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April 26, 2006

Exam 3

Actuarial Models

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4 HOURS

INSTRUCTIONS TO CANDIDATES

1. This 80 point examination consists of 40 multiple choice questions worth 2 points each.

2. To answer the multiple choice questions, use the short-answer card provided and a number 2 or HB pencil only. Mark your short-answer card during the examination period. No additional time will be allowed for this after the exam has ended. Please make your marks dark and fill in the spaces completely. Fill in that it is Spring 2006, and the exam number 3. Darken the spaces corresponding to your Candidate ID number. Four rows are available. If your Candidate ID number is fewer than 4 digits, include leading zeros. (For example, if your Candidate ID number is 987, consider that your Candidate ID number is 0987, enter a zero on the first row, a 9 on the second row, 8 on the third row, and 7 on the fourth [last] row.) Please write in your Candidate ID number next to the place where you darken the spaces for your Candidate ID number. Your name, or any other identifying mark, must not appear on the short-answer card.

   For each of the multiple choice questions, select the one best answer and fill in the corresponding letter. One quarter of the point value of the question will be subtracted for each incorrect answer. No points will be added or subtracted for responses left blank.

3. Do all problems until you reach the last page of the examination where "END OF EXAMINATION" is marked.

4. Prior to the start of the exam you will have a fifteen-minute reading period in which you can silently read the questions and check the exam booklet for missing or defective pages. Writing will NOT be permitted during this time and you will not be permitted to hold pens or pencils. The supervisor has additional exams for those candidates who have defective exam booklets. Verify that you have a copy of "Tables for CAS Exam 3" included in your exam packet.

5. Your Examination Envelope is pre-labeled with your Candidate ID number, name, exam number, and test center. Do not remove this label. Keep a record of your Candidate ID number for future inquiries regarding this exam.

6. Candidates must remain in the examination center until two hours after the start of the examination. You may leave the examination room to use the restroom with permission from the supervisor. To avoid excessive noise during the end of the examination, candidates may not leave the exam room during the last fifteen minutes of the examination.

CONTINUE TO NEXT PAGE OF INSTRUCTIONS

7. At the end of the examination, place the short-answer card in the Examination Envelope. BEFORE YOU TURN THE EXAMINATION ENVELOPE IN TO THE SUPERVISOR, BE SURE TO SIGN IT IN THE SPACE PROVIDED ABOVE THE CUT-OUT WINDOW. Anything written in the examination booklet will not be graded. Only the short-answer card and the answer sheets will be graded.

8. If you have brought a self-addressed, stamped envelope, you may put the examination booklet and scrap paper inside and submit it separately to the supervisor. It will be mailed to you. (Do not put the self-addressed stamped envelope inside the Examination Envelope.)

    If you do not have a self-addressed, stamped envelope, please place the examination booklet in the Examination Envelope and seal the envelope. You may not take it with you. Do not put scrap paper in the Examination Envelope. The supervisor will collect your scrap paper.

    Candidates may obtain a copy of the examination from the CAS website.

    All extra answer sheets, scrap paper, etc., must be returned to the supervisor for disposal.

9. Candidates must not give or receive assistance of any kind during the examination. Any cheating, any attempt to cheat, assisting others to cheat, or participating therein, or other improper conduct will result in the Casualty Actuarial Society disqualifying the candidate's paper, and such other disciplinary action as may be deemed appropriate within the guidelines of the CAS Policy on Examination Discipline.

10. The exam survey is available on the CAS website in the "Admissions" section. Please submit your survey by May 15, 2006.

END OF INSTRUCTIONS

1. The number of goals scored in a soccer game follows a Negative Binomial distribution. A random sample of 20 games produced the following distribution of the number of goals scored:

Goals Scored	Frequency
0	1
1	3
2	4
3	5
4	3
5	2
6	1
7	0
8	1

Use the sample data and the method of moments to estimate the parameter β of the Negative Binomial distribution.

A. Less than 0.25
B. At least 0.25, but less than 0.50
C. At least 0.50, but less than 0.75
D. At least 0.75, but less than 1.00
E. At least 1.00

2. Annual claim counts follow a Negative Binomial distribution. The following claim count observations are available:

Year	Claim Counts
2005	0
2004	3
2003	5

Assuming each year is independent, calculate the likelihood function of this sample.

