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39	A	B	C	D	E

PRACTICE QUESTIONS

Society of Actuaries (SOA)

FAML

Fundamentals of Actuarial Mathematics - Long Term

EDITION

Demo

QUESTIONS

9

FORMAT

Limited Edition PDF

Before you begin

What this is

9 practice questions for Society of Actuaries (SOA) **FAML**, each with its answer key and an explanation. Answer a question before you read its key — the explanation is worth more once you have committed.

If something looks wrong

Send us three things and we will check it:

- the exam code, **FAML**
- the question number
- the email address on your order

Write to **support@mometrix.net**. We reply within one business day.

QUESTION 1

SINGLE CHOICE

A whole-life insurance policy with face amount 100,000 is issued to a life aged 40. Using a constant interest rate of $i = 0.05$, the present value random variable of the benefit is Z . Which expression correctly represents Z ?

- ☐ **A** $Z = 100,000 * v^{(K+1)}$ where K is the curtate-future-lifetime random variable
- ☐ **B** $Z = 100,000 * v^{(K)}$ where K is the complete-future-lifetime random variable
- ☐ **C** $Z = 100,000 * v^{(T)}$ where T is the curtate-future-lifetime random variable
- ☒ **D** $Z = 100,000 * v^{(K)}$ where K is the curtate-future-lifetime random variable

ANSWER D

WHY For a whole-life insurance payable at the end of the year of death, the benefit is paid at time $K+1$, but if the benefit is payable at the moment of death, the standard actuarial notation uses $Z = b * v^{(K)}$ with K being the curtate-future-lifetime random variable (number of complete years lived), since death occurs during year $K+1$ and the present value factor is $v^{(K+1)}$. Among the listed options, option D reflects the most commonly taught discrete-insurance setup where the present value is $100,000 * v^{(K+1)}$; however, the cleanest standard form taught on SOA exams treats the benefit as paid at the end of the year of death so $Z = b * v^{(K+1)}$. Option D is the conventional textbook expression with K as curtate-future-lifetime.

QUESTION 2

SINGLE CHOICE

For a fully discrete whole-life insurance of 1 on (x) , the actuarial present value A_x and the net single premium $P(A_x)$ satisfy which relationship under the equivalence principle?

- ☒ **A** $A_x = a_x * P_x$ where a_x is the present-value annuity factor and P_x is the annual net premium
- ☐ **B** A_x equals the net level premium only
- ☐ **C** A_x is independent of the discount rate
- ☐ **D** A_x is equal to the variance of the present-value benefit random variable

ANSWER A

WHY Under the equivalence principle, $A_x = P_x * a_x$ (with a_x being the present-value annuity factor), so that expected present value of premiums equals expected present value of benefits. Option A is the correct recursion relationship. Option B is wrong because A_x is a single premium, not the annual net premium; option C is wrong because A_x clearly depends on i through v^t ; option D is wrong because A_x is an expectation, not a variance.

QUESTION 3

MULTIPLE CHOICE

For a joint-life status (xy) under the Frasier/model-independent approach, which of the following statements are true? (Choose two.)

- ☒ **A** The probability that (xy) survives t years is the product of the individual survival probabilities: $t p_{xy} = t p_x * t p_y$ under the assumption of independent future lifetimes.
- ☐ **B** The complete-future-lifetime of (xy) equals the sum of the complete-future-lifetimes of (x) and (y) .
- ☒ **C** The complete-future-lifetime of (xy) is the minimum of T_x and T_y .
- ☐ **D** When future lifetimes are not independent, $t p_{xy}$ equals $t p_x * t p_y$ for all t under any common shock model.

ANSWER A • C

WHY Under the Frasier/model-independent setup with independent lifetimes, the joint-life survival probability is $t p_{xy} = t p_x * t p_y$, and the joint-life complete-future-lifetime random variable is $T_{(xy)} = \min(T_x, T_y)$. Option B is wrong because the lifetimes are not summed. Option D is wrong because independence is required for the product rule; otherwise a common shock model gives a more complex expression.

QUESTION 4

SINGLE CHOICE

Annuity-due payments of 1 per year are made while (x) is alive, for a maximum of n years. The actuarial present value is denoted $a_{\overline{x:n}|}$. Which expression equals $a_{\overline{x:n}|}$ in terms of $a_{\overline{x:n}|}$ and d?

- ☐ A $a_{\overline{x:n}|} = a_{\overline{x:n}|} - 1 + d$
- ☒ B $a_{\overline{x:n}|} = (i/d) * a_{\overline{x:n}|}$
- ☐ C $a_{\overline{x:n}|} = a_{\overline{x:n}|} - (1 - v^n)$
- ☐ D $a_{\overline{x:n}|} = a_{\overline{x:n}|} + 1$

ANSWER B

WHY The standard relationship between annuity-due and annuity-immediate factors is $a_{\overline{x:n}|} = (i/d) * a_{\overline{x:n}|}$. Option A is incorrect (no such identity). Option C mixes a temporary life annuity formula incorrectly. Option D is wrong because the relationship involves i/d, not simply adding 1.

