SOA FUNDAMENTALS OF ACTUARIAL MATHEMATICS (FAM) PRACTICE TEST (SAMPLE)

STUDY GUIDE

SAMPLE STUDY GUIDE WITH LIMITED QUESTIONS

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Introduction

Preparing for a certification exam can feel overwhelming, but with the right tools, it becomes an opportunity to build confidence, sharpen your skills, and move one step closer to your goals. At Examzify, we believe that effective exam preparation isn't just about memorization, it's about understanding the material, identifying knowledge gaps, and building the test-taking strategies that lead to success.

This guide was designed to help you do exactly that.

Whether you're preparing for a licensing exam, professional certification, or entry-level qualification, this book offers structured practice to reinforce key concepts. You'll find a wide range of multiple-choice questions, each followed by clear explanations to help you understand not just the right answer, but why it's correct.

The content in this guide is based on real-world exam objectives and aligned with the types of questions and topics commonly found on official tests. It's ideal for learners who want to:

• Practice answering questions under realistic conditions,

• Improve accuracy and speed,

• Review explanations to strengthen weak areas, and

• Approach the exam with greater confidence.

We recommend using this book not as a stand-alone study tool, but alongside other resources like flashcards, textbooks, or hands-on training. For best results, we recommend working through each question, reflecting on the explanation provided, and revisiting the topics that challenge you most.

Remember: successful test preparation isn't about getting every question right the first time, it's about learning from your mistakes and improving over time. Stay focused, trust the process, and know that every page you turn brings you closer to success.

Let's begin.

How to Use This Guide

This guide is designed to help you study more effectively and approach your exam with confidence. Whether you're reviewing for the first time or doing a final refresh, here's how to get the most out of your Examzify study guide:

1. Start with a Diagnostic Review

Skim through the questions to get a sense of what you know and what you need to focus on. Your goal is to identify knowledge gaps early.

2. Study in Short, Focused Sessions

Break your study time into manageable blocks (e.g. 30 – 45 minutes). Review a handful of questions, reflect on the explanations.

3. Learn from the Explanations

After answering a question, always read the explanation, even if you got it right. It reinforces key points, corrects misunderstandings, and teaches subtle distinctions between similar answers.

4. Track Your Progress

Use bookmarks or notes (if reading digitally) to mark difficult questions. Revisit these regularly and track improvements over time.

5. Simulate the Real Exam

Once you're comfortable, try taking a full set of questions without pausing. Set a timer and simulate test-day conditions to build confidence and time management skills.

6. Repeat and Review

Don't just study once, repetition builds retention. Re-attempt questions after a few days and revisit explanations to reinforce learning. Pair this guide with other Examzify tools like flashcards, and digital practice tests to strengthen your preparation across formats.

There's no single right way to study, but consistent, thoughtful effort always wins. Use this guide flexibly, adapt the tips above to fit your pace and learning style. You've got this!

Questions

1. **Which coverage provides protection against damage caused by Unidentified, Uninsured, underinsured motorists?**

   A. Third party bodily injury

   B. medical payments (tort jurisdictions) or personal injury protection (no-fault jurisdictions)

   C. Unidentified, Uninsured, underinsured motorists protection

   D. Collision and other than collision

2. **For the second moment of Ax in the continuous case, which formula is correct?**

   A. Ax second moment = 1 - (2 delta) * (second moment annuity)

   B. Ax second moment = 1 - delta * (second moment annuity)

   C. Ax second moment = 1 - (2 i) * (second moment annuity)

   D. Ax second moment = 1 - (delta) * (second moment discrete)

3. **In binomial MLE, which constraint must hold for the number of trials m given observed data?**

   A. m must be less than the smallest observed number of successes

   B. m must be at least the largest observed number of successes

   C. m equals the number of observations

   D. m must be a prime number

4. **Put-call parity equation: Which expression holds?**

   A. c(t) - p(t) = S_t - Ke^{-rt}

   B. c(t) + p(t) = S_t + Ke^{-rt}

   C. p(t) - c(t) = S_t - Ke^{-rt}

   D. c(t) - p(t) = S_t + Ke^{-rt}

5. **Sum of independent Binomial variables with the same success probability q is distributed as which?**

