ACTEX Learning

ILA 201-U
Valuation and Advanced Product and Risk Management U.S. Course Study Manual

1st Edition

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An SOA Exam

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NOTES

This study guide is designed to assist candidates preparing for the SOA Exam ILA201-U: *Valuation and Advanced Product and Risk Management—US Course*. It summarizes, in outline form, all the required books, study notes, and articles listed in the official syllabus. Within each topic, outlines are organized according to syllabus order.

The major topic areas covered include:

- U.S. Financial Reporting Requirements
- Capital Management
- Management and Evaluation of Life Insurance Risks
- Advanced Product Management

To help candidates assess their understanding and prepare for the actual exam, a full-length practice exam is included. This mock exam mirrors the structure of the official exam (3 hours, 50 points). Both the questions and their assigned point values are representative of what candidates can expect. Complete solutions are provided for all questions to support self-assessment.

While every effort has been made to ensure the accuracy of the material, errors may remain. While every effort has been made to ensure the accuracy of the material, errors may remain. If you notice any issues or have suggestions for improvement, please contact us at support@actexlearning.com.

Best of luck in your studies and on exam day!

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STATUTORY VALUATION, CHAPTER 3, NAIC ANNUAL STATEMENT

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3. Exhibit 5 - Aggregate Reserve for Life Policies and Contracts
4. Exhibit 8 - Policy and Contract Claims
5. Exhibit of Life Insurance
6. Exhibit of Number of Policies

D. Successive Equation

$$\text{Value (E)} = \text{Value (B)} + \text{Increases} - \text{Decreases}$$
$$\text{Surplus (E)} = \text{Surplus (B)} + \text{Net Income} + \text{Other Changes}$$

where

- E is the end of the accounting period
- B is the beginning of the accounting period

1. Successive equations are used for
    a. Summary of Operations
    b. Cash Flow
    c. Analysis of Increase in Reserves
    d. Exhibit of Life Insurance
    e. Exhibit of Annuities
2. Balance sheet is as of a particular point in time
3. Summary of operations spans a period of time

II. Balance Sheet

A. Under GAAP, Assets = Liabilities + Equity

B. Under statutory accounting principles, Surplus = Assets - Liabilities

III. Assets

A. Significant detail is provided because the industry has a lot of assets

B. Cash and invested assets

1. Bonds
2. Common stocks
3. Preferred stocks
4. Mortgage loans on real estate
5. Real estate
6. Cash
7. Contract loans
8. Derivatives
9. Other invested assets

C. Total assets

1. Total cash and invested assets
2. Investment income due and accrued
3. Premiums and considerations
4. Uncollected premiums
5. Deferred premiums
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7. Separate account assets

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A. Most liabilities are the policy reserves

B. Total liabilities

1. Aggregate reserves for life contracts
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9. Transfers to separate accounts
10. Miscellaneous liabilities
11. Other liabilities
12. Separate account liabilities

C. Total liabilities and surplus

1. Total liabilities
2. Surplus

V. Summary of Operations

A. It presents operating results of company for a period of time

$$\text{Net gain} = \text{revenue} - \text{costs}$$
$$\text{Net income} = \text{net} + \text{realized capital gains (after taxes)}$$

B. Major revenue items are premium and annuity considerations and net investment income

1. Premium and annuity considerations
2. Considerations for supplementary contracts with life contingencies
3. Net investment income

4. Amortization of interest maintenance reserve
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C. Major cost items are benefit payments, increase in reserves, commissions and expenses

D. Benefit costs

1. Death benefits
2. Matured endowments
3. Annuity benefits
4. Disability benefits and accident and health benefits
5. Surrender and withdrawal benefits
6. Increase on deposit type contracts
7. Payments on supplementary contracts with life contingencies
8. Increase in aggregate reserves on life accident and health contracts

E. Total costs

1. Benefit costs
2. Commissions
3. General insurance expenses
4. Taxes, licenses and fees (other than income tax)
5. Increase in loading on deferred and uncollected premiums
6. Net transfers to/from separate accounts

F. Net income = Revenue - Total costs - Federal income tax - Dividends

VI. Capital and Surplus Account

A. It shows how surplus changed between two accounting dates

$$\text{Surplus (E)} = \text{Surplus (B)} + \text{Net income} - \text{Dividends} + \text{Other Charges}$$

B. Dividends represent dividends to shareholders

C. Other charges include change in unrealized gains and reserve change due to change in valuation basis

D. Net income is net income over the period; over a long period, net income is the primary source by which surplus grows

E. Net income less dividends should exceed growth rate times Surplus (B)

VII. Cash Flow Statement

A. It shows reconciliation of cash and short-term investments between two accounting dates

$$\text{Cash (E)} = \text{Cash (B)} + \text{CO} + \text{CI} + \text{CF}$$

B. First section demonstrates the three primary sources and uses of cash flow

1. Cash from operations (CO)
    a. Premium collected net of reinsurance
    b. Net investment income
    c. Miscellaneous income
    d. Net transfers to/from separate accounts
    e. Commissions, expenses, other deductions
    f. Dividends to policyholders
    g. Federal income tax
2. Cash from investment activities (CI)
    a. Proceeds from investments sold, matured or repaid
    b. Cost of long term investments acquired
    c. Net change in policy loans and premium notes
3. Cash from financing activities (CF)
    a. Cash provided
    b. Surplus notes
    c. Capital and paid in surplus
    d. Other cash
4. Reconciliation of cash and short term investments

$$\begin{aligned}&\text{Cash and short term investments at end of year} =\\ &\quad \text{Cash and short term investments at start of year}\\ &\quad + \text{Net change in cash and short term investments}\\ &\quad + \text{Cash and other short term investments}\end{aligned}$$

C. Second section shows how and why liquidity changed during the period

VIII. Analysis of Operations by Line of Business

A. It shows the gain from operations from major business segments of company

B. It provides information to do analysis of profitability

C. Also called Gain and Loss Exhibit

D. It uses the same categories as the Summary of Operations

IX. Analysis of Increase in Reserves During the Year

A. It shows how the policy reserve changed during the period

$$\begin{aligned}\text{Res (E)} = \text{Res (B)} &+ \text{Net Premium} + \text{Tabular Interest} \\ &- \text{Tabular Cost} + \text{Other Changes}\end{aligned}$$

B. Current year reserve =

$$\begin{aligned}&\text{Prior year reserve} \\ &+ \text{Tabular net premiums or considerations on reserves} \\ &+ \text{Tabular interest on reserves} \\ &- \text{Tabular cost on reserves} \\ &+ \text{Reserve released by death} \\ &+ \text{Reserves released by other terminations} \\ &- \text{Other charges}\end{aligned}$$

