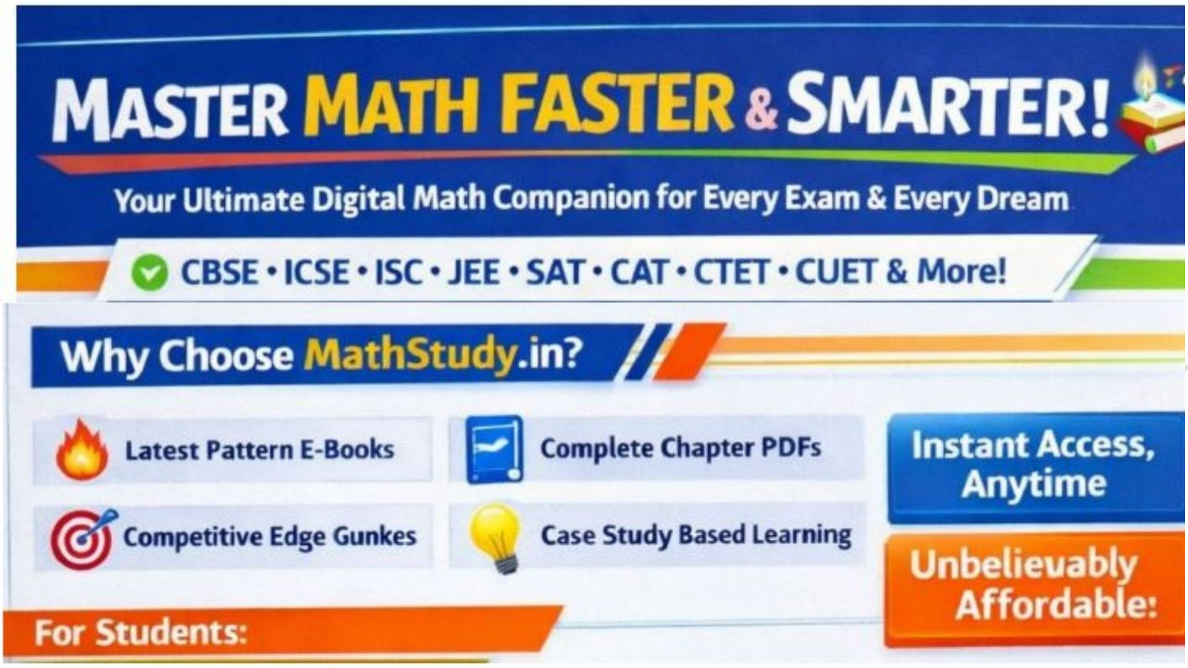
Chapter: Probability Distributions (Random Variables)



Special Features

- **Board-Specific** – CBSE, ICSE, ISC, State Boards
- **Exam-Focused** – JEE, SAT, CAT, CTET, CUET, NTSE
- **Grade-Wise** – Class 6 to 12
- **Bilingual Options** – English & Hindi Medium Support
- **Printable & Shareable** – Use offline, anytime

How to Order:

Visit : https://www.mathstudy.in
Browse by Exam, Class, or Topic
Add to Cart & Checkout

Contact & Support:

✉️ Email: admin@mathstudy.in
💬 WhatsApp Support Available : +91-+91 92118 65759

💡 Why Wait? Empower your learning journey, save time, and achieve your dreams!

🌐 Explore & Start Learning Today:
https://www.mathstudy.in – Premium eBooks for success
https://www.udgamwelfarefoundation.com – Free PDFs, practice tests, & guida

MathStudy.in — Empowering Learners, Enabling Educators, Encouraging Excellence.
Digital Learning | Affordable Excellence | Trusted by Thousands

Solutions

1. **Solution:** Sum of $P(x) = k(1^2 + 2^2 + 3^2) + k(4 + 5) = k(14) + k(9) = 23k = 1 \Rightarrow k = 1/23$.

2. **Solution:** $P(X \geq 3) = 1 - [P(X = 1) + P(X = 2)] = 1 - [1/2 + (1/2)^2] = 1 - 3/4 = 1/4$.

3. **Solution:** Total balls = 10. Drawn = 3. ${}^{10}C_3 = 120$. $P(0) = \frac{{}^6C_3}{120} = \frac{20}{120} = \frac{1}{6}$; $P(1) = \frac{{}^4C_1 \cdot {}^6C_2}{120} = \frac{60}{120} = \frac{1}{2}$; $P(2) = \frac{{}^4C_2 \cdot {}^6C_1}{120} = \frac{36}{120} = \frac{3}{10}$; $P(3) = \frac{{}^4C_3}{120} = \frac{4}{120} = \frac{1}{30}$.

