

CUET (UG) – MATHEMATICS

Chapter Test - Section B2: Applied Mathematics - Unit IV: Probability Distributions

SOLUTIONS

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Solutions

- Correct Option: (B).** $E(X) = \sum x_i p_i = 1(0.1) + 2(0.2) + 3(0.3) + 4(0.4) = 0.1 + 0.4 + 0.9 + 1.6 = 3.0$.
- Correct Option: (A).** $P(X \geq 1) = 1 - P(X = 0)$. $P(X = 0) = \binom{5}{0}(0.2)^0(0.8)^5 = (0.8)^5$. So, $1 - (0.8)^5$.
- Correct Option: (A).** $P(X = 0) = e^{-\lambda} = 0.2$. Taking natural log: $-\lambda = \ln(0.2) \implies \lambda = -\ln(1/5) = \ln(5)$. Since Variance = λ , Variance = $\ln(5)$.
- Correct Option: (B).** $Z = (x - \mu)/\sigma = (60 - 50)/5 = 10/5 = 2$.
- Correct Option: (B).** $Var(2X + 5) = 2^2 Var(X) = 4 \times 9 = 36$. S.D. = $\sqrt{36} = 6$.
- Correct Option: (B).** Mean $np = 10$. $50p = 10 \implies p = 0.2$. Thus $q = 1 - 0.2 = 0.8$.
- Correct Option: (A).** $E(X^2) = Var(X) + [E(X)]^2$. For Poisson, $\lambda + \lambda^2 = 6 \implies \lambda^2 + \lambda - 6 = 0 \implies (\lambda + 3)(\lambda - 2) = 0$. Since $\lambda > 0$, $\lambda = 2$.
- Correct Option: (A).** Area within 1σ is 0.6827. Area outside is $1 - 0.6827 = 0.3173$. Since the curve is symmetric, area to the right of $Z = 1$ is $0.3173/2 = 0.15865 \approx 0.1587$.
- Correct Option: (C).** In a Binomial experiment, the probability of success p must remain constant for all trials.
- Correct Option: (B).** $E(X - E(X)) = E(X) - E(E(X))$. Since $E(X)$ is a constant, $E(E(X)) = E(X)$. Thus $E(X) - E(X) = 0$.
- Correct Option: (A).** $P(X > 1) = 1 - [P(X = 0) + P(X = 1)]$.
- Correct Option: (A).** In a Normal Distribution, $QD \approx 0.6745\sigma$.
- Correct Option: (B).** $E(X) = \frac{1}{n}(1 + 2 + \dots + n) = \frac{1}{n} \cdot \frac{n(n+1)}{2} = \frac{n+1}{2}$.
- Correct Option: (A).** $n = 2, p = 3/5 = 0.6, q = 0.4$. $Var(X) = npq = 2(0.6)(0.4) = 0.48$.
- Correct Option: (C).** A standard normal distribution is defined with $\mu = 0$ and $\sigma = 1$.
- Correct Option: (B).** Variance $np(1 - p)$ is maximum when $p = 0.5$. Max value = $n(0.5)(0.5) = n/4$.
- Correct Option: (A).** $P(X = 2) = e^{-0.5}(0.5)^2/2! = e^{-0.5}(0.25)/2 = e^{-0.5}(1/4)/2 = e^{-0.5}/8$.
- Correct Option: (C).** The Normal distribution curve is symmetric and bell-shaped by definition.
- Correct Option: (A).** $E(X/n) = \frac{1}{n}E(X) = \frac{1}{n}(np) = p$.
- Correct Option: (A).** $P(X \geq 1) = 1 - P(X = 0) = 1 - \frac{e^{-1}1^0}{0!} = 1 - e^{-1} = 1 - 1/e$.