   A. Poisson(sum m_i q)

   B. Binomial(sum m_i, q)

   C. Normal(sum m_i, q)

   D. Negative Binomial(sum m_i, q)

6. In UD D method, a m-ly n-year term annuity is given by which expression?

A. alpha(m) * annual version - beta(m)*(1 - nEx)

B. alpha(m) * annual version - beta(m) * nEx

C. alpha(m) * annual version + beta(m) * (1 - nEx)

D. alpha(m) * annual version - beta(m) * nEx

7. In zero-modified Pn, E[N] Modified equals which expression?

A. ((1 - Pm0) / (1 - p0)) * E[N]

B. E[N] * (1 - p0) / (1 - Pm0)

C. E[N] / (1 - p0)

D. E[N] * (1 - Pm0)

8. Which expression correctly defines the cumulative hazard function H(x) in terms of the hazard rate h(t)?

A. H(x) = ∫_0^x h(t) dt

B. H(x) = S(x)

C. H(x) = -∫_0^x h(t) dt

D. H(x) = ∫_0^x f(t) dt

9. P(A|B) is equal to which expression?

A. P(A and B)/P(B)

B. P(B)/P(A)

C. P(A or B)/P(B)

D. P(A) P(B)

10. Which of the following is the credibility exposure formula ne?

A. ne = ((z_{1+p/2}) / k)^2 * (Mean[S])^2

B. ne = ((z_{1+p/2}) / k)^2 * (Variance(S))

C. ne = ((z_{1+p/2}) / k)^2 * (CV of S)^2

D. ne = ((z_{1+p/2}) / k)^2 * (Mean[S])

Answers

1. C
2. B
3. B
4. A
5. B
6. A
7. B
8. A
9. A
10. C

Explanations

1. Which coverage provides protection against damage caused by Unidentified, Uninsured, underinsured motorists?

A. Third party bodily injury

B. medical payments (tort jurisdictions) or personal injury protection (no-fault jurisdictions)

C. Unidentified, Uninsured, underinsured motorists protection

D. Collision and other than collision

Unidentified, Uninsured, Underinsured Motorists Protection is designed to cover you when the driver who hits you either has no insurance or not enough to pay for your losses, and also when the other vehicle cannot be identified (a hit-and-run). This coverage fills the gap left by other coverages by paying for your injuries and related losses up to your policy limits if the at-fault driver can't fully compensate you. It may cover medical expenses, lost wages, and, in some states, non-economic damages like pain and suffering, for you and sometimes your passengers. The other coverages address different situations: third-party bodily injury pays for injuries you cause to others, not your own; medical payments or PIP covers your own medical costs regardless of fault but doesn't cover the gap when the other driver lacks adequate insurance; collision covers damage to your own car from a crash, not injuries or uninsured motorist issues. So the coverage that specifically targets damage from unidentified, uninsured, or underinsured motorists is Unidentified, Uninsured, Underinsured Motorists Protection.

2. For the second moment of Ax in the continuous case, which formula is correct?

A. Ax second moment = 1 - (2 delta) * (second moment annuity)

B. Ax second moment = 1 - delta * (second moment annuity)

C. Ax second moment = 1 - (2 i) * (second moment annuity)

D. Ax second moment = 1 - (delta) * (second moment discrete)

In continuous-time actuarial math, the discounting uses the force of interest δ, not the nominal rate i. When you look at the second moment of the present value of a unit continuous life annuity, you're squaring the integral of the discounted payment stream over the lifetime and then taking expectations with respect to survival. Working this out with the double integral and the survival function shows that the effect of discounting enters as a single δ multiplier on the second moment of the corresponding (undiscounted or deterministically structured) payoff. This leads to a neat relation: the second moment of the continuous Ax equals 1 minus δ times the second moment of the (continuous) annuity payoff. The factor is δ (not 2δ), and i or a discrete-second-moment form does not apply in this continuous framework. Therefore the correct formula uses a single δ multiplying the second moment and matches the continuous-discounting setup.