A. $\left(\dfrac{1}{\beta+1}\right)^{3r}\left(\dfrac{\beta}{\beta+1}\right)^{8}\dfrac{r^{2}(r+2)^{2}(r+4)}{3!\,5!}$

B. $\left(\dfrac{1}{\beta+1}\right)^{3r}\left(\dfrac{\beta}{\beta+1}\right)^{8}\dfrac{r^{2}(r+2)^{2}(r+4)}{2!\,4!}$

C. $\left(\dfrac{1}{\beta+1}\right)^{3r}\left(\dfrac{\beta}{\beta+1}\right)^{8}\dfrac{r^{2}(r+1)^{2}(r+2)^{2}(r+3)}{2!4!}$

D. $\left(\dfrac{1}{\beta+1}\right)^{3r}\left(\dfrac{\beta}{\beta+1}\right)^{8}\dfrac{r^{2}(r+1)^{2}(r+2)^{2}(r+3)(r+4)}{2!4!}$

E. $\left(\dfrac{1}{\beta+1}\right)^{3r}\left(\dfrac{\beta}{\beta+1}\right)^{8}\dfrac{r^{2}(r+1)^{2}(r+2)^{2}(r+3)(r+4)}{3!5!}$

3. Mrs. Actuarial Gardener has used a global positioning system to lay out a perfect 20-meter by 20-meter gardening plot in her back yard.

    Her husband, Mr. Actuarial Gardener, decides to estimate the area of the plot. He paces off a single side of the plot and records his estimate of its length. He repeats this experiment an additional 4 times along the same side. Each trial is independent and follows a Normal distribution with a mean of 20 meters and a standard deviation of 2 meters. He then averages his results and squares that number to estimate the total area of the plot.

    Which of the following is a true statement regarding Mr. Gardener's method of estimating the area?

    A. On average, it will underestimate the true area by at least 1 square meter.
    B. On average, it will underestimate the true area by less than 1 square meter.
    C. On average, it is an unbiased method.
    D. On average, it will overestimate the true area by less than 1 square meter.
    E. On average, it will overestimate the true area by at least 1 square meter.

4. The random sample $x_1, x_2, ..., x_n$ is from a Normal distribution with unknown mean and variance.

Which of the following are true statements?

I. $\sum\limits_{i=1}^{i=n} x_i$ is a sufficient statistic.

II. $\sum\limits_{i=1}^{i=n} \dfrac{x_i^2}{n}$ is a biased estimator of $E(X^2)$.

III. $\sum\limits_{i=1}^{i=n} \dfrac{(x_i - \bar{x})^2}{n}$ is a consistent estimator of the variance.

A. None of the statements are true.
B. I and II
C. I and III
D. II and III
E. I, II and III

5. Which of the following are true statements about hypothesis testing?

 I. The significance level of a test is the probability of accepting H_0 when H_0 is true.

 II. According to the Neyman-Pearson Lemma, the most powerful test of two simple hypotheses is determined by the ratio of the likelihood functions for the two hypotheses.

 III. The critical region for a test cannot be determined using only a single observation.

A. I only
B. II only
C. I and II
D. II and III
E. I, II and III

6.   Big Insurance Company (BIC) believes that it has underwritten each of its accounts to an expected loss ratio of 60% or less. Consider this the null hypothesis.

BIC is reviewing its portfolio and decides that it will cancel any policyholder for whom it is 95% certain that the expected loss ratio is more than 60%, based on a review of the average observed loss ratio over the last n years. The annual loss ratio for each policyholder follows a Normal distribution, with $\sigma = 10\%$.

Let $\pi(x,n)$ represent the power of this test where:

x = true expected loss ratio for a given policyholder
n = number of years used to compute the average observed loss ratio

Which of the following is a true statement?

