term disability (LTD) benefits, you are given the following:

Pre-disability monthly earnings	5,000
Formula LTD benefit	60% of pre-disability earnings
Work earnings during disability	1,500 per month
Other income	None

A = Reduced LTD monthly benefit based on the proportionate loss formula
B = Reduced LTD monthly benefit based on the 50% offset benefit

Calculate A – B.

(A) –2,150

(B) –150

(C) –120

(D) 350

(E) 1,850

USE THIS PAGE FOR YOUR SCRATCH WORK

16. Company XYZ is re-pricing a universal life insurance product. You are given the following:

Year 2003:	
Profit margin:	3.5%
Premium margin:	75%
Annual sales:	20,000,000
Year 2004:	
Price decrease:	20%
Projected annual sales:	22,500,000

Calculate the 2004 profit margin.

(A) –16.50%

(B) –14.65%

(C) –14.38%

(D) 2.80%

(E) 15.42%

USE THIS PAGE FOR YOUR SCRATCH WORK

17. Each of questions 17 through 20 consist 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:

	Lettered Item	Is Related to Numbered Items
(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. Generally accepted accounting principles (GAAP)

Y. Statutory accounting

I. Use of Interest Maintenance Reserve

II. Allows for capitalization of deferred acquisition costs

III. Considers agent balances as nonadmitted assets

18.

X. Reinsurance reserves held by ceding company

Y. Reinsurance reserves held by reinsurer

I. Coinsurance

II. Modified coinsurance

III. Coinsurance with funds withheld

19.

X.	Defined contribution plan	I.	The benefit level is directly affected by investment performance
Y.	Defined benefit plan	II.	The benefits for employees who change jobs frequently will likely be inadequate
		III.	There is an opportunity for post-retirement benefit increases

20.

X.	Policy year data	I.	Most common method for compiling actuarial data
Y.	Accident year data	II.	Allows the pricing actuary to match premiums and losses from one accounting basis
		III.	Claims data almost always available in this format

21. Each of questions 21 through 26 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.

	ASSERTION		REASON
21.	In a medical plan using a capitation model, the provider assumes more insurance risk than the insurer.	BECAUSE	In a capitation model, the insurer subcontracts with a provider to perform a defined range of services in return for fee schedule reimbursement for each service rendered.

	ASSERTION		REASON
22.	After an insurer reimburses a policyholder for losses under a homeowner policy, the insurer can sue a third party for negligence and keep the total proceeds of the settlement.	BECAUSE	A subrogation clause exists in every homeowner's policy.

	ASSERTION		REASON
23.	Regulation of reinsurance is primarily concerned with solvency.	BECAUSE	Reinsurance contracts are generally subject to regulatory approval.

	ASSERTION		REASON
24.	Under a generational annuity mortality table, the mortality rate at age 50 for an individual currently age 40 is less than that for an individual currently age 30.	BECAUSE	A generational annuity mortality table assumes mortality rates will be subject to continuous improvement.

	ASSERTION		REASON
25.	In the early years of an old age security system, pay-as-you-go funding will be more expensive than a fully funded plan.	BECAUSE	In a fully funded old age security system, investment earnings help pay for future benefits.

	ASSERTION		REASON
26.	A group insurance retrospective premium rider will create a due and unpaid premium on the financial statement if experience is worse than expected.	BECAUSE	Under a group insurance retrospective premium rider, a policyholder agrees to remit an additional premium based on a monthly review of the previous month's paid claims.

27. For a dynamic life insurance product at policy year t, you are given the following:

Account value	40,000
Surrender charge as a percentage of the account value	30%
Account value not subject to surrender charge	10%
Account value withdrawn	15%

Calculate the partial withdrawal charge.