X. Exhibit 1 - Part 1: Premiums and Annuity Considerations

A. Premium is major source of revenue for most companies

B. It shows how premiums have been adjusted from cash to an accrual basis

C. It also shows effect of reinsurance ceded and assumed

D. It splits total premiums into

1. Premiums earned on policies in first policy year (indication of sales)
2. Single premiums (indication of non-recurring premiums)
3. Premiums earned on policies after first policy year (renewal premiums)

E. Premium formulas

$$\text{Premium} = \text{Direct premium} + \text{Reinsurance assumed} - \text{Reinsurance ceded}$$
$$\text{Direct premium} = \text{Collected premium} + \Delta\text{Deferred premium} - \Delta\text{Advance premium}$$

F. Deferred premium reflects frequency of premium payments assumed in reserves and actual frequency of payments required

G. Advance premium reflects premium received prior to the valuation date but due only after that date

XI. Exhibit 5 - Aggregate Reserve for Life Policies and Contracts

A. One of the most important actuarial exhibits in the statement

B. It shows policy reserves for current period by major product line and valuation standard

C. Valuation standard represents methodology and assumptions used

D. Categories

1. Life
2. Annuities
3. Supplementary Contracts With Life Contingencies
4. Accidental Death Benefit
5. Disability: Active lives
6. Disability: Disabled lives
7. Miscellaneous Reserves

XII. Exhibit 7 - Deposit Type Contracts

A. Shows account balance for deposit type contracts

B. Account balance at end of period =

$$\begin{aligned}&\text{Account balance at beginning of period}\\ &+\text{Deposits during the year}\\ &+\text{Investment earnings credited}\\ &-\text{Fees and other charges assessed}\\ &-\text{Surrender charges}\\ &-\text{Net surrender or withdrawal payments}\\ &+\text{Net transfers to separate accounts}\end{aligned}$$

C. Balance (E) =

$$\text{Balance (B)} + \text{Deposits} + \text{Interest} - \text{Fees} - \text{Withdrawals} + \text{Other Changes}$$

XIII. Exhibit 8 - Contract Claims

A. It shows how certain benefit payments have been adjusted from cash to accrual basis

B. Separated into direct, reinsurance assumed, reinsurance ceded

C. Categories

1. Due and unpaid
2. In course of settlements
3. Incurred but not reported

XIV. Exhibit 8 - Exhibit of Life Insurance

A. Recursive formula

$$\begin{aligned}&\text{Inforce current year} =\\ &\quad \text{Inforce prior year}\\ &\quad + \text{Issued during year}\\ &\quad + \text{Increases}\\ &\quad - \text{Death}\\ &\quad - \text{Maturity}\\ &\quad - \text{Disability}\\ &\quad - \text{Expiry}\\ &\quad - \text{Surrender}\\ &\quad - \text{Lapse}\\ &\quad - \text{Conversion}\\ &\quad - \text{Other decreases}\end{aligned}$$

A. Inforce(E) = Inforce (B) + Issues - Deaths - Other terminations + Other Changes

XV. Exhibit 8 - Exhibit of Annuities

A. Recursive formula

$$\begin{aligned}&\text{Inforce current year} =\\ &\quad \text{Inforce prior year}\\ &\quad + \text{Increases}\\ &\quad - \text{Decreases}\end{aligned}$$

B. Also shows

1. Amount of income payable
2. Account balance

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U.S. GAAP, CHAPTER 7
UNIVERSAL LIFE INSURANCE

I. Background and classification

A. Universal life commenced in the 1970s due to consumer demand and high interest rates

1. Market moved from covering mortality risks with stable and predictable costs to a consumer savings model with higher and more transparent returns

2. Tt started with a whole life or term protection with a general account investment savings element

3. It expanded to variable and indexed universal life with similar designs but with different investment options

4. To compete with term insurance, universal life added secondary guarantees

B. Definition of universal life insurance

1. Universal life policies share four characteristics

a. They are legally classified as life insurance contracts

b. They include at least one key element (premium or benefit) that is not fixed and guaranteed

c. They include an account balance mechanism into which premiums are deposited and to which investment returns are credited

d. They provide insurance coverage through the assessment of periodic charges to the account balance

2. The last two requirements are explicit, but not well defined in older universal life products

3. Universal life can be used to provide other insurance coverages such as long term care

4. Universal life contracts are long duration contracts classified as universal life type products along with contracts, such as variable annuities with guaranteed minimum benefits

5. The difference between universal life type contracts and other long duration contracts are lack of fixed and guaranteed terms
    a. Policyholders elect the amount and timing of premium payments
    b. The insurer has discretion over amounts that accrue to policyholders or that are assessed against policyholders
6. Traditional life and participating life policies are not universal life because they have fixed and guaranteed premium and benefit features
    a. Policyholders do not have discretion over the amount and timing of premium payments
    b. The insurer does not have significant discretion over amounts that accrue to policyholders or that are assessed against policyholders
7. Interest sensitive whole life
    a. It is similar to universal life, but with premiums specified by the company
    b. As interest rates or cost of insurance rates change, the policyholder can pay a higher premium or adjust the face amount of coverage to a level supported by the premium
    c. While offering less premium discretion than other universal life policies, it is still considered universal life
8. Pre-need insurance may qualify as universal life insurance despite having traditional life characteristics
    a. The policy has a fixed premium; it names the funeral director the irrevocable beneficiary in exchange for a pre-arranged funeral service
    b. However, features such as paid-up additions, discretionary or inflation indexed excess interest features may justify universal life treatment
9. The determination as to whether a contract follows universal life accounting depends on a consideration of all elements and how they align with universal life contracts

C. Universal life insurance mechanics

1. Most universal life products are distinguished by an accumulation fund where deposits are paid
    a. For fixed universal life, the fund increases by an interest rate declared by the company and decreases for charges
    b. For variable universal life, the fund value increases or decreases by the performance of a fund selected by the policyholder
    c. For indexed universal life, the company credits interest based on an external index, with some constraints (cap rates on the index)

