CUET Mathematics Test

Unit VI: Probability

SOLUTIONS

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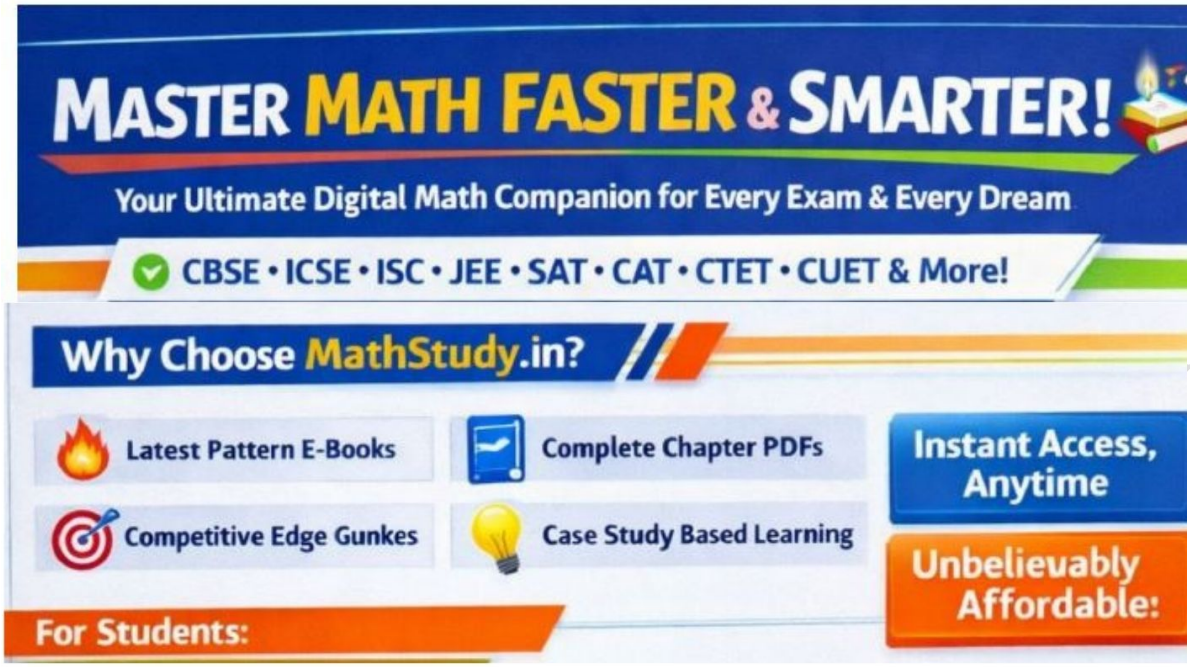

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Solutions

1. **Solution:** $P(B|A) = \frac{P(A\cap B)}{P(A)} \implies 0.6 = \frac{P(A\cap B)}{0.4} \implies P(A \cap B) = 0.24$. Then $P(A \cup B) = P(A) + P(B) - P(A \cap B) = 0.4 + 0.8 - 0.24 = 0.96$. **Correct Option: (B)**

2. **Solution:** $P(B|A) = \frac{P(A\cap B)}{P(A)} = 1 \implies P(A \cap B) = P(A)$. This is possible only when $A \subseteq B$. **Correct Option: (A)**

3. **Solution:** $P(\text{exactly one}) = P(A)P(\bar{B}) + P(\bar{A})P(B) = p(1-2p) + (1-p)2p = p - 2p^2 + 2p - 2p^2 = 3p - 4p^2$. Given $3p - 4p^2 = 5/9 \implies 27p - 36p^2 = 5 \implies 36p^2 - 27p + 5 = 0$. Solving using quadratic formula: $p = \frac{27 \pm \sqrt{729 - 720}}{72} = \frac{27 \pm 3}{72}$. $p = 30/72 = 5/12$ or $p = 24/72 = 1/3$. **Correct Option: (C)**

4. **Solution:** Total balls = 8. Ways to draw 3 balls = ${}^8C_3 = 56$. Ways to draw 2 red and 1 blue = ${}^5C_2 \times {}^3C_1 = 10 \times 3 = 30$. Probability = $30/56 = 15/28$. **Correct Option: (A)**

5. **Solution:** $P(A|B) = \frac{P(A\cap B)}{P(B)} \implies 0.4 = \frac{P(A\cap B)}{0.6} \implies P(A \cap B) = 0.24$. $P(\bar{A} \cap \bar{B}) = P(\overline{A \cup B}) = 1 - P(A \cup B)$. $P(A \cup B) = 0.3 + 0.6 - 0.24 = 0.66$. $P(\bar{A} \cap \bar{B}) = 1 - 0.66 = 0.34$. $P(\bar{A}|\bar{B}) = \frac{P(\bar{A}\cap\bar{B})}{P(\bar{B})} = \frac{0.34}{1-0.6} = \frac{0.34}{0.4} = 0.85$. **Correct Option: (B)**