A. $\pi(50\%,2) > \pi(50\%,1)$
B. $\pi(50\%,1) > \pi(60\%,1)$
C. $\pi(50\%,2) > \pi(60\%,2)$
D. $\pi(60\%,2) > \pi(70\%,1)$
E. $\pi(70\%,2) > \pi(70\%,1)$

7.   The independent random variables X and Y are from separate Normal distributions. Random samples from each distribution are shown below:

X	Y
1	1
5	4
9	5
10	5
17	15
36	

Using the sample data and a 5% significance level, which of the following are true statements regarding hypothesis testing?

I.   Reject H_o: $\sigma_X^2 = 50$ in favor of H_a: $\sigma_X^2 > 50$

II. Reject H_o: $\sigma_Y^2 = 50$ in favor of H_a: $\sigma_Y^2 < 50$

III. Reject H_o: $\sigma_X^2 = \sigma_Y^2$ in favor of H_a: $\sigma_X^2 > \sigma_Y^2$

A. I only
B. II only
C. I and II
D. I and III
E. II and III

8. The joint probability distribution of the first and last order statistic, y_i and y_n, from a sample of size n is:

$$f(y_i, y_n) = n(n-1)[F(y_n) - F(y_i)]^{n-2} f(y_i) f(y_n)$$

Recall that $\int_a^b x e^{-\alpha x} dx = -(1/\alpha) x e^{-\alpha x}\Big|_a^b + (1/\alpha) \int_a^b e^{-\alpha x} dx$

For a sample of size two from the exponential distribution $f(x) = e^{-x}$, determine the expected value of the sample range.

A. Less than 0.5
B. At least 0.5 but less than 0.7
C. At least 0.7 but less than 0.9
D. At least 0.9 but less than 1.1
E. At least 1.1

9. The following summary statistics are available with respect to a random sample of seven observations of the price of gasoline, Y, and the price of oil, X:

$$\sum x_i = 315$$

$$\sum x_i^2 = 14,875$$

$$\sum y_i = 12.8$$

$$\sum y_i^2 = 24.3$$

$$\sum x_i y_i = 599.5$$

Use the available information and a linear regression model of the form $Y = \alpha + \beta X$ to calculate the predicted price of gasoline if the price of oil reaches $75.

A. Less than $2.85
B. At least $2.85, but less than $2.90
C. At least $2.90, but less than $2.95
D. At least $2.95, but less than $3.00
E. At least $3.00

10. The force of mortality is given as:

$$\mu(x) = \frac{2}{110 - x} \qquad \text{for } 0 \le x < 110$$

· Calculate the expected future lifetime for a life aged 30.

A. Less than 20
B. At least 20, but less than 30
C. At least 30, but less than 40
D. At least 40, but less than 50
E. At least 50

11. Eastern Digital uses a single machine to manufacture digital widgets. The machine was purchased 10 years ago and will be used continuously until it fails. The failure rate of the machine, $u(x)$, is defined as:

$$u(x) = \frac{x^2}{4000} \qquad \text{for } x \le \sqrt{4,000} \text{ where } x \text{ is the number of years since purchase.}$$

Calculate the probability that the machine will fail between years 12 and 14, given that the machine has not failed during the first 10 years.

A. Less than 1.5%
B. At least 1.5%, but less than 3.5%
C. At least 3.5%, but less than 5.5%
D. At least 5.5%, but less than 7.5%
E. At least 7.5%

12. The following select-and-ultimate table is available:

[x]	$l_{[x]}$	$l_{[x]+1}$	l_{x+2}
30	9906.7380	9904.5387	9901.2702
31	9902.8941	9900.5769	9897.0919
32	9898.7547	9896.2800	9892.5491
33	9894.2903	9891.6287	9887.6028
34	9889.4519	9886.5741	9882.2141

Calculate the probability that [31] will die in the second year following selection.

A. 0.00023
B. 0.00035
C. 0.00047
D. 0.00055
E. 0.00059

13. Given a uniform distribution of death and $q_{90} = 0.1587$, calculate the probability that a life aged 90.25 will survive six months.

    A. Less than 0.92
    B. At least 0.92, but less than 0.93
    C. At least 0.93, but less than 0.94
    D. At least 0.94, but less than 0.95
    E. At least 0.95

14. For two independent lives, (x) and (y), the probability density function for death at time t is defined as:

$$f(t) = c(5 + t) \qquad \text{for } 0 \le t \le 20 \text{ and constant } c.$$

Calculate the probability that (x) and (y) are both alive at $t = 5$.