2. The notional value of the accumulation value is the account balance
3. When a policy terminates, the policy pays the cash surrender value (full account balance less a surrender charge); surrender charges wear off over time (10 - 20 years)
4. The death benefit of a universal life contract takes one of three forms
    a. Option A: max (face amount, accumulation fund * factor)
    b. Option B: max (face amount + accumulation fund, accumulation fund * factor)
    c. Option C: max (face amount + cumulative premiums - cumulative withdrawals, accumulation fund * factor)
5. For each option, the referenced factor provides sufficient mortality risk to qualify as life insurance under IRC 7702
6. The cost of insurance charge proportional to the net amount at risk (excess of death benefit over the account balance) is deducted from the account balance at the beginning of each month
    a. It covers the cost of death benefits
    b. It may also provide margin to help cover expenses and contribute to profit or risk margin
    c. Charges are based on age, sex, underwriting class and may be based on an attained age basis (most common) or level
    d. Cost of insurance rates are adjustable by the company subject to a cap to keep them in line with anticipated future experience
    e. The death benefit is usually discounted one month before applying the cost of insurance charge
    f. Older products make changes annually
7. Partial surrenders are permitted
    a. They decrease the amount payable on death (usually dollar for dollar)
    b. Some withdrawals may have no surrender charge
8. Premiums
    a. Most policies allow the timing and amount of premiums to be adjusted by the policyholder subject to
        i. Minimum annual or cumulative premiums
        ii. Tax driven maximums
    b. Premiums can be single premium or premiums on a regular or irregular basis

c. Policies may have a target premium

i. It defines a tier above which commissions are reduced

ii. Percentage of premium charges also differ above the target premium

9. Policies lapse voluntarily or when the contract is not adequately funded

a. For older policies, the contract lapses after a grace period when the account balance or cash surrender value drops to or below zero

b. Newer contracts have no lapse guarantees that keep the policy in force if certain conditions are met, even if the contract would otherwise terminate

c. Two types of no lapse guarantees

i. The policy remains in force if the cumulative premiums less withdrawals (sometimes accumulated with interest) exceed a minimum threshold

ii. The policy remains in force if a shadow account value is positive, where the shadow account is calculated as an account balance, but with different loads, charges, or credited rates; some contracts have multiple shadow accounts

10. Loans are permitted

a. Loan balances receive a low crediting rate

b. Some contracts credit the loan rate on the account balance supporting the loan

c. Loan rates may be fixed or variable

11. Universal life policies have a wide range of options and can be used for many purposes depending on policyholder needs

12. Some contracts apply a front-end load to premiums; other contracts rely on on-going charges or investment spread for revenue

13. Surrender charges are contractually defined and guaranteed

a. Cost of insurance, policy loads and interest rates have a current and guaranteed structure

b. The insurer can adjust these rates on anticipated future experience based on minimums and maximums

c. Interest is adjusted frequently; cost of insurance and policy loads are adjusted infrequently

14. Types of product designs

a. Early designs had front end load with low or no surrender charges

b. Later designs had few front-end loads but high surrender charges

15. Types of sales inducements
    a. A persistency bonus increasing the account value if the policy stays in force for 10 years
    b. A refund of cost of insurance charges if the policy says in force for 20 years
    c. A bonus interest rate applied in the first policy year
16. Commission forms
    a. A percentage of premium commission rate, generally higher in the first year than later years, with a rate close to the renewal year rate on premiums paid in excess of the target premium in any year (most common)
    b. A percentage of commission paid monthly or annually in all or just later years
17. Universal life policies may cover a single life or multiple lives which is common in estate planning in the second to die market; multiple life cost of insurance rates are Frasierized so that product mechanics are identical to a single life policy
18. Typical formula for processing account value for a fixed universal life policy in policy month t

    $$AV_t = V_{t-1} + Prem_t \times (1 - Prem\ Load\%_t) - Exp\ Load_t - COI_t + Int_t$$

    where

    AV_t = the account value at the end of month t

    $Prem_t$ = gross premium paid during policy month t

    $Prem\ Load\%_t$ = percent of premium expense load for policy month t

    $Exp\ Load_t$ = the non-premium related expense load in month t usually expressed as a per policy or per$1,000 insurance amount

    COI_t = the cost of insurance charge for month t

    $$COI_t = \left[\left(DB_t/(1+ic)^{1/12} \right) - (AV_{t-1} + Prem_t \times (1 - Prem\ Load\%_t) - Exp\ Load_t) \right] \times COI\ Rate_t$$

    DB_t = the death benefit in month t

    Int$t$ = the credited interest for month t using a formula similar to (but with adjustments for the actual timing of premium payments

    $$AV_{t-1} + (Prem_t \times (1 - Prem\ Load\%_t) - Exp\ Load_t - COI_t) \times \left((1+i_C)^{1/12} - 1 \right)$$

    i_c = current annual credited interest rate

    i_g = guaranteed annual fixed account credited interest rate

    $COI\ Rate_t$ = monthly cost of insurance per dollar of net amount at risk on insured life or lives at month t

D. Indexed universal life insurance

1. These policies are fundamentally the same as fixed universal life except for the interest crediting mechanism
2. Contracts offer a fixed account and several accumulation fund accounts each with a different crediting strategy
3. Interest credits are applied at the end of an index term based on the performance of an underlying index (S&P 500, Dow Jones, Russell 500, bond, real estate or commodity)
4. Policies have a defined index term (1 year) and credits are made to fund value at the end of the term
5. Credits are based on index growth and a cap, participation rate or a spread
6. Insurers buy options to hedge against risk; the option budget is money set aside to buy options to back the index credit
7. The policy uses a fixed account in the general fund to hold money until it can be invested in a fund at the fund anniversary date or on a reset date; this can be complex where charges must be allocated at the individual contract level
8. Contract level loads and cost of insurance charges are subtracted from the fixed income fund or prorated across indexed and fixed income funds
    a. Fees are subtracted from funds before interest is distributed
    b. Timing may impact interest crediting (beginning, average, or ending account balance)
9. Indexed interest credits are based on the design of the indexed growth rate
    a. Design defines the period over which measurement occurs
    b. Interest is credited at the index reset date
    c. If the policy terminates, no interest is credited, or it is pro-rated to the termination date

E. Variable universal life insurance

1. These policies are similar to fixed universal life except for the crediting rate methodology
2. Premiums purchase units in a separate account with values that fluctuate daily
3. Several funds are offered including a fixed rate option

4. Two types of fees charged that are not typically paid on universal life policies
    a. Mortality and expense fee as a percent of underlying asset values which is deducted from the gross return on asset before determining the change in net asset value
    b. An investment management fee levied by fund managers is deducted from gross returns
5. These charges may be subject to a minimum and a maximum
6. The allocation of charges among funds vary by product and can be charged to the general account or allocated to all funds on a pro-rated basis

F. Products without explicit account value
1. A universal life policy may not have an explicit cash value
2. This occurs when premiums or benefits are not fixed and guaranteed often due to an interest rate crediting mechanism that varies over time
3. This occurs in pre-need policies that are similar to a participating whole life policy with dividends purchasing paid up additions, except excess interest replaces dividends and credits are fully discretionary and do not follow the contribution principle
4. Other forms that do not have an account value are interest sensitive whole life or excess interest whole life; excess interest accumulates in a side fund and is used to purchase paid up additions

II. Benefit reserves
A. A liability for policy benefits is established on the balance sheet for universal life insurance
B. Most universal life products have an account balance as the primary component of the reserve
1. For simple products, the account value is the reserve
2. For products with secondary guarantees, bonuses, and unusual charge patterns, additional requirements apply
C. The liability for policy benefits on universal lie policies equals the sum of
1. The balance that accrues to the benefit of policyholders at the date of the financial statements
2. Any amounts that have been assessed to compensate the entity for services to be performed over future periods
3. Any amounts previously assessed against policyholders that are refundable on termination of the policy
4. Any probable loss (premium deficiency)