3. In binomial MLE, which constraint must hold for the number of trials m given observed data?

A. m must be less than the smallest observed number of successes

B. m must be at least the largest observed number of successes

C. m equals the number of observations

D. m must be a prime number

In a binomial model, the number of trials m sets the maximum possible number of successes in a single experiment. Since each observed count of successes k must satisfy $0 \le k \le m$*, the data can only come from a scenario where m is at least as large as the largest observed count. If m were smaller than that maximum, that observation would have zero probability under the model, which is impossible. So the likelihood is only positive when* $m \ge \max(k_i)$ *across all observations. That's why the correct constraint is that m must be at least the largest observed number of successes. The other options don't fit: m could be larger than the largest observed count, not restricted to be smaller; it isn't tied to the number of observations; and it need not be a prime number.*

4. Put-call parity equation: Which expression holds?

A. $c(t) - p(t) = S_t - Ke^{-rt}$

B. $c(t) + p(t) = S_t + Ke^{-rt}$

C. $p(t) - c(t) = S_t - Ke^{-rt}$

D. $c(t) - p(t) = S_t + Ke^{-rt}$

Put-call parity shows a fixed relationship between European call and put prices with the same strike and maturity on a non-dividend-paying asset. At expiration, the difference in payoffs between a call and a put with the same strike is $(S_T - K)$*. This is because* $(S_T - K)^+ - (K - S_T)^+$ *simplifies to* $S_T - K$*. If you value that payoff today, its value must equal the difference in option prices:* $c(t) - p(t) = S_t - K e^{-r(T-t)}$*. In the notation where the time to maturity is t, this becomes* $c(t) - p(t) = S_t - K e^{-r t}$*. So the expression* $c(t) - p(t) = S_t - K e^{-r t}$ *is the correct relation. The other forms would imply the wrong payoff structure (adding the PV of K or reversing the order), which would not match no-arbitrage pricing.*

5. Sum of independent Binomial variables with the same success probability q is distributed as which?

A. Poisson(sum m_i q)

B. Binomial(sum m_i, q)

C. Normal(sum m_i, q)

D. Negative Binomial(sum m_i, q)

When you sum independent binomial counts that share the same success probability, you can view all trials together as one big binomial experiment. If each $X_i \sim \text{Binomial}(m_i, q)$ *and the trials are independent, then the total number of successes* $X = X_1 + X_2 + \dots + X_k$ *behaves like a Binomial with the total number of trials* $M = \text{sum } m_i$ *and the same success probability q. In other words,* $X \sim \text{Binomial}(M, q)$*. This works because each of the M individual trials has probability q of success, and the total number of successes is just counting successes across all these trials. The probability mass function is* $P(X = k) = C(M, k)\, q^k (1-q)^{M-k}$*, with mean* $E[X] = M q$ *and variance* $Var[X] = M q (1-q)$*. If the probabilities q differed across* X_i*, the sum would not be binomial; it would follow a more general Poisson-binomial distribution. The given setup requires the same q, which is why the binomial form with the total number of trials is the correct description.*

6. In UD D method, a m-ly n-year term annuity is given by which expression?

A. alpha(m) * annual version - beta(m)*(1 - nEx)

B. alpha(m) * annual version - beta(m) * nEx

C. alpha(m) * annual version + beta(m) * (1 - nEx)

D. alpha(m) * annual version - beta(m) * nEx

In the Uniform Distribution of Deaths (UD) method, the value of a m-ly n-year term annuity is expressed as a linear combination of two standard quantities: the present value of a level annual annuity for n years and a correction term that accounts for the chance of dying within the n-year horizon. The coefficients α(m) and β(m) depend on the starting age m. The correct form uses the present value of the n-year annual annuity (the "annual version") multiplied by α(m), then subtracts β(m) times the probability of dying within the next n years. Under UD, that death-probability within the horizon is 1 − nEx, where nEx is the probability of surviving n years from age m. So the expression is: α(m) × (PV of an n-year annual annuity) − β(m) × (1 − nEx). This reflects how the annuity payments are potentially cut short by death within the term, reducing the present value, while survival to the end of the term would not trigger the death adjustment. Using nEx instead of (1 − nEx) would mix up survival with death within the horizon, which isn't consistent with how a term annuity behaves. Adding the β(m) term would incorrectly increase the value rather than subtract the expected reduction due to death early in the term.

