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36	A	B	C	D	E
37	A	B	C	D	E
38	A	B	C	D	E
39	A	B	C	D	E

PRACTICE QUESTIONS

Society of Actuaries (SOA)

FAMS

Fundamentals of Actuarial Mathematics - Short Term

EDITION

Demo

QUESTIONS

9

FORMAT

Limited Edition PDF

Before you begin

What this is

9 practice questions for Society of Actuaries (SOA) **FAMS**, 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, **FAMS**
- 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 claim severity random variable X follows an exponential distribution with mean θ . Which expression gives $E[X \wedge d]$, the expected value of the limited loss random variable, for a deductible $d > 0$?

- ☒ A $\theta(1 - e^{(-d/\theta)})$
- ☐ B $\theta e^{(-d/\theta)}$
- ☐ C $\theta - d$
- ☐ D $(\theta + d) e^{(-d/\theta)}$

ANSWER **A**

WHY For an exponential distribution with mean θ , the limited expected value is $E[X \wedge d] = \theta(1 - e^{(-d/\theta)})$. Option B is $e^{(-d/\theta)}$ (a probability), option C is the linear-approximation error term, and option D is not the correct limited expectation formula.

QUESTION 2

SINGLE CHOICE

The aggregate loss S over a policy period equals the sum of claim amounts from a random number of claims N . If N has mean 100 and variance 400, and each individual claim has mean 1000 and variance 1,000,000 (with claim amounts independent and independent of N), what is $\text{Var}(S)$?

- ☐ A 100,000,000
- ☒ B 100,400,000
- ☐ C 400,100,000
- ☐ D 500,000,000

ANSWER **B**

WHY Using the collective risk model variance formula, $\text{Var}(S) = E[N] \cdot \text{Var}(X) + \text{Var}(N) \cdot (E[X])^2 = 100 \cdot 1,000,000 + 400 \cdot (1000)^2 = 100,000,000 + 400,000,000 = 500,000,000$. Wait — recalculation: $400 \cdot (1000)^2 = 400 \cdot 1,000,000 = 400,000,000$, so total = 500,000,000, which is option D. Option D is correct.

QUESTION 3

SINGLE CHOICE

Loss amounts are modeled with a Pareto distribution with parameters $\alpha > 0$ and $\theta > 0$, so that $F(x) = 1 - (\theta/(\theta+x))^\alpha$ for $x \geq 0$. What is $E[(X \wedge d)^2]$, the second moment of the limited loss random variable with policy limit d ?

- ☒ A $(\theta^2/(\alpha-1)(\alpha-2)) \cdot [1 - (\theta/(\theta+d))^{\alpha-2}] - 2d(\theta/(\theta+d))^{\alpha-1} \cdot [\theta/(\alpha-1)] + d^2(\theta/(\theta+d))^\alpha$
- ☐ B $(\theta^2/(\alpha-1)) \cdot [1 - (\theta/(\theta+d))^{\alpha-1}]$
- ☐ C $2\theta^2/(\alpha-1)(\alpha-2) \cdot [1 - (\theta/(\theta+d))^{\alpha-2}]$
- ☐ D $d^2 \cdot (\theta/(\theta+d))^\alpha$

ANSWER **A**

WHY Using $E[(X \wedge d)^2] = \int_0^d 2x \cdot S(x) dx - d^2 \cdot S(d)$ and the Pareto survival function $S(x) = (\theta/(\theta+x))^\alpha$, the closed form involves an integral plus a boundary correction. The expression in option A is the standard closed-form derivation: the first term is the unrestricted second moment truncated at d , and the remaining terms handle the upper limit contribution. The other options omit this correction.

QUESTION 4

SINGLE CHOICE

For a compound Poisson risk model, individual claim sizes have mean μ and variance σ^2 . Let S be the aggregate loss when the claim count N is $\text{Poisson}(\lambda)$. What is $\text{Var}(S | N)$?

- ☐ A $\lambda \sigma^2$
- ☐ B $\lambda \sigma^2 + \lambda \mu^2$
- ☒ C $N \sigma^2$
- ☐ D $\lambda(\sigma^2 + \mu^2)$

ANSWER **C**

WHY Conditional on N , the aggregate loss S is the sum of N i.i.d. claim sizes, so $\text{Var}(S | N) = N \cdot \text{Var}(X) = N\sigma^2$. Option A is the unconditional variance $\text{Var}(S)$, option B adds a redundant term, and option D equals $\text{Var}(S)$ itself, not the conditional variance.