D. Account balance

1. Account balance is the balance that accrues to policyholders on the date of the financial statements
2. It is the accumulation at interest of premiums less withdrawals less cost of insurance and contract loads
3. Accruals are required for amounts not yet credited to policyholders and other applicable adjustments
4. Indexed universal life has an account balance, but due to the nature of crediting mechanism, it does not form the basis for policy reserves
5. The accrued account balance is the sum of
   a. Deposits net of withdrawals
   b. Plus amounts credited pursuant to the contract
   c. Less fees and charges assessed
   d. Plus additional interest
   e. Other adjustments to the extent not already credited or included
6. The account balance can be used as the reserve for universal life using the retrospective accumulation form of a net level premium reserve for traditional life insurance
7. The net level premium reserve is

   $V_t = (V_{t-1} + P_t) \times (1 + i) - q_t \times (DB_t - V_t)$

   Where

   V = the end of the year reserve

   P = the net premium

   DB = the death benefit

   i = the annual valuation interest rate

   q = the valuation annual mortality rate
8. Translating to universal life
   a. Premium and expense loads replace the gross less net difference
   b. Cost of insurance rate replaces valuation mortality
   c. Credited interest rate replaces the valuation interest rate
9. Surrender charges are deducted to calculate the cash surrender value, but disregarded in the account balance liability

10. For policies with more than one account balance, the accrued account balance is the highest contractually determined value available in cash at contract maturity before deduction for future fees and charges; only non-shadow accounts are reflected
11. Contracts without an account balance use a proxy which represents the value of the contract; otherwise, cash surrender value is used
12. The foundational element
    a. For fixed and variable life insurance, it is the account balance communicated to the policyholder
    b. For indexed universal life insurance, it is the value of an embedded derivative and a host value
13. Foundational elements
    a. Fixed universal life
        i. The account balance for a fixed universal life policy equals the sum of deposits and interest credited minus withdrawals, cost of insurance and other fees assessed to the policy
        ii. Interest is credited at the end of the month at a stated rate at the start of the month
        iii. The account balance is available to the policyholder on surrender after assessment of surrender charges
        iv. The account balance is the primary component of the accrued account balance which is a foundational component of policy benefits for universal life
    b. Variable universal life
        i. Mechanics are consistent with fixed universal life except accumulating the account value with daily changes in separate accounts instead of a fixed crediting rate
        ii. Policies may have a general account fund similar to fixed universal life
        iii. The liability includes the sum of the separate and general account balances
    c. Indexed universal life
        i. Description
            a) The account balance contains one or more investment accounts with different interest options and terms, and may also include a fixed account
            b) If funds are managed as separate accounts, the variable universal life model can be used

c) Indexed account investment options grow based on a pre-defined crediting rate, which is subject to caps, floors, spreads, and participation rates

ii. Because index credits are determined by reference to an outside source, that is not clearly and closely to the universal life contract, it is an embedded derivative that must be separated from its host and recorded at fair value

a) The account value is replaced in the benefit reserve by the sum of the value of the host contract and the value of the embedded derivative

b) The embedded derivative represents the fair value of benefits in excess guaranteed benefits by virtue of the index crediting feature over the life of the contract

c) The host contract liability is the accreted value of the difference between premiums received into the contract and the increments to the embedded derivative generated by each premium

d) The host accretes at a rate that accumulates the initial host to the guaranteed minimum value at maturity

iii. Determining guaranteed minimum value at maturity

a) Many companies calculate this as the maximum nonforfeiture value and account value if the guaranteed credited rate were zero, even if negative credits are allowed

b) Some companies treat indexed account credits as partial settlements into the host as they occur; the embedded derivative is treated at fair value in each reporting period

iv. There is no explicit guidance for the value of an embedded derivative in a universal life contract, but one method is based on an option budget

a) Assume that the company has a target for the purchase of options at the beginning of the indexed term, and the option payoff is the amount spent on options grown at the risk free rate at the end of the indexed term; this is an approximation for a risk neutral simulation of option payoffs over stochastic paths

b) The indexed universal life policy is more complicated than a deferred annuity because of fees and benefits funded by the universal life fund balance; also, deposits are required to fund benefits with multiple deposit dates

c) All of these charges and benefit cash flows are contributors to the fair value of the derivative; each deposit is treated separately

d) The embedded derivative can also be valued as the present value of option budget credits

v. Indexed universal life is projected twice using

a) The return equal to the option budget grown at the risk-free rate and current load and charge rates

b) The guaranteed basis

vi. The difference between the two projections determines a notional set of embedded derivative cash flows associated with a deposit

a) At the deposit date, the deposit less the notional embedded derivative is the notional host

b) The notional host accretes at a constant rate until it reaches the ultimate guaranteed amount

c) The ultimate guaranteed amount can be zero if the contract is expected to terminate on a guaranteed basis due to the exhaustion of the account balance

vii. Alternatively, companies may exclude loads and charges until they occur; host accretion on each valuation date is redetermined back to issue to reflect cash flows as they occur

viii. On any valuation date, the embedded derivative is the sum of all the notional embedded derivatives; host valuation is complicated by contract level charges and partial withdrawals

ix. Projected benefits on indexed funds

a) Since universal life tends to have a constant face amount or net amount at risk, consideration is given to the cash flows funded by the indexed account value

b) The underlying indexed fund value funds the death benefit and is released on death, surrender, and incrementally to fund fees charged by the insurer; these are funded in part by index fund growth

c) These items are included in the embedded derivative benefit projection

x. Guaranteed projections

a) The ultimate guaranteed value is projected into the future

1) The contractually guaranteed cash value is the guaranteed value due to policyholders of an index fund with due consideration for decrements such as cost of insurance or loads

2) This is compared to the minimum fund value and minimum nonforfeiture value

b) Some companies do not reflect contract charges in the notional host calculation until those charges have occurred

xi. Indexed fund projections

a) The present value of the difference between the current projected benefits and guaranteed projected benefits is discounted to the deposit date; the process is complicated by multiple deposits and investment options

b) Each policy must be evaluated for investment structures, limitations on deposit timing, and a holding investment structure thar retains deposits until the contract anniversary

c) Multiple deposits are recorded in the embedded derivative once deposits are made into the indexed fund; each is tracked separately

d) Each deposit creates a new deposit tranche with a new embedded derivative and a new notional host

1) Each tranche is projected separately

2) A contract projection must also be maintained

3) The contract level projections are needed to measure projected fees that are allocated across deposit tranches