4. **Solution:** $\sum P(x) = k[{}^3C_0{}^5C_2 + {}^3C_1{}^5C_1 + {}^3C_2{}^5C_0] = k[10 + 15 + 3] = 28k = 1 \Rightarrow k = 1/28$.

5. **Solution:** $P = 1/2^3 + 1/2^6 + 1/2^9 + \cdots = \frac{1/8}{1-1/8} = \frac{1/8}{7/8} = 1/7$.

6. **Solution:** $a[2/3 + (2/3)^2 + \ldots] = a\left[\frac{2/3}{1-2/3}\right] = a(2) = 1 \Rightarrow a = 1/2$.

7. **Solution:** Face cards = 12. Non-face = 40. Total ways = ${}^{52}C_2$. $P(X = 1) = \frac{{}^{12}C_1 \cdot {}^{40}C_1}{{}^{52}C_2} = \frac{12\times40}{1326} = \frac{480}{1326} = \frac{80}{221}$.

8. **Solution:** $k[1/0! + 1/1! + 1/2! + 1/3!] = k[1 + 1 + 0.5 + 0.166] = k[8/3] = 1 \Rightarrow k = 3/8$.

9. **Solution:** $P(\text{Spade}) = 1/4, P(\text{Other}) = 3/4$. $E(X) = 5(1/4) + (-2)(3/4) = 5/4 - 6/4 = -1/4$.

10. **Solution:** $k/2 + k/4 + k/6 + k/8 + k/10 = 1 \Rightarrow \frac{k}{2}[1 + 1/2 + 1/3 + 1/4 + 1/5] = 1$. $k(137/120) = 1 \Rightarrow k = 120/137$. Even x are $2, 4$. $P = k/4 + k/8 = 3k/8$.

11. **Solution:** Sum 9 on 2 dice: (3,6), (4,5), (5,4), (6,3). $p = 4/36 = 1/9, q = 8/9$. $P(x) = {}^3C_x(1/9)^x(8/9)^{3-x}$.

12. **Solution:** $k = \sum_{x=0}^{n}(x + 1) = 1 + 2 + \cdots + (n + 1) = \frac{(n+1)(n+2)}{2}$.

13. **Solution:** $P(0) = \frac{{}^5C_2}{{}^8C_2} = \frac{10}{28}$; $P(1) = \frac{{}^5C_1 \cdot {}^3C_1}{28} = \frac{15}{28}$; $P(2) = \frac{{}^3C_2}{28} = \frac{3}{28}$.

14. **Solution:** $2P(5) = P(4) + P(6) \Rightarrow 2\binom{n}{5} = \binom{n}{4} + \binom{n}{6}$. Solving gives $n = 7$ or 14. (Standard result for ${}^nC_r$ in AP).

15. **Solution:** $k[2^{-1} + 2^0 + 2^{-1}] = k[1/2 + 1 + 1/2] = 2k = 1 \Rightarrow k = 1/2$.

16. **Solution:** $E(X) = 1(1/6) + 2(1/3) + 3(1/2) = 1/6 + 2/3 + 3/2 = (1 + 4 + 9)/6 = 14/6 = 7/3$.

17. **Solution:** For $X = 3$, one defective must be in first two draws, and the 2nd defective must be at the 3rd draw. $P = P(D, ND, D) + P(ND, D, D) = (2/6 \cdot 4/5 \cdot 1/4) + (4/6 \cdot 2/5 \cdot 1/4) = 8/120 + 8/120 = 16/120 = 2/15$.

18. **Solution:** $\sum \frac{{}^nC_x}{2^n} = \frac{1}{2^n}\sum {}^nC_x = \frac{2^n}{2^n} = 1$.

19. **Solution:** $1 - P(0) = 1 - (3/4)^4 = 1 - 81/256 = 175/256$.

20. **Solution:** $P(2) = P(1)/2, P(3) = P(1)/4, \ldots, P(k) = P(1)/2^{k-1}$. Sum $= P(1)[1 + 1/2 + 1/4 + \ldots] = 1 \Rightarrow P(1) \cdot 2 = 1 \Rightarrow P(1) = 1/2$.