Answers

Exercise 1.1

1. (1) $U = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$

(2) U = {(1, *H*), (2, *H*), (3, *H*), (4, *H*), (5, *H*), (6, *H*),
(1, *T*), (2, *T*), (3, *T*), (4, *T*), (5, *T*), (6, *T*)}

(3) $U = \{(a, b), (a, c), (a, d), (a, e), (b, c), (b, d), (b, e), (c, d), (c, e), (d, e)\}$

2. (1) U = {0, 1, 2, ..., 100}, No. of sample points = 101

3. Denoting four persons by a, b, c, d

U = {(a, b), (a, c), (a, d), (b, c), (b, d), (c, d), (b, a), (c, a), (d, a), (c, b), (d, b), (d, c)}

The first place in the bracket shows minister and the second place shows deputy minister.

4. U = {H, TH, TTH, TTTH, ...}, infinite sample space

5. U = {(1, 2, 3), (1, 2, 4), (1, 2, 5), (1, 3, 4), (1, 3, 5), (1, 4, 5), (2, 3, 4), (2, 3, 5), (2, 4, 5), (3, 4, 5) }

6. (1) A = {1, 3, 5, 7, 9, 11, 13, 15, 17, 19}

(2) B = {3, 6, 9, 12, 15, 18}

(3) C = {2, 3, 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20}

7. U= {BB, BG, GB, GG}

(1) A_1 = {BG, GB}

(2) A_2 = {BG, GB, GG}

8. U= {(i, j); i, j = 1, 2, 3, 4, 5, 6}

(1) A_1 = {(1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1)}

(2) A_2 = {(1, 1), (1, 2), (2, 1),}

(3) A_3 = {(1, 2), (1, 5), (2, 1), (2, 4), (3, 3), (3, 6), (4, 2), (4, 5), (5, 1), (5, 4), (6, 3), (6, 6)}

(4) A_4 = { }

9. (1) U = {(1, 2), (1, 3), (1, 4), (1, 5), (2, 3), (2, 4), (2, 5), (3, 4), (3, 5), (4, 5)}

(2) A = {(1, 5), (2, 4), (2, 5), (3, 4), (3, 5), (4, 5)}

(3) B = {(1, 3), (1, 5), (2, 4), (3, 5)}

(4) $A \cup B$ = {(1, 3), (1, 5), (2, 4), (2, 5), (3, 4), (3, 5), (4, 5)}

(5) $A \cap B$ = {(1, 5), (2, 4), (3, 5)}

(6) A' = {(1, 2), (1, 3), (1, 4), (2, 3)}

(7) $A - B$ = {(2, 5), (3, 4), (4, 5)}

(8) $A' \cap B$ = {(1, 3)}

(9) Events A and B are not mutually exclusive as $A \cap B \neq \phi$

(10) No. of sample points = 10

10. Denoting three females by *a, b, c* and two males by *x, y*.

(1) U = {*a, b, c, x, y*}

(2) A = {*a, b, c*}

(3) B = {*x, y*}

(4) $A \cup B$ = {*a, b, c, x, y*}

(5) $A \cap B$ = { }

(6) $A' \cap B$ = {*x, y*}

(7) Events A and B are mutually exclusive as $A \cap B = \phi$

(8) Events A and B are exhaustive as $A \cup B = U$

11. (1) $U = \{S_A, S_2, S_3, \ldots\ldots, S_K, D_A, D_2, D_3, \ldots\ldots, D_K, C_A, C_2, C_3, \ldots\ldots, C_K, H_A, H_2, H_3, \ldots\ldots, H_K\}$

(2) $A = \{S_A, S_2, S_3, \ldots\ldots, S_K\}$

(3) $B = \{S_A, S_2, S_3, \ldots\ldots, S_{10}, D_A, D_2, D_3, \ldots\ldots, D_{10}, C_A, C_2, C_3, \ldots\ldots, C_{10}, H_A, H_2, H_3, \ldots\ldots, H_{10}\}$

(4) $A \cup B = \{S_A, S_2, S_3, \ldots\ldots, S_k, D_A, D_2, D_3, \ldots\ldots, D_{10}, C_A, C_2, C_3, \ldots\ldots, C_{10}, H_A, H_2, H_3, \ldots\ldots, H_{10}\}$