4) Allocations may be made on a deposit cash flow basis, last in first out basis, or first in, first out basis, pro-rata allocation

xii. Black Scholes option pricing method

a) The option budget amount may be established using many approaches

b) One approach is the Black-Scholes option pricing model which is usually established by the pricing or asset liability matching unit

xiii. Guaranteed benefits projections

a) Guaranteed benefits are projected with guaranteed charges and interest levels to project cash flows for the base insurance policy

b) The guaranteed value is compared to the maturity benefit, nonforfeiture benefit and projected cash surrender value

c) Multiple deposits complicate the calculations; contract level cash flows are needed to allocate charges and loads to guaranteed segments

d. Alternate methods

i. Some methods may be impractical due to computational complexity, system constraints, and timeliness

ii. There is no guidance and no agreement as to how to treat indexed universal life

iii. Alternate procedures and estimates should be reviewed for consistency with concepts in the guidance

iv. One simplified assumption is to let the fair value of the embedded derivative equal the market value of the embedded payoff at the end of the index term and adding it to the current account value; however, this ignores the value of future renewal index credits within the embedded derivative

v. Approximations must be considered in light of materiality thresholds

14. Additional interest

a. Additional interest represents amounts not yet credited to a policyholder account which is accrued as a liability; these are frequently used with sales inducements

b. Sales inducements are contractually inducements offered to policyholders that enhance the investment yield of a contract over what market conditions would suggest

c. A persistency bonus is a sales inducement credited to the contractholder account balance at the end of a specified period if the contract is in force at that time

d. Common forms of persistency bonuses are

i. A one-time bonus

ii. A higher crediting interest rate

iii. A refund of some of the cost of insurance charges or expense loads previously assessed

iv. Some other discontinuous increase to the policyholder account value

e. Additional interest is accrued on the balance sheet at a rate that accrues to the policy in cash (or cash equivalent) before deductions for future fees and charges

f. Sales inducements of up-front bonuses or bonus interest are automatically credited to the account balance and no liability is needed

g. A persistency bonus must be accrued as a liability because it is earned over time and only becomes part of the account balance when all conditions are satisfied

i. They must be accrued as a liability over the period the contract must remain in force to receive the bonus

ii. No adjustment is made to reduce the liability for surrender charges, persistency, or early withdrawal features

iii. The liability is accrued consistent with the accrual of interest

iv. The liability is released along with all other liabilities on termination of the contract

v. If the benefit is not known in advance, a constant accrual factor from issue would be recalculated as new estimates of the amount payable are developed

vi. An alternate method is to take the current account value multiplied by the persistency bonus percentage multiplied by the time lapsed since policy issue and divided by the time at which the bonus is credited

vii. Other methods can be used; there is no prescribed method

15. Other adjustments

a. These are returns to policyholders determined as the total return of a contractually referenced pool of assets

b. The liability is the fair value of the asset pool

c. If assets are valued daily, no adjustment is needed; if valued less frequently require an adjustment at the valuation date

d. Other adjustments are rare and include recognition of experience rating accounts found in corporate owned life insurance

E. Amounts to compensate for future services

1. Amounts assessed to compensate the entity for services to be performed over future periods are not earned in the period assessed, and a liability is established to defer recognition of income to align when services are performed

a. Unearned revenue arises from front end loads or fees assessed for a limited period of time

b. Liabilities for death or other insurance features are insurance features with an expectation of profits in the early years followed by losses in later years

2. Amounts collected in anticipation of future services

a. Amounts assessed for services to be performed in future periods are not earned in the year assessed and are held as an unearned premium liability

b. Types of unearned revenue

i. Cost of insurance charges collected but not earned on the valuation date

a) These are charged monthly, but not on the first day of each calendar month;

b) It is the last collected cost of insurance charge multiplied by the number of days between the valuation date and the next date the charge is assessed divided by 30 (or actual days in a month)

ii. Front end loads are applied to policies in the early years

a) They can be a percent of premium (up to target premium), per policy or per 1,000 of face amount

b) They can be designed to mirror some or all acquisition costs

c) Unearned revenue (fees) is reported as a liability deducted from the account balance and the liability (to defer recognition into the future) is amortized similar to DAC amortization

iii. Cost of insurance charges that do not follow a normal mortality pattern

a) They may be level or reducing (reverse select and ultimate cost of insurance charges)

b) The excess over normal charges is an unearned revenue liability that is recognized into income in future periods

c) The liability is appropriate even if the expected profits followed by losses test does not require an additional liability

c. Determination of a liability requires judgment, but usually created when there is an excess charge over an ultimate level

d. Some companies project fees using persistency assumptions over the life of the contract and defer the excess of front-end loads over projected annual loads

e. Premium based charges on policies classified as limited payment contracts are considered unearned

f. New layers of unearned revenue increases the unearned revenue liability

g. Face amount in force is the most commonly used basis for amortizing DAC and unearned revenue for universal life

3. Death or other insurance benefit features

a. When a universal life policy has death or insurance benefits, they must be tested to determine if they meet the definition of a market risk benefit or an embedded derivative

i. Death benefits are excluded because

a) Market risk excludes death benefits in a life insurance contract

b) Embedded derivatives cannot include life insurance risk

ii. Universal life rarely contains market risk or embedded derivative elements, except for index crediting on indexed universal life

iii. Components of universal life not classified as a market risk benefit or an embedded derivative are tested as to whether expected profits are followed by losses; if they are, an additional liability may be established

iv. Similar requirements apply to annuitization, but annuity benefits are rarely found in universal life policies

v. The liability for expected profits followed by losses is

a) Performed at the cohort level

b) Calculated as the present value of insurance benefits paid in excess of account value less a benefit ratio multiplied by the present value of expected assessments

c) An identical calculation is the accumulation of the benefit ratio times past assessments less past excess benefits paid

d) The benefit ratio is the ratio of

1) The present value of expected payments over the life of the contract discounted at the contract rate

2) The present value of expected assessments over the life of the contract discounted at the contract rate

e) The contract rate is the average credited rate on policyholder balances

f) For variable products, the best estimate is the net separate account growth rate (after mortality and expense charges and management fees)

g) For indexed products, the best estimate growth rate or assumed option budget is used that is either

1) Locked in at contract inception or

2) A rate based on emerging experience

vi. The profits followed by losses test is applied separately to base mortality and each insurance feature (long term care rider, no lapse guarantee benefit, etc.)