A. Less than 0.725
B. At least 0.725, but less than 0.750
C. At least 0.750, but less than 0.775
D. At least 0.775, but less than 0.800
E. At least 0.800

15. Gadgets, Inc. manufactures a device that uses two non-rechargeable, non-replaceable batteries. The company backs this product with a guarantee that if the device fails in the first three years after purchase, Gadgets, Inc. will pay the consumer $100 at the end of the year in which the device failed. The device will fail if either battery fails. Each battery has a probability of failure according to the following mortality table:

Age (x)	q_x
0	0.03
1	0.09
2	0.14
3	0.18

The interest rate is 5%.

Calculate the actuarial present value of the warranty.

A. Less than $20
B. At least $20, but less than $30
C. At least $30, but less than $40
D. At least $40, but less than $50
E. At least $50

16. The force of mortality is given as:

$$\mu(x) = \frac{1}{100 - x} \qquad \text{for } 0 \leq x < 100$$

. Calculate the probability that exactly one of the lives (40) and (50) will survive 10 years.

A. 9/30
B. 10/30
C. 19/30
D. 20/30
E. 29/30

17. A musician signs a 20-year contract with a recording studio. There are only three ways the contract may be terminated early. Each termination option has a constant force of mortality:

   - $\mu_x^{(1)} = 0.010$
   - $\mu_x^{(2)} = 0.015$
   - $\mu_x^{(3)} = 0.025$

Calculate the probability that the contract is terminated between years 10 and 11 due to option 2.

A. Less than 1%
B. At least 1%, but less than 2%
C. At least 2%, but less than 3%
D. At least 3%, but less than 4%
E. At least 4%

18.   Death may be the result of: (1) an accident or (2) natural causes.

The following information is available:

- $\mu_t^{(1)} = 0.1$ for all t
- $\mu_t^{(2)} = 0.1$ for $t \leq 10$
- $\mu_t^{(2)} = 0.2$ for $t > 10$

Calculate the probability that an individual death will be the result of an accident.

A. Less than 0.45
B. At least 0.45, but less than 0.46
C. At least 0.46, but less than 0.47
D. At least 0.47, but less than 0.48
E. At least 0.48

19. For a 10-year pure endowment, the following information is available:

- The benefit payment is $100.
- The force of mortality, μ, is 0.05.
- The force of interest, δ, is 0.08.

Calculate the standard deviation of the present value of the benefit.

A. Less than 15
B. At least 15, but less than 20
C. At least 20, but less than 25
D. At least 25, but less than 30
E. At least 30

20. A 3-year term insurance with a $1 million benefit payable at the end of the year of death is offered to managers who work overseas.

Using the Illustrative Life Table and $i = 3.5\%$, calculate the actuarial present value of the benefit for an insured aged 35.

A. Less than $6,000
B. At least $6,000 but less than $6,100
C. At least $6,100 but less than $6,200
D. At least $6,200 but less than $6,300
E. At least $6,300

21. You are given:

   - The force of mortality, μ, is constant.
   - The force of interest, δ, is constant.

. Which of the following represents the probability that $\bar{a}_{\overline{T|}}$ will exceed $\bar{a}_x$ for a life age x?

   A. $[\mu / (\delta + \mu)]^{(\delta/\mu)}$
   B. $[\mu / (\delta + \mu)]^{(\mu/\delta)}$
   C. $[\delta / (\delta + \mu)]^{(\delta/\mu)}$
   D. $[\delta / (\delta + \mu)]^{(\mu/\delta)}$
   E. $[1 / (\delta + \mu)]$

22. For a fully continuous whole life policy issued to (35), you are given:

- The force of mortality, μ, is 0.05.
- The force of interest, δ, is 0.03.
- Premiums are determined by the equivalence principle.

Calculate the probability that the insurer will not sustain a loss.