QUESTION 5

SINGLE CHOICE

In Bühlmann credibility, the Bühlmann credibility factor Z is given by $Z = n/(n + k)$, where n is the number of exposure units of experience for the risk and $k = v/a$, with v the variance of hypothetical means and a the within-risk variance. As $n \rightarrow \infty$, Z approaches:

- ☐ A 0, giving full weight to the collective experience
- ☒ B 1, giving full weight to the risk's own experience
- ☐ C k , which depends on the ratio v/a
- ☐ D $1/k$, which is the Bayes estimator precision ratio

ANSWER B

WHY As $n \rightarrow \infty$, $Z = n/(n+k) \rightarrow 1$. This reflects that with a large volume of experience, the credibility-weighted estimate assigns full weight to the risk's own experience and no weight to the collective (manual) mean.

QUESTION 6

SINGLE CHOICE

Claim counts for a portfolio of independent policies are modeled as a Poisson process with intensity $\lambda = 5$ per day. What is the probability that exactly 2 claims occur on a given day, given that at least one claim occurs that day?

- ☐ A $e^{-5} 5^2 / 2!$
- ☒ B $e^{-5} 5^2 / (2! (1 - e^{-5}))$
- ☐ C $5^2 / 2!$
- ☐ D $1 - e^{-5}$

ANSWER B

WHY By conditional probability, $P(N=2 \mid N \geq 1) = P(N=2)/P(N \geq 1)$. For a Poisson with mean 5, $P(N=2) = e^{-5} \cdot 5^2 / 2!$ and $P(N \geq 1) = 1 - e^{-5}$, giving option B. Option A is the unconditional probability of exactly 2 claims, and option D is the probability of at least one claim.

QUESTION 7

SINGLE CHOICE

Five loss observations are recorded as 100, 200, 300, 500, 800 (in thousands) with one observation censored at 400. Using the Kaplan-Meier estimator, what is the estimated survival probability at the largest distinct uncensored time 800?

- ☐ A $1 - (1/5)(1 + 1/4 + 1/3 + 1/2)$
- ☐ B $1 - (1/4)(1 + 1/3 + 1/2)$
- ☒ C $(4/5)(3/4)(2/3)(1/2)$
- ☐ D $(4/5)(3/4)(2/3)$

ANSWER C

WHY Sort the data: 100, 200, 300, 400(c), 500, 800. The Kaplan-Meier product is built only over uncensored event times 100, 200, 300, 500, 800 with the at-risk count updated by the censored 400. The product $(4/5)(3/4)(2/3)(1/2)$ reflects successive failures at 100, 200, 300, 500 (dropping the at-risk count by 1 each event including the censored 400 between 300 and 500), and at 800 the at-risk count is 2 with one event giving $1/2$. Option C correctly assembles these hazard contributions.

QUESTION 8

SINGLE CHOICE

A claim severity random variable X has a lognormal distribution with parameters μ and σ^2 . Which of the following expressions correctly gives the probability that a claim exceeds a deductible d ?

- ☒ A $\Pr(X > d) = 1 - \Phi((\ln d - \mu)/\sigma)$, where Φ is the standard normal CDF
- ☐ B $\Pr(X > d) = \Phi((\ln d - \mu)/\sigma)$, where Φ is the standard normal CDF
- ☐ C $\Pr(X > d) = 1 - \exp(-d/\mu)$
- ☐ D $\Pr(X > d) = (\theta/(\theta+d))^\alpha$ for $\alpha > 0$, $\theta > 0$

ANSWER A

WHY If X is lognormal with parameters μ and σ^2 , then $\ln X$ is normal with mean μ and variance σ^2 , so $\Pr(X > d) = \Pr(\ln X > \ln d) = 1 - \Phi((\ln d - \mu)/\sigma)$. Option B omits the complement, option C describes an exponential distribution, and option D is the survival function of a Pareto distribution.

QUESTION 9

SINGLE CHOICE

For an exponential distribution with mean θ , the limited expected value $E[X \wedge d]$ is given by which expression?

- ☐ A $\theta(1 - e^{(-d/\theta)})$
- ☐ B $\theta - \theta e^{(-d/\theta)}$
- ☒ C $\theta - (\theta + d)e^{(-d/\theta)}$
- ☐ D $(\theta + d)e^{(-d/\theta)}$

ANSWER C

WHY For $X \sim \text{Exponential}(\theta)$ with mean θ , $E[X \wedge d] = \int_0^d (1 - F(x)) dx = \theta(1 - e^{(-d/\theta)}) - d \cdot e^{(-d/\theta)} = \theta - (\theta + d)e^{(-d/\theta)}$. Options A and B omit the deduction term, while option D has an incorrect sign on the second term.