b. Indicators that a mortality or morbidity feature should be evaluated separately

i. Explicit incremental charge

ii. Offered separately in the marketplace

iii. Described in the contract as a separate benefit

iv. The contractholder can accept or reject the additional benefit without rejecting the base contract

c. The list is not exhaustive

d. Two benefit features in universal life policies that are commonly tested for profits followed by losses

   i. Core death benefit feature

      a) It occurs when expected death benefits (amounts in excess of account value) in later years exceeds cost of insurance charges in those years

      b) Anticipated losses are required; no liability is established for simply declining profits in later years

      c) If all years are losses, a liability is required

   ii. No lapse or secondary guarantee

      a) This feature keeps the policy in force and exposes the insurer to pay benefits on death even if the policy would otherwise have lapsed due to exhaustion of account balance or cash surrender value going to zero

      b) These benefits by definition meet the profits followed by losses test and require an additional liability

e. Definition of an assessment

   i. Assessments in the calculation of the liability for future policy benefits that have an expectation of profits followed by losses are defined as the aggregate of all charges (administration, mortality, expense, surrender) within the policy; they are not restricted to those related to benefits

   ii. Assessments are limited to items collected from the policy directly by the insurer that has the liability

      a) It does not include income from fund managers on separate accounts

      b) The investment margin (amounts earned less amounts credited on policyholder balances) on general account assets does qualify as an assessment

f. Range of scenarios

   i. Expected experience is based on a range of scenarios that consider the volatility inherent in the assumptions rather than a single set of best estimate assumptions

   ii. Possible scenarios by product and benefit

      a) For variable life insurance or indexed universal life insurance with no lapse guarantees, test real world scenarios for separate account or indexed fund growth rates

      b) For flexible premium products, test a range of funding levels

      c) For no lapse guarantees on fixed universal life insurance, test real world interest rate scenarios

d) For some product features, a range of morbidity, mortality or policyholder behavior scenarios can be used; stochastic analysis can be used also, but, due to the symmetrical nature of stochastic results, a single best estimate scenario for mortality and morbidity produces the same answer

g. Discounting

i. Present value of assessments and excess benefits are calculated using the initial or best estimate future contract rate(credited rate)

ii. The contract rate may be either

a) The initial contract rate for the block of business

b) The currently anticipated future contract rate combined with historical credited rates

iii. The election must be made consistently across blocks of business

iv. Present values are usually calculated using the best estimate contract rate for each scenario; guidance is not specific on this issue

h. Testing for profits followed by losses

i. Profits followed by losses test of death and other insurance benefit period is done once at contract issue and the conclusion is valid for the life of the contract

ii. A contract where profits followed by losses is not projected to occur when a policy is issued does not record a liability for the benefit feature even if profits followed by losses emerges at a later date

iii. Illustrations assume

a) Deaths occur at the end of a policy year just before lapse

b) Premiums are assumed at the beginning of the year with immediate deductions for loads and cost of insurance charges

c) Interest earned uses the same formula as interest credited

iv. Profits followed by losses occurs when experience mortality table grows more rapidly than the cost of insurance rate table with advancing age

v. When the test is performed on the core insurance coverage, only revenue associated with that feature is included in the analysis

vi. The analysis is run o a range of scenarios (interest rate and mortality); a single scenario could be used if results are not materially different from using a range of scenarios

i. Calculating the liability of an insurance benefit feature exhibiting profits followed by losses

i. The reserve calculation is performed at the cohort level

ii. Cohorts are usually the same as used for DAC amortization

iii. They are defined by issue year and insurance benefit feature

iv. Policies with multiple benefit features have multiple reserves, each separately calculated, unless aggregating features into a single calculation provides materially the same results

v. The calculation is performed over the life of the business using past experience and projected future experience using best estimate assumptions without adverse deviation

vi. Both assessments and benefits are averaged over a range of scenarios before computing the benefit ratio

vii. The reserve can be calculated prospectively or retrospectively

a) The benefit ratio at issue is the ratio of the present value of excess benefits (benefits less cash value released) less the present value of assessments

b) An unearned revenue liability may be needed if earlier assessments are larger than later year assessments

c) The change in unearned revenue liability is subtracted from assessments in the current period; this way, assessments reflect the timing of revenue recognition arising from premium loads and fees

j. Annuitization benefits

i. Universal life policies require an incremental liability when annuitization or guaranteed lifetime withdrawal benefits values on the date of annuitization may exceed account balances at that time

ii. These features are rare in universal life policies, but if they exist

a) They must be evaluated for market risk benefits

b) If not, an additional liability is set up for gains followed by losses

k. Shadow adjustments

i. Shadow adjustments are established to cover an insurance benefit or annuitization feature with an expectation of profits followed by losses

ii. It is an adjustment to the reserve to reflect what it would be if unrealized capital gains on assets that are available for sale were realized and reflected in the assessment stream

a) The adjustment is recorded in accumulated other comprehensive income

b) It is estimated as the net unrealized capital gains and losses on available for sale assets and the benefit ratio

c) The approximation is reasonable because, if sold, the assets would have to be invested at current market rates, so

1) The present value of lifetime assessments since cohort inception would remain materially unchanged

2) The benefit ratio is also unchanged

III. Universal life insurance features

A. No lapse guarantee

1. No lapse or secondary guarantees keep a universal life policy in force and the insurer must still pay death benefits even if the policy may otherwise lapse due to exhaustion of account value or the cash surrender value of the policy drops below zero

2. This benefit exposes the insurer to other than nominal capital markets risk because they are triggered when the account value can no longer cover the cost of insurance charge

3. It can be in the base policy form or a rider

4. No lapse guarantees are not classified as market risk benefits because they relate to the life insurance coverage

5. But they always trigger an additional liability when profits are followed by losses

a. This occurs because fees or rider charges are collected in the early years of a contract followed by losses incurred through death benefits in the later policy years if the no lapse guarantee is triggered

b. The excess benefits are the death benefits payable in later policy years when the no lapse guarantee is triggered

B. Minimum guaranteed death benefits

1. Variable universal life insurance policies have a minimum death benefit

2. Some may be equivalent to secondary guarantees and follow that accounting

C. Long term care benefits

1. Long term care benefits are provided on an actuarially equivalent basis in the death benefit or policy lien

2. The claim has no impact on contract reserves

3. After claim, the reserve is decreased to the extent the account value is decreased

4. If the rider provides benefits in excess of the actuarial reductions to the life insurance benefit, the benefit is assessed for an expectation of profits followed by losses; if so, an additional reserve is required
5. This can occur with an extension of benefits paid pursuant to long term care payment criteria

D. Accelerated death benefits

1. Accelerated death benefits provide a portion of the death benefit as an advance or lien when the conditions for acceleration are satisfied
2. This feature can be assessed as to whether it represents profits followed by losses; however, no adjustment is typically required to the account value reserve as it does not generate losses in excess of those generated on a policy without this rider

E. Waiver of premium benefits

1. Two forms—waiver of deduction and waiver of premium
2. There is a separate charge that is part of the monthly deduction
3. Charges vary by risk class, on a current or guaranteed basis, and rates increase with age
   a. The payment amount is based on reference to a premium measure, such as target premium
   b. Payment is provided when the policyholder becomes disabled
   c. The benefit is fixed and guaranteed for a premium that is fixed and guaranteed
   d. The benefit is separate from the policy and is treated as a stand-alone traditional insurance policy