A. $(3/8)^{(5/3)}$
B. $(5/8)^{(5/3)}$
C. $(3/8)^{(3/5)}$
D. $(5/8)$
E. $(5/8)^{(3/5)}$

23. For a fully discrete, 5-year term insurance on (30), you are given:

- The benefit is $1,000
- Mortality follows DeMoivre's Law with $\omega=100$
- $i=5\%$
- $\ddot{a}_{30:\overline{5}|} = 4.4224$

Calculate the benefit reserve at the end of the third year.

A. Less than 0.5
B. At least 0.5, but less than 0.6
C. At least 0.6, but less than 0.7
D. At least 0.7, but less than 0.8
E. At least 0.8

24. Health insurance policyholders are classified as preferred, standard, or substandard. A $40 discount is applied to the premium of a preferred policyholder. All premiums are paid at the beginning of each period.

A policyholder transitions between classes each period, as shown in the following probability matrix, where class 1 is preferred, class 2 is standard, and class 3 is substandard:

$$\begin{bmatrix} 0.6 & 0.2 & 0.2 \\ 0.3 & 0.6 & 0.1 \\ 0.1 & 0.3 & 0.6 \end{bmatrix}$$

The interest rate is 4%, 5%, and 6% in the first, second and third periods, respectively.

For a new standard policyholder, calculate the actuarial present value of the total discount received in the first three periods.

A. Less than $25
B. At least $25, but less than $30
C. At least $30, but less than $35
D. At least $35, but less than $40
E. At least $40

25. Calculate the skewness of a Pareto distribution with $\alpha = 4$ and $\theta = 1,000$.

    A.   Less than 2
    B.   At least 2, but less than 4
    C.   At least 4, but less than 6
    D.   At least 6, but less than 8
    E.   At least 8

26. The aggregate losses of Eiffel Auto Insurance are denoted in euro currency and follow a Lognormal distribution with $\mu = 8$ and $\sigma = 2$.

Given that 1 euro = 1.3 dollars, which set of lognormal parameters describes the distribution of Eiffel's losses in dollars?

A. $\mu = 6.15$, $\sigma = 2.26$
B. $\mu = 7.74$, $\sigma = 2.00$
C. $\mu = 8.00$, $\sigma = 2.60$
D. $\mu = 8.26$, $\sigma = 2.00$
E. $\mu = 10.40$, $\sigma = 2.60$

27. The following information is available regarding the random variables X and Y:

- X follows a Pareto distribution with $\alpha = 2$ and $\theta = 100$
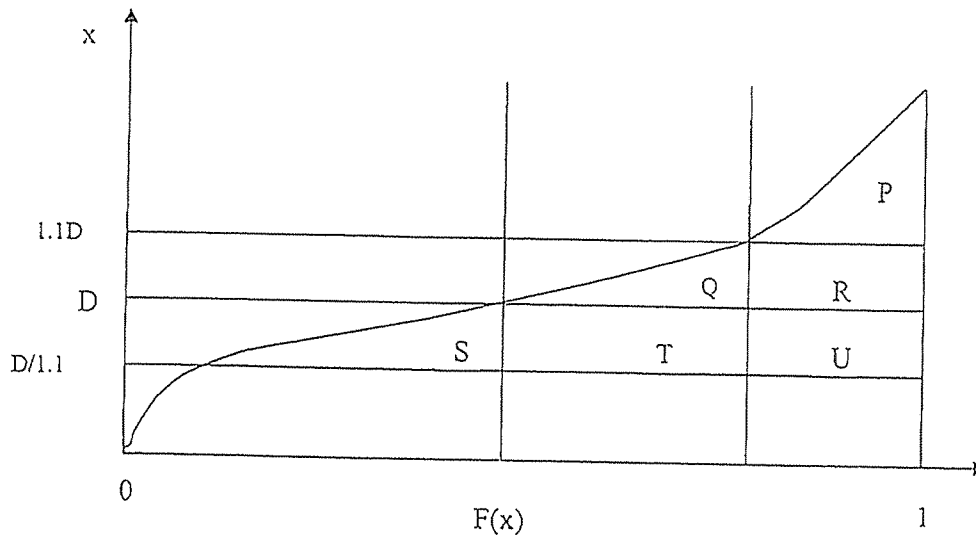- $Y = \ln(1 + (X/\theta))$

Calculate the variance of Y.