(5) $A \cap B = \{S_1, S_2, S_3, \ldots\ldots, S_{10}\}$

(6) $B' = \{S_J, S_Q, S_K, D_J, D_Q, D_K, C_J, C_Q, C_K, H_J, H_Q, H_K\}$

12. $A_1 \cup A_2 = \{x \mid 0 \le x < 5\}$

$A_1 \cap A_2 = \{x \mid x = 1, 2\}$

13. $A_1 \cup A_2 = \{x \mid 2 \le x \le 8, x \in N\}$

$A_1 \cap A_2 = \{x \mid x = 4, 5\}$

14. $A' = \{x \mid x = 0, 1, 3, 5, 7, 8, 9, 10\}$

15. $A' = \{x \mid 0 < x < \frac{1}{2}\}$

Exercise 1.2

1. (1) $\frac{1}{8}$ (2) $\frac{1}{8}$ (3) $\frac{7}{8}$ (4) $\frac{1}{2}$ (5) $\frac{1}{2}$

(6) $\frac{1}{2}$ (7) $\frac{1}{4}$ (8) $\frac{1}{2}$ **2.** (1) $\frac{5}{36}$ (2) $\frac{11}{12}$

(3) $\frac{1}{3}$ (4) $\frac{1}{9}$ **3.** (1) $\frac{1}{2}$ (2) $\frac{3}{4}$ **4.** $\frac{7}{50}$

5. (1) $\frac{1}{3}$ (2) $\frac{2}{3}$ (3) $\frac{1}{4}$ (4) $\frac{3}{4}$ (5) $\frac{1}{12}$

6. $\frac{1}{30}$ **7.** $\frac{1}{20}$ **8.** $\frac{2}{5}$ **9.** $\frac{1}{7}$ **10.** $\frac{1}{7}$

11. $\frac{1}{7}$ **12.** $\frac{3}{7}$ **13.** (1) $\frac{1}{7}$ (2) $\frac{4}{7}$ (3) $\frac{3}{7}$

14. (1) $\frac{3}{28}$ (2) $\frac{5}{14}$ (3) $\frac{15}{28}$ **15.** (1) $\frac{26}{51}$ (2) $\frac{11}{221}$

(3) $\frac{32}{221}$ **16.** $\frac{14}{15}$ **17.** (1) 0.4 (2) 0.35 (3) 0.45

(4) 0.85 **18.** $P(A-B) = 0.2,\ P(B-A) = 0.5$

Exercise 1.3

1. (1) $\frac{4}{17}$ (2) $\frac{25}{51}$ **2.** $\frac{3}{7}$ **3.** (1) $\frac{4}{13}$ (2) $\frac{9}{13}$

4. $\frac{47}{100}$ **5.** $\frac{2}{3}$ **6.** 0.9 **7.** 0.97 **8.** 0.59

9. $P(A) = \frac{2}{3}$ **10.** $P(A \cup C) = \frac{35}{47}$, $P(B \cup C) = \frac{32}{47}$ **11.** $P(A \cup B \cup C) = 0.8$

12. $P(A) = 0.4$, $P(B) = 0.4$

Exercise 1.4

1. $\frac{1}{2}$ **2.** $\frac{1}{5}$ **3.** (1) $\frac{5}{8}$ (2) $\frac{5}{6}$ **4.** $\frac{4}{5}$

5. $P(A/B) = \frac{5}{6}$ **6.** $P(A \cap M) = \frac{1}{20}$, $P(A \cap F) = \frac{1}{4}$ **7.** $\frac{11}{24}$ **8.** $\frac{8}{15}$

9. $\frac{9}{100}$ **10.** $\frac{4}{15}$ **11.** (1) $\frac{11}{36}$ (2) $\frac{1}{6}$ **12.** $\frac{23}{24}$

13. $\frac{14}{15}$ **14.** 0.26 **15.** 0.72

Exercise 1.5

1. (1) $\frac{29}{357}$ (2) $\frac{125}{357}$ (3) $\frac{275}{357}$ **2.** (1) $\frac{1319}{2536}$ (2) $\frac{1319}{2437}$

Exercise 1

Section A

1. (d) **2.** (b) **3.** (c) **4.** (a) **5.** (a)

6. (c) **7.** (c) **8.** (b) **9.** (a) **10.** (b)

11. (d) **12.** (b) **13.** (a) **14.** (a) **15.** (c)

16. (c) **17.** (b)

Section B

13. $P(A \cap B) = 0$, $P(A \cup B) = 1$ **15.** $A \cap B = \{x \mid \frac{1}{4} \le x < 1\}$ **16.** 0.15

17. 0.55 **18.** 0.1 **19.** 2K **20.** 0.45 **21.** $\frac{2}{3}$

22. 0.98 **23.** $2^5 = 32$ **24.** $2 \times 6 \times 6 = 72$ **25.** Not possible. As $P(A \cup B) > P(A)$