(A) 0

(B) 600

(C) 1,620

(D) 1,800

(E) 10,800

USE THIS PAGE FOR YOUR SCRATCH WORK

28. For a pension plan, you are given the following:

Actuarial cost method:	Projected unit credit
Normal retirement benefit:	2% of final salary for each year of service

Actuarial assumptions:

Interest rate	7%
Annual salary increase	5%
Pre-retirement decrement	None
Retirement age	65
$\ddot{a}_{65}^{(12)}$	8.33

Data for the sole participant:

Age at hire	30
Age at January 1, 2003	45
Salary at January 1, 2003	40,000
Actual 2003 salary increase	10%

Calculate the experience loss for the plan as of January 1, 2004.

(A) –2,940

(B) –3,108

(C) –3,315

(D) –3,547

(E) –3,724

USE THIS PAGE FOR YOUR SCRATCH WORK

29. For a Property and Casualty insurer, you are given the following:

- Paid loss development factors based on cumulative payments.

1/0	2/1	3/2	$\infty/3$
1.63	1.23	1.12	1.02

- For accident year 2003 you have paid claims of 54,000 as of duration 1 (December 31, 2004).
- Expected loss ratio is 75%.
- Earned premium for accident year 2003 is 95,000

Using the chain ladder method, calculate the estimated loss reserves for accident year 2003 as of December 31, 2004.

(A) 17,250

(B) 20,544

(C) 21,878

(D) 69,681

(E) 75,878

USE THIS PAGE FOR YOUR SCRATCH WORK

30. A person, with current wealth of 25, has a utility function given by $\mu(x) = 100x - x^2$. Calculate the maximum wager this person would make in a game where there is a 20% chance of winning 10 plus the return of the wager.

(A) 1.1

(B) 1.3

(C) 1.9

(D) 2.0

(E) 2.5

USE THIS PAGE FOR YOUR SCRATCH WORK

31. For a dynamic life insurance product, you are given the following:

Policy Month	M-1	M
Fixed amount death benefit	40,000	40,000
Cumulative partial withdrawal	3,000	6,000
Account value at end of month	30,000	27,075
Minimum death benefit as % of account value	120%	120%
Annual Cost of Insurance (COI) charge rate per 1,000 net amount of risk	2.00	2.20

Calculate the COI charge for policy month M under death benefit option A.

(A) 1.10

(B) 1.28

(C) 1.64

(D) 2.37

(E) 6.78

USE THIS PAGE FOR YOUR SCRATCH WORK

32. For an automobile insurance policy, Other Than Collision (OTC) premiums usually vary for all of the following EXCEPT:

(A) Age of policyholder

(B) Territory

(C) Expectation as to ease of damage to vehicle

(D) Vehicle value

(E) Cost to repair vehicle

33. Group supplemental life plans differ from basic group life coverage in all of the following ways EXCEPT:

(A) Minimum participation limits are more liberal

(B) Evidence of insurability is more stringent

(C) Suicide exclusion is common

(D) If a disability provision is included, it is usually limited to waiver of premium

(E) Contributions are generally subsidized by the employer

34. In the US, a policyholder can, under certain conditions, perform all of the following without incurring taxable income EXCEPT:

(A) Exchange a life insurance policy for a life insurance policy

(B) Exchange a life insurance policy for an annuity policy

(C) Exchange an annuity policy for an annuity policy

(D) Exchange an annuity policy for a life insurance policy

(E) Take a policy loan against a life insurance policy

35. Regarding the Health Insurance Portability and Accountability Act (HIPAA), all of the following are true EXCEPT:

(A) Restricts post-issue underwriting during claims adjudication process

(B) Defines a small employer group

(C) Requires underwriters to offer insurance to all groups regardless of industry/occupation

(D) Requires HMOs to offer all major medical and comprehensive health insurance products on a guaranteed acceptance and renewal basis

(E) Restricts application of pre-existing condition limitation or exclusions for individual employees who have had continuous coverage for more than 12 months

36. Under the traditional unit credit actuarial cost method, all of the following affect future normal costs EXCEPT:

(A) aging of active employees

(B) actual withdrawal experience

(C) actual death experience

(D) actual number of new employees

(E) actual investment performance

37. In the Accumulation Reserve method used for universal life insurance, all of the following can be used to amortize acquisition expenses EXCEPT:

(A) Income from surrender charges

(B) Premiums

(C) Interest margins

(D) Cost of insurance margins

(E) Expense margins

USE THIS PAGE FOR YOUR SCRATCH WORK

38. Each of questions 38 through 40 consist 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:

	Lettered Item	Is Related to Numbered Items
(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).

