2/25/20

More Severity Problems

#50 / SOA Exam P Sample Q's)

#51 / SOA Exam P Sample Q's)

SOA STAM Sample Q's

284)

101)

168)

49. This question duplicates Question 44 and has been deleted

50. A company buys a policy to insure its revenue in the event of major snowstorms that shut down business. The policy pays nothing for the first such snowstorm of the year and 10,000 for each one thereafter, until the end of the year. The number of major snowstorms per year that shut down business is assumed to have a Poisson distribution with mean 1.5. $N \sim P(\lambda = 1.5)$

Calculate the expected amount paid to the company under this policy during a one-year period.

$Y = 10000\,(N-1)_+$

$E[(N-1)_+] = \underbrace{E[N]}_{\lambda = 1.5} - \underbrace{E[N \wedge 1]}_{1-e^{-1.5}}$

$N \wedge 1$	Pr
0	$P_0 = e^{-1.5}$
1	$1-e^{-1.5}$

(A) 2,769
(B) 5,000
(C) 7,231
(D) 8,347
(E) 10,578

$E[Y] = 10000\left(1.5 - (1-e^{-1.5})\right) = 7231.\cdots$

51. A manufacturer's annual losses follow a distribution with density function

$$f(x) = \begin{cases} \dfrac{2.5(0.6)^{2.5}}{x^{3.5}}, & x > 0.6 \\ 0, & \text{otherwise.} \end{cases}$$

To cover its losses, the manufacturer purchases an insurance policy with an annual deductible of 2.

Calculate the mean of the manufacturer's annual losses not paid by the insurance policy.

(A) 0.84
(B) 0.88
(C) 0.93
(D) 0.95
(E) 1.00

$E[X \wedge 2]$

$$X \wedge 2 = \begin{cases} 0 & \text{if } X < 0.6 \\ X & \text{if } 0.6 < X < 2 \\ 2 & \text{if } X > 2 \end{cases}$$

$$E[X] = \int_{0.6}^{2} x \cdot f(x)\,dx + \int_{2}^{\infty} 2 \cdot f(x)\,dx$$

284. A risk has a loss amount that has a Poisson distribution with mean 3. $X \sim P(\lambda = 3)$

An insurance covers the risk with an ordinary deductible of 2. An alternative insurance replaces the deductible with coinsurance α, which is the proportion of the loss paid by the insurance, so that the expected insurance cost remains the same.

Calculate α.

Insurance 1

$Y = (X-2)_+$

$E[Y] = \underbrace{E[X]}_{=3} - E[X \wedge 2]$

$X \wedge 2$	Pr
0	e^{-3}
1	$3e^{-3}$
2	$1-4e^{-3}$

Insurance 2

$Y = \alpha \cdot X$

$E[Y] = \alpha \cdot (3)$

(A) 0.22

(B) 0.27

(C) 0.32

(D) 0.37

(E) 0.42

$E[Y] = 3 - (3e^{-3} + 2(1-4e^{-3})) = 3\alpha \Rightarrow \alpha = 0.4163\ldots$

285. You are the producer for the television show Actuarial Idol. Each year, 1000 actuarial clubs audition for the show. The probability of a club being accepted is 0.20.

The number of members of an accepted club has a distribution with mean 20 and variance 20. Club acceptances and the numbers of club members are mutually independent.

Your annual budget for persons appearing on the show equals 10 times the expected number of persons plus 10 times the standard deviation of the number of persons.

Calculate your annual budget for persons appearing on the show.

(A) 42,600

(B) 44,200

(C) 45,800

(D) 47,400

(E) 49,000

100. The unlimited severity distribution for claim amounts under an auto liability insurance policy is given by the cumulative distribution:

$$F(x) = 1 - 0.8e^{-0.02x} - 0.2e^{-0.001x}, \quad x \geq 0$$

The insurance policy pays amounts up to a limit of 1000 per claim.

Calculate the expected payment under this policy for one claim.

(A) 57

(B) 108

(C) 166

(D) 205

(E) 240

101. The random variable for a loss, X, has the following characteristics:

x	$F(x)$	$E(X \wedge x)$
0	0.0	0
100	0.2	91
200	0.6	153
1000	1.0	331

Calculate the mean excess loss for a deductible of 100.

(A) 250

(B) 300

(C) 350

(D) 400

(E) 450

$E[X-100 \mid X>100]$ = mean excess loss with $d=100$

$Pr(X>100) = 1 - F(100) = 0.8$

$E[(X-100)_+] = \underbrace{E[X-100 \mid X>100]}_{=?} \cdot Pr(X>100)$

$E[(X-100)_+] = E[X] - \underbrace{E[X \wedge 100]}_{=91}$

$X \wedge 1000 = X$ since $F(1000) = 1$

$\therefore E[(X-100)_+] = 331 - 91 = 240$

$\therefore E[X-100 \mid X>100] = \frac{240}{.8} = 300$

168. For an insurance:

(i) Losses can be 100, 200 or 300 with respective probabilities 0.2, 0.2, and 0.6.

(ii) The insurance has an ordinary deductible of 150 per loss.

(iii) Y^P is the claim payment per payment random variable.

X	Pr
100	0.2
200	0.2
300	0.6

Calculate $\mathrm{Var}(Y^P)$.

Y^L = rvr payment per loss

(A) 1500

(B) 1875

(C) 2250

(D) 2625

(E) 3000

$(X-150)_+ = $

Y^L	Pr
0	.2
50	.2
150	.6

Y^P	Pr
50	.25
150	.75

$E[Y^P] = 125$

$E[(Y^P)^2] = 17500$

$\therefore \mathrm{Var}(Y^P) = 1875$

169. The distribution of a loss, X, is a two-point mixture:

(i) With probability 0.8, X has a two-parameter Pareto distribution with $\alpha = 2$ and $\theta = 100$.

(ii) With probability 0.2, X has a two-parameter Pareto distribution with with $\alpha = 4$ and $\theta = 3000$.

Calculate $\Pr(X \le 200)$.

(A) 0.76

(B) 0.79

(C) 0.82

(D) 0.85

(E) 0.88