26. 2704 **27.** $\frac{2}{5}$ **28.** $\frac{1}{1000}$

Section C

12. $\frac{1}{6}$ **13.** 0.08 **14.** 0.0024 **15.** $\frac{19}{20}$ **16.** 0.58

17. $A \cup B = \{x \mid \frac{1}{2} \leq x < 3\}$, $A \cap B = \{x \mid 1 < x < 2\}$ **18.** $\frac{1}{20}$ **19.** $\frac{1}{6}$

20. (1) $\frac{1}{6}$ (2) $\frac{3}{10}$ **21.** (1) 0.44 (2) 0.09 **22.** $\frac{17}{20}$

23. 0.976

Section D

1. $\frac{31}{80}$ **2.** $\frac{4}{25}$ **3.** $\frac{1}{2}$ **4.** $p(3-3p+p^2)$

5. (1) $\frac{9}{10}$ (2) $\frac{4}{5}$

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Exercise 2.1

1. Given distribution is a probability distribution of variable x.

2. $k = 30$ **3.** $k = \frac{24}{17}$, $P(1 < x < 4) = \frac{5}{17}$ **4.** $k = \frac{1}{7}$, Mean $= \frac{9}{7}$

5. Mean $= \frac{-1}{8}$, Variance $= \frac{135}{64}$

6. Probability distribution of sum

x	2	3	4	5	6	7	8	9	10	11	12	કુલ
$p(x)$	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$	1

Expected value of sum = 7

7. Probability distribution of x

x	1	2	3	Total
$p(x)$	$\frac{4}{20}$	$\frac{12}{20}$	$\frac{4}{20}$	1

Expected number of red balls = 2

8. Probability distribution of x

x	1	2	3	4	5	Total
$p(x)$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$	1

Mean $= \frac{31}{16}$, Variance $= \frac{367}{256}$

9. Expected value of the prize = ₹ $\frac{20}{3}$

Exercise 2.2

1. $p(X \leq 1) = \frac{9}{256}$ **2.** $n = 6,\ p = \frac{5}{6}$; $\frac{15625}{46656}$ **3.** 0.6912 **4.** 0.0729

5. 0.1382

Exercise 2

Section A

1. (d) **2.** (c) **3.** (c) **4.** (a) **5.** (d)

6. (d) **7.** (b) **8.** (b) **9.** (b) **10.** (b)

Section B

6. 14 **7.** $\frac{12}{5}$ **8.** $p + q = 1$ **9.** Mean > Variance **10.** 0.4

Section C

1. $C = 0.1$ **2.** $\frac{10}{3}$ **3.** 2.8 **4.** $\frac{1}{16}$ **6.** $\frac{8}{9}$

7. $\frac{4}{3}$ **8.** $n = 8,\ p = \frac{1}{2}$ **9.** 2 **10.** 0.96

Section D

1. $k = \frac{1}{5}; \frac{2}{5}$ **2.** $c = \frac{1}{10}$ **3.** $k = \frac{1}{326}$, Mean = $\frac{1305}{326}$ **6.** $\frac{54}{125}$, Mean = $\frac{9}{5}$

7. $\frac{1620}{16807}$ **8.** $p(1) = \frac{162}{625}$, $p(2) = \frac{216}{625}$ **9.** 0.0146, Variance = 0.54

Section E

1. Expected demand = 3.62, Variance = 2.2156

2.

x	0	1	2	Total
$p(x)$	$\frac{25}{36}$	$\frac{10}{36}$	$\frac{1}{36}$	1

3. (i) 0.9510 (ii) 0.0490 **4.** 0.1631 **5.** 0.3447 **6.** 0.5443

7. (i) 0.3599 (ii) 0.1066

Section F

(1)

x	0	1	2	3	Total
$p(x)$	$\frac{84}{220}$	$\frac{108}{220}$	$\frac{27}{220}$	$\frac{1}{220}$	1

Expected value $= \frac{165}{220}$, Variance $= 0.4602$

(2) 56

●

Exercise 3

Section A

1. (c) **2.** (d) **3.** (b) **4.** (a) **5.** (c)

6. (b) **7.** (d) **8.** (c) **9.** (a) **10.** (b)

11. (c) **12.** (d) **13.** (a) **14.** (b) **15.** (c)

Section B

2. 0 **4.** 0 **5.** Yes **6.** $z = 0$ **7.** Mean

8. 95.45 % **9.** 20 **10.** 4 **11.** 10 **12.** 18

13. (–0.675, 0.675) **14.** 25 **15.** No **16.** 1.5 **17.** 50

Section C

7. $Q_1 = 6.63$ **8.** 12 **9.** $Q_1 = 40$ **10.** (90, 110) **11.** ± 2.575

Section D

4. (1) 0.3413 (2) 0.6826 **5.** (1) 84.13 % (2) 97.72 % **6.** (1) 409 approximately