F. Other features

1. Other features include
   a. Term insurance riders
   b. Additional insured riders
   c. Accidental death benefits
2. Term riders and riders providing guaranteed benefits to additional insureds are treated as stand-alone contracts
3. Accidental death riders require no additional reserves
4. Individual riders are assessed to determine the appropriate accounting treatment

IV. Deferred acquisition cost asset

A. When applying principles for deferring acquisition costs and DAC amortization, key considerations include

1. Which expenses are deferrable

2. What constitutes an appropriate constant-level basis if a grouped contract approach is used for amortization

B. Deterrability criteria is the same as all long duration contracts

1. However, flexible premium contracts with graded commission scales complicates the determination as to whether expenses are deferrable

2. Some companies limit deferability of premium based commissions only to the extent that they exceed the ultimate, long term commission rate applied to the target premium

3. Some companies defer all commissions on premiums in excess of the target premium, arguing they are incremental to the baseline policy commissions

4. Other companies argue that all commissions are deferrable, because they are always incremental since a premium does not have to be paid; not widely accepted

5. Also uncommon is to defer commissions in excess of the ultimate commission rate applied to the projected ultimate premium

C. Trail commissions are generally not deferable

1. If the trail declines with time, early year excess trail commissions may be deferable if deferability criteria is met

2. Acquisition costs that vary in a constant relationship to premiums or insurance in force are recurring in nature or incurred in level amounts and not deductible

D. DAC may be amortized either on a

1. Straight line basis applied at the individual policy level or

2. Constant-level basis for groups of policies that approximates a straight-line pattern applied at the individual contract level

3. When using a group approach, a constant level basis can be based on

a. Death benefit amount for policies with level lifetime death benefits

b. Net amount at risk for policies with level lifetime net amounts at risk

c. Policy count; however if the expected lifetime of individual policies varies significantly based on policy size, it may not approximate a straight line on an individual contract basis

V. Sales inducement assets

A. Universal life contracts provide enhancements to policy accumulation values (sales inducements) which include bonus interest, one-time bonuses to account value and persistency bonuses

B. When they meet qualifying criteria, the accrued liabilities are deferred and amortized similar to acquisition expenses

C. A sales inducement asset is set up that amortizes the way DAC amortizes with similar impacts on the income statement and balance sheet

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Section PEQ

Practice Exam Questions

Introductory Note

This section of the study manual contains an array of review questions covering the entire syllabus. These questions were written to serve as an aid in assessing your understanding of the material after you have completely covered it through your studies. It is unlikely that you would see questions of this type on the actual exam, since those questions are developed with an eye toward application of multiple parts of the syllabus in actual job situations.

While these questions were not developed as possible exam questions by themselves, it is entirely possible that you could see some of these questions as parts of actual exam questions.

START OF EXAM
50 Points – 6 Questions

Question 1 (10 points)

See Solution

As the Appointed Actuary for an insurance company, you are asked to develop an attribution analysis for the source of changes in the VM-20 reserve.

(a) (6 points) Discuss the sources of reserve change for

i. Noneconomic assumptions

ii. Demographic assumptions

(b) (4 points) Describe differences between this attribution and an attribution analysis under MCEV.

GO TO NEXT PAGE

Question 2 (11 points)

See Solution

With respect to life insurance taxation,

(a) (2 points) Define the requirements for life insurance under the Internal Revenue Code.

(b) (6 points) Briefly describe the taxation of life insurance death benefits.

(c) (3 points) Describe the coverage and disclosure requirements for employer-owned life insurance.

GO TO NEXT PAGE

Question 3 (9 points)

See Solution

Document your approach to calculate the minimum reserve requirement under VM-20.

GO TO NEXT PAGE

Question 4 (4 points)

See Solution

Briefly describe deferred annuity valuation under CARVM.

GO TO NEXT PAGE

Question 5 (9 points)

See Solution

You are the consulting actuary for a small life insurance company that primarily writes term life and whole life insurance. The company wants to expand its portfolio to include flexible premium variable life insurance with guaranteed minimum death benefits and asks for your recommendation.

Outline your recommendation.

GO TO NEXT PAGE

Question 6 (7 points)

See Solution

With respect to rating agencies, discuss the core rating factors every rating agency considers when rating a life insurance company.

END OF EXAMINATION

Section PES

Solutions to Practice Exam Questions

Question 1 Solution

Source: Stat Valuation – Chapter 23

I. Sources of reserve change

Non-economic assumption changes that result in a change to a financial measure

Experience assumptions

Included are persistency, policy loan, mortality and expense assumptions

Changes in the baseline occur at time 0 based on discounted future cash flows

The experience review suggests whether an assumption should be changed

The order in which changes are made impacts attribution analysis because they can be correlated

The change that naturally occurs in the liability measure without updating the baseline is the expected change; the amount directly related to the update of the baseline assumption is the unexpected portion of the change

Methodology changes

Includes structural formula changes, correction of an error and any variance in approach taken by the company

Attribution will quantify changes by calculating the financial measure under both the former and revised approach

Prevailing reserve type

Changes apply to any regime where the financial measure is determined by the larger of more than one calculated element

Under VM-20, it does not contribute to attribution unless the prevailing reserve changes from deterministic, stochastic or net premium

Nonguaranteed elements (NGEs)

NGEs are not a contributor to change unless management makes material changes to NGE factors to reflect policyholder behavior

Material adjustments are unexpected changes

Policyholder behavior may react to the difference between the competitor crediting rate and the company crediting rate; if the competitor rate is based on a spot rate, it will change in each valuation period

This second order effect is captured in the reference yield curve

Demographic changes to the in-force portfolio that result in a change to a financial measure

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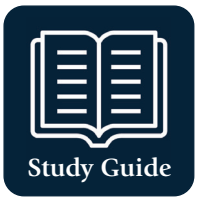

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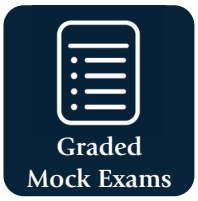

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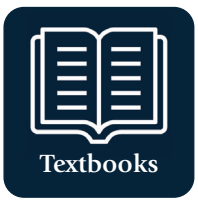

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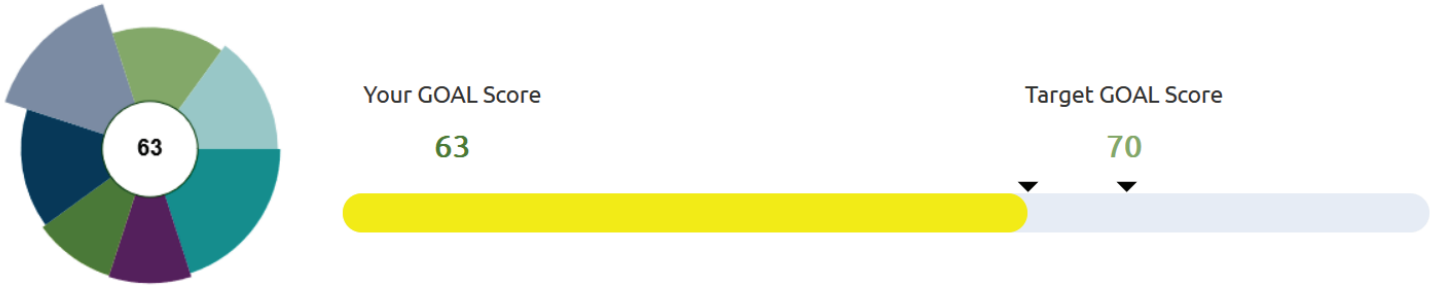