A. Less than 0.10
B. At least 0.10 but less than 0.20
C. At least 0.20 but less than 0.30
D. At least 0.30 but less than 0.40
E. At least 0.40

28. The following graph shows the distribution function, F(x), of loss severities in 2005.

Loss severities are expected to increase 10% in 2006 due to inflation. A deductible, D, applies to each claim in 2005 and 2006.

Which of the following represents the expected size of loss in 2006?

A. P
B. 1.1P
C. 1.1(P+Q+R)
D. P+Q+R+S+T+U
E. 1.1(P+Q+R+S+T+U)

29. Professional baseball players are assigned to one of four classes: A, AA, AAA, and Major League (in order from lowest to highest).

   - All players are reassigned at the beginning of each year, and reassignments occur only at the beginning of each year.
   - When reassigned, players may stay in the same class, move up one class, or move down one class.
   - The probabilities of moving up from classes A, AA, and AAA are 50%, 40%, and 30%, respectively.
   - The probability of moving down from classes AA or AAA is 10%.
   - There is no possibility of moving down from class A or the Major League.

   If a baseball player starts in class A at age 18, calculate the probability that he will be playing in the Major League at age 22.

   A. Less than 11%
   B. At least 11%, but less than 16%
   C. At least 16%, but less than 21%
   D. At least 21%, but less than 26%
   E. At least 26%

30. Claim counts for each policyholder are independent and follow a common Negative Binomial distribution. A priori, the parameters for this distribution are $(r, \beta) = (2,2)$ or $(r, \beta) = (4,1)$. Each parameter set is considered equally likely.

Policy files are sampled at random. The first two files sampled do not contain any claims. The third policy file contains a single claim.

Based on this information, calculate the probability that $(r, \beta) = (2,2)$.

A. Less than 0.30
B. At least 0.30, but less than 0.45
C. At least 0.45, but less than 0.60
D. At least 0.60, but less than 0.75
E. At least 0.75

31. N is a discrete random variable from the (a,b,0) class of distributions. The following information is known about the distribution:

- Pr(N=0)=0.327680
- Pr(N=1)=0.327680
- Pr(N=2)=0.196608
- E(N)=1.25

Based on this information, which of the following are true statements?

I. Pr(N=3) = 0.107965
II. N is from a Binomial distribution.
III. N is from a Negative Binomial distribution.

A. I only
B. II only
C. III only
D. I and II
E. I and III

32. Total claim counts generated from a portfolio of 1,000 polices follow a Negative Binomial distribution with parameters $r = 5$ and $\beta = 0.2$.

Calculate the variance in total claim counts if the portfolio increases to 2,000 policies.

A. Less than 1.0
B. At least 1.0 but less than 1.5
C. At least 1.5 but less than 2.0
D. At least 2.0 but less than 2.5
E. At least 2.5

33. While on vacation, an actuarial student sets out to photograph a Jackalope and a Snipe, two animals common to the local area. A tourist information booth informs the student that daily sightings of Jackalopes and Snipes follow independent Poisson processes with intensity parameters:

$$\lambda_J(t) = \frac{t^{1/3}}{5} \quad \text{for Jackalopes}$$

$$\lambda_S(t) = \frac{t^{1/2}}{10} \quad \text{for Snipes}$$

where: $0 \leq t \leq 24$ and t is the number of hours past midnight

If the student takes photographs between 1 pm and 5 pm, calculate the probability that he will take at least 1 photograph of each animal.

A. Less than 0.45
B. At least 0.45, but less than 0.60
C. At least 0.60, but less than 0.75
D. At least 0.75, but less than 0.90
E. At least 0.90

34. The number of claims arriving each day in the Montana and Nevada claim offices follow independent Poisson processes with parameters $\lambda_M = 2$ and $\lambda_N = 3$, respectively.

   Calculate the probability that the Montana office receives three claims before the Nevada office receives two claims.

   A. Less than 0.15
   B. At least 0.15 but less than 0.20
   C. At least 0.20 but less than 0.25
   D. At least 0.25 but less than 0.30
   E. At least 0.30

35. The following information is known about a consumer electronics store:

- The number of people who make some type of purchase follows a Poisson distribution with a mean of 100 per day.