(2) 11 approximately **7.** (1) $Z_1 = 2.445$ (2) $Z_1 = 1.96$ **8.** (1) $Z_1 = -1.035$ (2) $Z_1 = -0.675$

9. (1) $Z_1 = -0.5$ (2) $Z_1 = 1.08$ **10.** $\mu = 2000$ $\sigma = 400$

11. $Q_1 = 95.95$, $Q_3 = 104.05$ **12.** (5, 95) **13.** $\mu = 15.75$

14. (1) $Q_1 = 193.25$, $Q_3 = 206.75$ (2) 6.67 (3) 8

Section E

1. (1) 0.3785 (2) 0.2426

2. No. of fat persons = 33, No. of healthy persons = 192, No. of physically weak persons = 11

3. (1) 6.06 % (2) 65.54 % (3) 78.81 % **4.** ₹ 8320 and ₹ 12,560

5. (49.44, 54.56) **6.** $x_1 = 55$, 8 weeks (approximately) **7.** $\sigma^2 = 1361.61$, 0.2148

8. $\mu = 21.15$ mm, 80.27 % **9.** $D_4 = 392.35$, $P_{90} = 438.4$

10. (1) 150 (2) 140

Section F

1. (1) 250 children (2) 30.54 % (3) 96 marks (approximately)

2. (i) 30.13 years (ii) 33.79 years (iii) 47.68 years

3. (a) 456 (b) 1846 (c) 16362 (d) 1336

4. N = 5051, ₹ 8350 **5.** $\mu = 62.12$, $\sigma = 17.28$, $Q_3 = 73.78\%$

6. $\mu = 4300$, $\sigma = 500$, (3320, 5280)

7. (1) $x_2 = 157$ (2) $x_1 = 68$ (3) 0.1401

8. (1) 50 (2) $Q_1 = 43.25$, $Q_3 = 56.75$ (3) $\frac{20}{3}$ (4) 8

●

Exercise 4.1

1. (1) Modulus form : $|x-4| < 0.4$

Interval form : (3.6, 4.4)

(2) Modulus form : $|x-2| < 0.02$

Interval form : (1.98, 2.02)

(3) Modulus form : $|x| < 0.05$

Interval form : (–0.05, 0.05)

(4) Modulus form : $|x+1| < 0.001$

Interval form : (–1.001, –0.999)

2. (1) Interval form : (1.99, 2.01)

Neighbourhood form : N (2, 0.01)

(2) Interval form : (–5.1, –4.9)

Neighbourhood form : N (–5, 0.1)

(3) Interval form : $\left(-\frac{1}{3}, \frac{1}{3}\right)$

Neighbourhood form : N $\left(0, \frac{1}{3}\right)$

(4) Interval form : (–3.15, –2.85)

Neighbourhood form : N (–3, 0.15)

3. (1) Modulus form : $|x-4.3|<0.5$

Neighbourhood form : N (4.3, 0.5)

(2) Modulus form : $|x-2|<0.05$

Neighbourhood form : N (2, 0.05)

(3) Modulus form : $|x-0.5|<0.9$

Neighbourhood form : N (0.5, 0.9)

(4) Modulus form : $|x-2|<0.002$

Neighbourhood form : N (2, 0.002)

4. Interval form : (15.5, 16.5)

Modulus form : $|x-16|<0.5$

5. $b = 0.05,\ k = 3.05$ **6.** $K_1 = 0.01,\ K_2 = 9.99$

Exercise 4.2

1. (1) 3 (2) 4 (3) 11 (4) –3 (5) 2

Exercise 4

Section A

1. (b) **2.** (c) **3.** (a) **4.** (b) **5.** (d)

6. (c) **7.** (d) **8.** (a) **9.** (a) **10.** (d)

11. (b) **12.** (c)

Section B

1. $(-0.09, 0.09)$ **2.** $|x+5|<0.001$ **3.** $N(10, \frac{1}{10})$ **4.** $\left(-\frac{1}{4}, \frac{1}{4}\right)$