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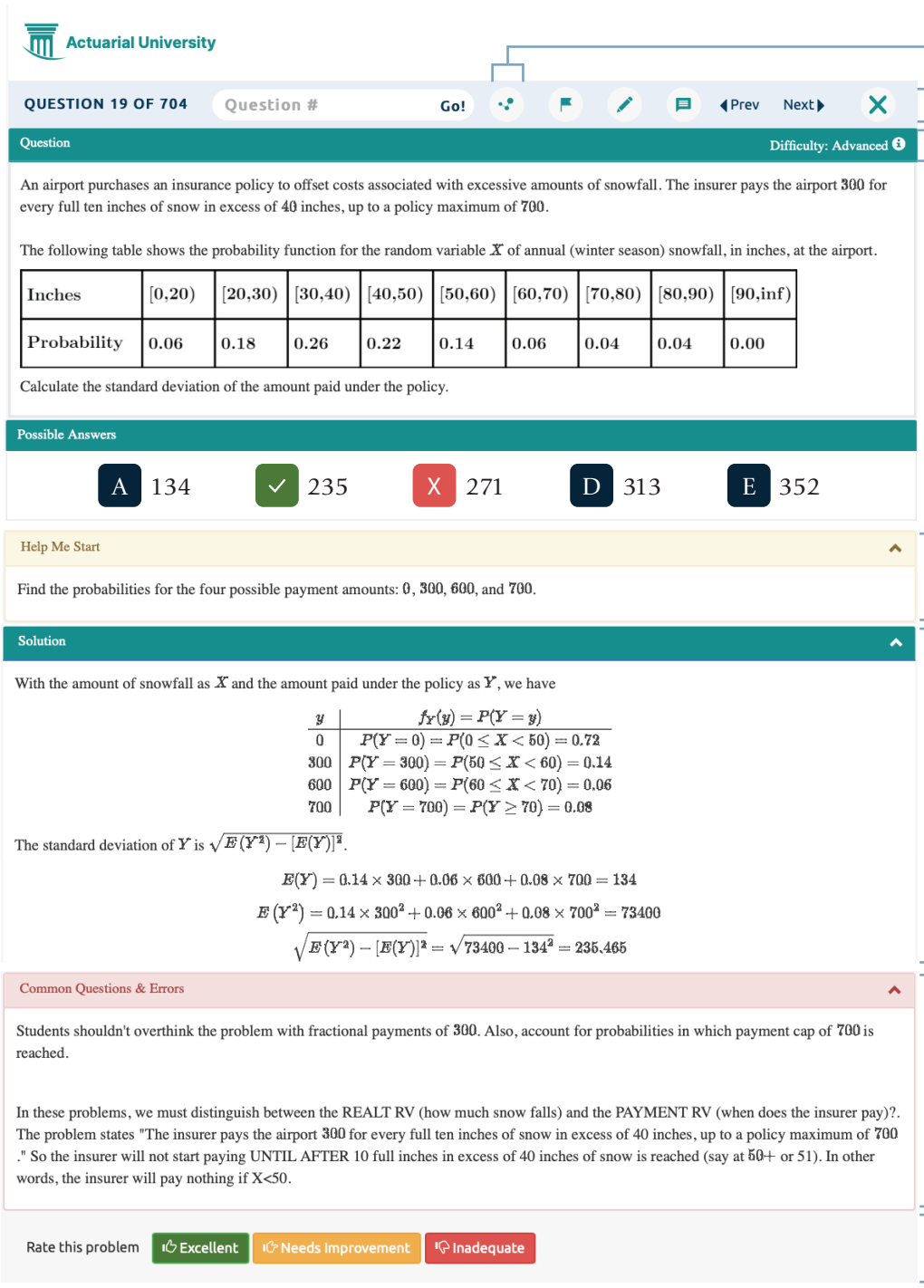

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QUESTION 19 OF 704 | Question # | Go! | Prev | Next

Question — Difficulty: Advanced

An airport purchases an insurance policy to offset costs associated with excessive amounts of snowfall. The insurer pays the airport 300 for every full ten inches of snow in excess of 40 inches, up to a policy maximum of 700.

The following table shows the probability function for the random variable X of annual (winter season) snowfall, in inches, at the airport.

Inches	[0,20)	[20,30)	[30,40)	[40,50)	[50,60)	[60,70)	[70,80)	[80,90)	[90,inf)
Probability	0.06	0.18	0.26	0.22	0.14	0.06	0.04	0.04	0.00

Calculate the standard deviation of the amount paid under the policy.

Possible Answers

A 134 ✓ 235 X 271 D 313 E 352

Help Me Start

Find the probabilities for the four possible payment amounts: 0, 300, 600, and 700.

Solution

With the amount of snowfall as X and the amount paid under the policy as Y, we have

y	$f_Y(y) = P(Y = y)$
0	$P(Y = 0) = P(0 \le X < 50) = 0.72$
300	$P(Y = 300) = P(50 \le X < 60) = 0.14$
600	$P(Y = 600) = P(60 \le X < 70) = 0.06$
700	$P(Y = 700) = P(Y \ge 70) = 0.08$

The standard deviation of Y is $\sqrt{E(Y^2) - [E(Y)]^2}$.

$$E(Y) = 0.14 \times 300 + 0.06 \times 600 + 0.08 \times 700 = 134$$

$$E(Y^2) = 0.14 \times 300^2 + 0.06 \times 600^2 + 0.08 \times 700^2 = 73400$$

$$\sqrt{E(Y^2) - [E(Y)]^2} = \sqrt{73400 - 134^2} = 235.465$$

Common Questions & Errors

Students shouldn't overthink the problem with fractional payments of 300. Also, account for probabilities in which payment cap of 700 is reached.

In these problems, we must distinguish between the REALT RV (how much snow falls) and the PAYMENT RV (when does the insurer pay)?. The problem states "The insurer pays the airport 300 for every full ten inches of snow in excess of 40 inches, up to a policy maximum of 700 ." So the insurer will not start paying UNTIL AFTER 10 full inches in excess of 40 inches of snow is reached (say at 50+ or 51). In other words, the insurer will pay nothing if X<50.

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