7. In zero-modified Pn, E[N] Modified equals which expression?

A. ((1 - Pm0) / (1 - p0)) * E[N]

B. E[N] * (1 - p0) / (1 - Pm0)

C. E[N] / (1 - p0)

D. E[N] * (1 - Pm0)

Zero-modified means you change only the probability of zero and renormalize the nonzero part so the total probability is 1, leaving the shape of the positive counts proportional to the original. If P(N=0) = p0 and P(N=n) = pn for n ≥ 1, with sum_{n≥1} pn = 1 − p0, and you set the zero probability to Pm0, the nonzero probabilities must be Pm(n) = c · pn for n ≥ 1 where c is chosen so that sum_{n≥1} Pm(n) = 1 − Pm0. This gives c = (1 − Pm0)/(1 − p0). The modified expectation becomes E[N Modified] = sum_{n≥1} n · Pm(n) = c · sum_{n≥1} n · pn = [(1 − Pm0)/(1 − p0)] · E[N]. Therefore the modified expectation is E[N] multiplied by (1 − Pm0)/(1 − p0).

8. Which expression correctly defines the cumulative hazard function H(x) in terms of the hazard rate h(t)?

A. H(x) = ∫_0^x h(t) dt

B. H(x) = S(x)

C. H(x) = -∫_0^x h(t) dt

D. H(x) = ∫_0^x f(t) dt

Hazard rate h(t) is the instantaneous risk of failure at time t for someone who has survived to t. To accumulate that risk up to time x, you integrate h(t) over time from 0 to x. That sum of instantaneous risks, ∫_0^x h(t) dt, defines the cumulative hazard H(x). A key consequence is the relation to the survival function: S(x) = exp(-H(x)). The other forms don't fit because S(x) is a survival probability, not a hazard accumulation; a negative integral would have no physical meaning for hazard; and integrating f(t) would give the distribution function F(x), not the cumulative hazard.

9. P(A|B) is equal to which expression?

A. P(A and B)/P(B)

B. P(B)/P(A)

C. P(A or B)/P(B)

D. P(A) P(B)

Conditional probability asks for the probability of A given that B has occurred. It is defined as the probability of A and B both happening divided by the probability that B occurs, provided P(B) > 0. This reflects restricting attention to outcomes in B and asks what portion of that B-portion also lies in A. So P(A|B) = P(A   B) / P(B). The other forms aren't correct: P(B)/P(A) is the reverse, P(A   B)/P(B) uses the union, and P(A)P(B) would only equal P(A|B) if A and B were independent.

10. Which of the following is the credibility exposure formula ne?

A. ne = ((z_{1+p/2}) / k)^2 * (Mean[S])^2

B. ne = ((z_{1+p/2}) / k)^2 * (Variance(S))

C. ne = ((z_{1+p/2}) / k)^2 * (CV of S)^2

D. ne = ((z_{1+p/2}) / k)^2 * (Mean[S])

*The idea is to determine how much exposure is needed to achieve a target level of relative precision when estimating the mean of S. Start from the fact that the relative standard error of the sample mean is CV(S) divided by the square root of the number of observations n, where CV(S) = σ(S)/μ(S). In symbols, relative error ≈ CV(S) / sqrt(n). If you want the relative margin of error to match a specified bound tied to a z-value, you set CV(S)/sqrt(n) equal to k divided by z_{1+p/2}. Solving for n gives n = (z_{1+p/2} / k)^2 * [CV(S)]^2. This is precisely ne = ((z_{1+p/2}) / k)^2 * (CV of S)^2. Using CV makes the formula scale-free, capturing dispersion relative to the mean rather than relying on the mean or the variance alone. The other forms would tie exposure to the mean or to the variance directly, which doesn't reflect how much data you need relative to the size of the mean when aiming for a specified relative precision. Example: if CV(S) = 0.2, z_{1+p/2} = 1.96 (for ~95% CI), and desired relative precision k = 0.05, then ne ≈ (1.96/0.05)^2 * 0.04 ≈ 61. So about 61 exposure units are needed to meet that precision target.*

Next Steps

Congratulations on reaching the final section of this guide. You've taken a meaningful step toward passing your certification exam and advancing your career.

As you continue preparing, remember that consistent practice, review, and self-reflection are key to success. Make time to revisit difficult topics, simulate exam conditions, and track your progress along the way.

If you need help, have suggestions, or want to share feedback, we'd love to hear from you. Reach out to our team at hello@examzify.com.

Or visit your dedicated course page for more study tools and resources:

https://soafam.examzify.com

We wish you the very best on your exam journey. You've got this!