6. **Solution:** $P(\text{hit}) = 1 - P(\text{none hit}) = 1 - P(\bar{A})P(\bar{B})P(\bar{C})$. $P(\text{hit}) = 1 - (0.6 \times 0.7 \times 0.8) = 1 - 0.336 = 0.664$. **Correct Option: (C)**

7. **Solution:** Sum is 8: $S = \{(2,6), (3,5), (4,4), (5,3), (6,2)\}$, $n(S) = 5$. Event E (4 appears at least once): $\{(4,4)\}$, $n(E) = 1$. $P(E|S) = 1/5$. **Correct Option: (A)**

8. **Solution:** By definition of independence, $P(A \cap B) = P(A) \cdot P(B)$. **Correct Option: (C)**

9. **Solution:** Probability of black $p = 4/10 = 0.4$. Probability of red $q = 0.6$. $n = 2$. Variance for Binomial distribution $= npq = 2 \times 0.4 \times 0.6 = 0.48$. **Correct Option: (A)**

10. **Solution:** E_1: Bag I, E_2: Bag II, A: Red ball. $P(E_1) = 1/2, P(E_2) = 1/2$. $P(A|E_1) = 3/7, P(A|E_2) = 5/11$. $P(E_2|A) = \frac{P(E_2)P(A|E_2)}{P(E_1)P(A|E_1)+P(E_2)P(A|E_2)} = \frac{(1/2)(5/11)}{(1/2)(3/7)+(1/2)(5/11)} = \frac{5/11}{33/77+35/77 \text{ (wait) } 5/11 \div (3/7+5/11)} = \frac{5/11}{68/77} = \frac{5}{11} \times \frac{77}{68} = \frac{35}{68}$. **Correct Option: (A)**

11. **Solution:** $\text{Var}(X) = E(X^2) - [E(X)]^2 = 13 - 3^2 = 13 - 9 = 4$. $\text{SD}(X) = \sqrt{\text{Var}(X)} = \sqrt{4} = 2$. **Correct Option: (C)**

12. **Solution:** $P(A|B) > P(A) \implies \frac{P(A\cap B)}{P(B)} > P(A) \implies P(A \cap B) > P(A)P(B)$. Now, $P(B|A) = \frac{P(A\cap B)}{P(A)} > \frac{P(A)P(B)}{P(A)} = P(B)$. **Correct Option: (C)**

13. **Solution:** $P(H) = 3/4, P(T) = 1/4$. $P(X = 1) = P(HT) + P(TH) = (3/4 \times 1/4) + (1/4 \times 3/4) = 3/16 + 3/16 = 6/16$. **Correct Option: (B)**

14. **Solution:** E_1: Head occurs, E_2: Tail occurs, A: A reports head. $P(E_1) = 1/2, P(E_2) = 1/2$. $P(A|E_1) = 4/5$ (Truth), $P(A|E_2) = 1/5$ (Lie). $P(E_1|A) = \frac{(1/2)(4/5)}{(1/2)(4/5)+(1/2)(1/5)} = \frac{4/10}{5/10} = 4/5$. **Correct Option: (A)**

15. **Solution:** Both formulas are valid representations of the multiplication theorem. **Correct Option: (C)**

16. **Solution:** $\sum P(X) = 1 \implies k + 2k + 3k = 1 \implies 6k = 1 \implies k = 1/6$. **Correct Option: (B)**

17. **Solution:** Let E_1, E_2, E_3 be bolts from A, B, C. D is defective. $P(E_1) = 0.25, P(E_2) = 0.35, P(E_3) = 0.40$. $P(D|E_1) = 0.05, P(D|E_2) = 0.04, P(D|E_3) = 0.02$. $P(E_2|D) = \frac{0.35\times0.04}{(0.25\times0.05)+(0.35\times0.04)+(0.40\times0.02)} = \frac{0.0140}{0.0125+0.0140+0.0080} = \frac{140}{125+140+80} = \frac{140}{345} = 28/69$. **Correct Option: (A)**

18. **Solution:** $P(\text{King}) = 4/52 = 1/13$. $P(KK) = 1/13 \times 1/13 = 1/169$. **Correct Option: (A)**

19. **Solution:** $P(A|B) = \frac{P(A\cap B)}{P(B)}$. Since $P(B) = 0$, division by zero is not defined. **Correct Option: (C)**

20. **Solution:** $k = 1/6$ (from solution 16). $E(X) = \sum xP(X) = 0(k) + 1(2k) + 2(3k) = 2k + 6k = 8k = 8(1/6) = 4/3$. **Correct Option: (B)**