- The number of televisions bought by a purchasing customer follows a Negative Binomial distribution with parameters $r = 1.1$ and $\beta = 1.0$.

Using the normal approximation, calculate the minimum number of televisions the store must have in its inventory at the beginning of each day to ensure that the probability of its inventory being depleted during that day is no more than 1.0%.

A. Fewer than 138
B. At least 138, but fewer than 143
C. At least 143, but fewer than 148
D. At least 148, but fewer than 153
E. At least 153

36. The following information is available for a collective risk model:

   - X is a random variable representing the size of each loss.
   - X follows a Gamma distribution with $\alpha = 2$ and $\theta = 100$.
   - N is a random variable representing the number of claims.
   - S is a random variable representing aggregate losses.
   - $S = X_1 + \ldots + X_N$

Calculate the mode of S when N =5.

A. Less than 950
B. At least 950 but less than 1050
C. At least 1050 but less than 1150
D. At least 1150 but less than 1250
E. At least 1250

37. Between 9 am and 3 pm Big National Bank employs 2 tellers to service customer transactions. The time it takes Teller X to complete each transaction follows an exponential distribution with a mean of 10 minutes. Transaction times for Teller Y follow an exponential distribution with a mean of 15 minutes. Both Teller X and Teller Y are continuously busy while the bank is open.

On average, every third customer transaction is a deposit and the amount of the deposit follows a Pareto distribution with parameters $\alpha=3$ and $\theta=5,000$. Each transaction that involves a deposit of at least $7,500 is handled by the branch manager.

Calculate the expected total deposits made through the tellers each day.

A. Less than $31,000
B. At least $31,000, but less than $32,500
C. At least $32,500, but less than $35,000
D. At least $35,000, but less than $37,500
E. At least $37,500

38.   The number of calls arriving at a customer service center follows a Poisson distribution
       with $\lambda = 100$ per hour. The length of each call follows an exponential distribution with an
       expected length of 4 minutes. There is a $3 charge for the first minute or any fraction
       thereof and a charge of $1 per minute for each additional minute or fraction thereof.

       Determine the total expected charges in a single hour.

A. Less than $375
B. At least $375, but less than $500
C. At least $500, but less than $625
D. At least $625, but less than $750
E. At least $750

39. Prior to the application of any deductible, aggregate claim counts during 2005 followed a Poisson distribution with $\lambda = 14$. Similarly, individual claim sizes followed a Pareto distribution with $\alpha = 3$ and $\theta = 1,000$.

Annual severity inflation is 10%.

If all policies have a $250 ordinary deductible in 2005 and 2006, calculate the expected increase in the number of claims that will exceed the deductible in 2006.

A. Fewer than 0.41 claims
B. At least 0.41, but fewer than 0.45
C. At least 0.45, but fewer than 0.49
D. At least 0.49, but fewer than 0.53
E. At least 0.53

40. An insurance company with initial surplus of $30 collects premium at the beginning of each year. Collected premium in Year 1 is $100. If there are no losses in the first year, collected premium in Year 2 will be $90, otherwise the collected premium will be $110.

The company pays operating expenses of $50 at the beginning of each year. Investment income of 8% is received at the end of the year. Losses are paid at the end of the year after the receipt of investment income.

Annual losses are distributed as follows:

Losses	Probability
$0	40%
$50	30%
$100	20%
$200	10%

Calculate the probability of ruin within the first two years.

A. Less than 35%
B. At least 35%, but less than 40%
C. At least 40%, but less than 45%
D. At least 45%, but less than 50%
E. At least 50%

SPRING 2006 EXAM 3   ANSWERS

Question	Answer
1	A
2	E
3	D
4	C
5	B
6	E
7	A
8	D
9	A
10	B
11	E
12	B
13	A
14	C
15	C
16	A
17	A
18	D
19	C
20	A
21	B
22	B
23	C
24	B
25	D
26	D
27	C
28	E
29	B
30	E
31	C
32	D
33	C
34	B
35	E
36	A
37	B
38	D
39	A
40	B