38.

X. Anti-selection

Y. Claims volatility

I. Function of the inherent degree of fluctuation in the benefit and in the volume of business

II. Addressed through the initial plan design

III. Limited by provisions restricting payment of claims

39.

X.	Hazard	I.	Collision
Y.	Peril	II.	Poor wiring
		III.	Dishonesty

40.

X.	Variable universal life products	I.	Passes full investment risk to the policyholder
Y.	Unitised-with-profit products	II.	Uses bid/offer spread as hidden expense charge
		III.	Uses front-end loads to cover acquisition costs

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. *(5 points)* In Canada, describe the design of extended health plans in the group market.

10. *(3 points)* Describe the reasons why a plan sponsor would switch from a defined benefit pension plan to a defined contribution pension plan.

11. *(5 points)* You are pricing the latest version of a life insurance company's flexible premium universal life (UL) product.

With respect to the company, you are given the following:

- Superior ratings from the major ratings agencies
- Strong reputation in the estate planning market
- Target market consists of affluent, sophisticated retirees
- Average face amount on policies is significantly higher than the industry average
- UL sold for many years
- New UL product is similar to its best-selling product

The new product has the following features:

Commissions:		
	First-year:	50% of first-year premium up to the target commissionable premium, plus 3% of first-year premium in excess of the target commissionable premium
	Renewal:	3% of premium in policy year 2 onwards
	Chargeback:	100% of first-year commissions for lapses in the first 3 policy years
Bonus refund:		return of COI charges at the end of policy year 25
Surrender charges:		15% in policy year 1, grading linearly to 0% in policy year 16

(a) Describe how the information given above would influence your lapse rate assumption.

(b) Describe the effect of the surrender charge on the investment risk and the investment strategy for this product.

12. *(7 points)* For a property and casualty insurance company, you are given the following:

Gross premium rates	In effect for 6 months
Policy length	3 months
Trend factors	Increase at an exponential rate
δ	0.133
Distribution of claims	Uniform

Additional loadings:

Commissions	0.00
General Expenses	12.0%
Taxes	3.5%
Profit	4.0%

Incurred losses for reported claims by development year

Accident Year	Development Year		
	0	1	2
2001	10,432,532	12,414,789	12,787,542
2002	12,503,672	15,248,731	
2003	14,813,156		

No further development beyond year two.

Accident Year	Earned Exposure Units	Number of Incurred Claims	Credibility Factor
2001	106,454	5,569	0.0%
2002	107,127	5,603	40.0%
2003	107,962	5,691	60.0%

(a) *(2 points)* Calculate the expected ultimate incurred losses by accident year.

(b) *(5 points)* Calculate the gross premium rate that will take effect at May 1, 2004.

13. *(5 points)* With respect to group health insurance:

(a) List the criteria that should be considered when underwriting large groups.

(b) Indicate why these criteria are important.

14. *(5 points)* Describe the considerations in group insurance financial reporting for:

(a) Alternative funding arrangements

(b) Administrative arrangements

15. *(5 points)* In the context of U.S. insurance company solvency regulation:

(a) Describe the role of State Guaranty Funds.

(b) Explain the effect of reinsurance regulation.

16. *(5 points)* With respect to group long term disability and group long term care insurance contracts:

(a) Describe the features that are important when calculating claim reserves.

(b) Describe the considerations in preparing an actual to expected (A/E) claim termination rate study.

(c) Describe the steps in calculating IBNR reserves by the loss ratio method.

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