5. $|x-50|<0.8$ **6.** $a = 7$ **7.** $k = -4.04$ **8.** 20 **9.** 2

10. 2 **11.** 80 **12.** ma^{m-1} **13.** $k = 10$ **14.** $k = 5$

Section C

4. $|x|<0.5$ **5.** $N(-8, 0.75)$ **6.** $K_1 = 20,\ K_2 = 20.5$

7. Neighbourhood form : $N\left(-\frac{1}{3}, \frac{2}{3}\right)$ Interval form : $\left(-1, \frac{1}{3}\right)$ **8.** $A_1 = 4$ $A_2 = 3.91$

Section D

1. 2 **2.** $\frac{1}{9}$ **3.** -8 **4.** 2 **5.** $\frac{7}{4}$

6. $\frac{3}{5}$ **7.** $-\frac{1}{3}$ **8.** $\frac{31}{3}$ **9.** $-\frac{1}{7}$ **10.** 1

11. 1 **12.** $-\frac{4}{3}p$ **13.** $\frac{27}{2}$ **14.** -64 **15.** $-\frac{2017}{2018}$

16. $\frac{7}{3}$ **17.** $\frac{2}{3}$

Section E

II. (1) 7 (2) 7 (3) -3 (4) -1

III. (1) $7x^6$ (2) $\frac{1}{10}$ (3) n (4) 1 (5) $3x^2$

(6) $7x^6$ (7) $\frac{1}{6}$ (8) 8 (9) 4 (10) 5

●

Exercise 5.1

1. 2 **2.** $2x$ **3.** $7x^6$ **4.** $\frac{-1}{(x+1)^2}$ **5.** $\frac{1}{3x^{\frac{2}{3}}}$

6. $\frac{-6}{(3x-4)^2}$ **7.** 0

Exercise 5

Section A

1. (c) **2.** (b) **3.** (a) **4.** (b) **5.** (d)

6. (d) **7.** (b) **8.** (c) **9.** (a) **10.** (a)

Section B

2. 0 **3.** 0 **5.** Negative **6.** Negative **11.** $14x-6$

12. $18x^2+7x+\frac{6}{5}$

Section C

8. $-\frac{3}{16x^{\frac{7}{4}}}$ **10.** 6 **11.** $90-x$ **14.** Decreasing **15.** $-\frac{1}{2}$

17. 1 **18.** $12x+10+\frac{24}{x^4}-\frac{60}{x^5}$ **19.** $\frac{-1}{4x^{\frac{3}{2}}}+\frac{3}{4x^{\frac{5}{2}}}$

20. $0.0024x-0.18$

Section D

1. a **2.** $10x^9$ **3.** $\frac{-8}{(3+4x)^2}$ **4.** 1 **5.** 45

6. $27x^2+36x+2$ **7.** $\frac{a^2-b^2}{(bx+a)^2}$ **8.** $\frac{1}{(x+1)^2}$ **9.** $\frac{-30}{(2x+3)^2}$

10. $\frac{-42}{(7x+8)^2}$ **11.** $\frac{x}{\sqrt{x^2+5}}$ **12.** $\frac{5}{2}(3x^3-2x^2+1)^{\frac{3}{2}}(9x^2-4x)$

13. $7(x^2+3x+4)^6(2x+3)$ **14.** $\frac{1}{3}$ **15.** $25-\frac{3x^2}{100}$

16. Function is decreasing at $x=1$

Function is decreasing at $x=2$

17. Function is decreasing at $x=\frac{1}{2}$

Function is decreasing at $x=3$

18. Function is increasing at $x = -4$

Function is decreasing at $x = 4$

19. Marginal cost $= \frac{x}{5} + 5$

$x = 100$, Marginal cost $= 25$

20. Marginal cost $= 2 + \frac{1}{2\sqrt{x}}$

$x = 100$ Marginal cost $= 2.05$

Section E

5. $\frac{50}{3}$ hundred tons **6.** $x = 25$, Minimum cost = 1400 **8.** $x = 10$, $p = 20$

9. $p = 30$, $x = 90$, $R = 2700$ **10.** $x = 250$, $p = 50$ **11.** $x = 200$, Maximum profit = 14,000

12. $x = 250$

Section F

1. y is maximum at $x = 2$, Maximum value of y is 40

y is minimum at $x = 3$, Minimum value of y is 39

2. $f(x)$ is maximum at $x = -3$, Maximum value of $f(x)$ is 91

$f(x)$ is minimum at $x = 2$, Minimum value of $f(x)$ is -34

3. $f(x)$ is maximum at $x = \frac{-1}{3}$, Maximum value of $f(x)$ is $\frac{59}{27}$

$f(x)$ is minimum at $x = 1$, Minimum value of $f(x)$ is 1

4. Profit function $= 1000x - 25x^2$

Profit is maximum at $x = 20$

5. 5000 refrigerators

6. 1750 toys