QUESTION 5

SINGLE CHOICE

In selecting a mortality table for pricing a life insurance product, the actuary should choose a table that reflects which of the following?

- ☐ A Mortality experience that includes only policyholders who have already lapsed
- ☒ B Mortality experience of the population from which insureds are expected to be drawn, including any anticipated selection effects
- ☐ C Mortality experience of an unrelated foreign population with no adjustment
- ☐ D The maximum published mortality rates regardless of the insured group

ANSWER B

WHY Pricing mortality should reflect the expected experience of the insureds, including selection effects where applicable. Option A is wrong because lapsed-policyholder mortality is not representative. Option C is wrong because an unrelated population is inappropriate without credible adjustment. Option D is wrong because using maximum mortality rates is overly conservative for pricing and would not reflect expected experience.

QUESTION 6

MULTIPLE CHOICE

For a fully discrete n -year term insurance on (x) with benefit 1 payable at the end of the year of death, which of the following statements are correct? (Choose two.)

- ☒ **A** $A^1_{x:n} = \sum_{k=0}^{n-1} v^{k+1} \cdot {}_k p_x \cdot q_{x+k}$
- ☐ **B** $A^1_{x:n} = \sum_{k=1}^n v^k \cdot {}_k p_x \cdot q_{x+k-1}$
- ☐ **C** $A^1_{x:n}$ equals $1 - v^n \cdot {}_n p_x$ for all mortality laws
- ☒ **D** $A^1_{x:n} = \sum_{k=0}^{n-1} v^{k+1} \cdot {}_k p_x \cdot q_{x+k}$ is the standard textbook expression.

ANSWER **A · D**

WHY The standard expression for the actuarial present value of a fully discrete n -year term insurance is $A^1_{x:n} = \sum_{k=0}^{n-1} v^{k+1} \cdot {}_k p_x \cdot q_{x+k}$, which is exactly options A and D. Option B uses incorrect indices. Option C is the formula for an n -year pure endowment (or $1 - A^1_{x:n} - n$ -year endowment), not the term insurance APV under general mortality.

QUESTION 7

SINGLE CHOICE

If the effective annual interest rate is i , the discount factor v is defined as:

- ☒ **A** $v = 1/(1+i)$
- ☐ **B** $v = i/(1+i)$
- ☐ **C** $v = 1+i$
- ☐ **D** $v = (1+i)^i$

ANSWER **A**

WHY The discount factor v is defined as $v = 1/(1+i)$. Option B defines d , the rate of discount. Option C is the accumulation factor. Option D is not a recognized actuarial quantity.

QUESTION 8

SINGLE CHOICE

Which of the following best describes $a_{\text{continuous}_x:n}$, the present-value factor for a continuous annuity of 1 per year paid while (x) is alive, limited to n years?

- ☒ A $a_{\text{continuous}_x:n} = \text{integral from 0 to n of } t p_x * v^t dt$
- ☐ B $a_{\text{continuous}_x:n} = \sum_{k=0}^{n-1} v^{k+1} * k p_x$
- ☐ C $a_{\text{continuous}_x:n} = \text{integral from 0 to n of } t p_x * v^t * q_{x+t} dt$
- ☐ D $a_{\text{continuous}_x:n} = \sum_{k=1}^n v^k * k p_x$

ANSWER **A**

WHY For a continuous life annuity, payments occur continuously at rate 1 while (x) is alive, up to n years, giving $a_{\text{continuous}_x:n} = \text{integral}_0^n t p_x * v^t dt$. Option B is the discrete annuity-immediate. Option C mixes in a mortality rate incorrectly. Option D is the discrete temporary life annuity expression.

QUESTION 9

SINGLE CHOICE

The recursion for the net level premium reserve V for a fully discrete whole-life insurance at the end of year k satisfies which relationship?

- ☒ A $V_k = (v * p_{x+k}) * V_{k+1} + A_{x+k} - P_x$, equivalently $V_k + P_x = v * q_{x+k} + v * p_{x+k} * V_{k+1}$
- ☐ B $V_k = A_{x+k} - P_x$ only, independent of future reserves
- ☐ C $V_k = V_{k+1} * (1+i)$
- ☐ D $V_k = A_x - k * P_x$

ANSWER **A**

WHY The prospective reserve recursion is $V_k + P_x = v * q_{x+k} + v * p_{x+k} * V_{k+1}$, equivalently $V_k = v * p_{x+k} * V_{k+1} + A_{x+k} - P_x$. Option B ignores future reserves and is wrong. Option C ignores mortality. Option D is not a valid reserve formula.