ANSWERS

Exercise 1.1

1. ₹ 5760, ₹ 42,240
2. ₹ 7500
3. 22
4. ₹ 50,000
5. ₹ 80,000
6. 20%
7. ₹ 5800, 6%
8. ₹ 1,00,000
9. Cash Sales = ₹ 66,000,
   Credit Sales = ₹ 36,000
10. 11.75%
11. Rs 47,500
12. ₹ 10,200
13. C.P. = ₹ 6400, marked price = ₹10,000
14. ₹ 4,464
15. ₹ 1,140

Exercise 1.2

1. ₹ 10500
2. ₹ 8333.33
3. ₹ 7560, ₹ 7000
4. 5 years.
5. 10 % p. a.
6. T. D. = ₹ 182.60, B. D = ₹ 190.80,
   B. G. = ₹ 8.20
7. 6% p. a.
8. B. D = ₹ 313.12, C. V. = ₹ 6621.88
9. 15th April 1998
10. ₹ 43800
11. 5 months
12. T.D. = ₹ 1200, B.D. = ₹ 1220,
    Amount = ₹ 73200
13. B. G. = ₹ 20, T. D. = 1000
14. r = 20%
15. ₹ 12,000

MISCELLANEOUS EXERCISE - 1

I)
1. b. Del credere agent
2. a. factor
3). c. nominal due date
4. a. The legal due date
5. a. Face Value
6. b. Present worth
7. d. True discount
8. b. List Price
9. b. Invoice price = Net selling price
10. b. True discount

II)
1. Drawer
2. Auctioneer
3. Catalogue/list
4. Commercial Discount
5. higher
6. Bankers Gain
7. Legal due date
8. A broker
9. Trade, Catalogue / list
10. Invoice Price

III)
1. Flase
2. False
3. True
4. False
5. True
6. False
7. False
8. True

9. False
10. True.

IV)
1. ₹ 5125
2. ₹ 75,00,000
3. ₹ 1989, ₹ 28611
4. ₹ 1,00,000
5. 8% p. a.
6. C. P. = ₹ 650
7. Salary = ₹ 8000, r = 10%
8. 100
9. ₹ 6923
10. 5 months
11. ₹ 4000, ₹ 4080, ₹ 2,04,000
12. 13%
13. ₹ 1280
14. ₹ 120, ₹ 4680
15. 14th November
16. ₹ 50,000, ₹ 2500
17. ₹ 18000, ₹ 33,000.

Exercise 2.1

1. (i) ₹ 75,000 (ii) ₹ 60,000
2. ₹ 2430, ₹ 364.5
3. 3.25%, ₹ 1430
4. ₹ 2,25,000
5. ₹ 3,85,714.3
6. 50,000 kg
7. ₹ 71,040
8. ₹ 3,60,000
9. From Company A : ₹ 3600
   From Company B : ₹ 2250
   From Company C: ₹ 3150
10. ₹ 1,40,000
11. ₹ 153.6
12. ₹ 5595.8
13. ₹ 1,90,400
14. ₹ 1,40,000

Exercise 2.2

1. ₹ 2,597
2. ₹ 23,205
3. ₹ 1,05,000
4. ₹ 42,475
5. ₹ 91,120
6. ₹ 1,83,555
7. ₹ 1,00,000
8. ₹ 1,50,000
9. 200% p. a.
10. 3 years
11. ₹ 3,641
12. ₹ 824.16
13. ₹ 2,146.5
14. ₹ 2,400
15. ₹ 31,944
16. ₹ 3,703.70

MISCELLANEOUS EXERCISE - 2

I) 1 c 2. d 3. d 4. d 5. c 6. b
7. c 8. b 9. b 10. d

II)
1. premium
2. life
3. property value
4. policy value
5. annuitant
6. installment
7. payment period
8. perpetuity
9. annuity due
10. immediate annuity OR ordinary annuity.

III) 1. F 2. T 3. F 4. T 5. T 6. T
7.F 8 T 9 F 10 T.

IV)
1. ₹ 432
2. ₹ 96,000
3. ₹ 18,00,000
4. ₹ 85,000
5. ₹ 1,07,000
6. ₹ 32,800
7. ₹ 26,000
8. 16,000 kg
9. 875
10. ₹ 58,800
11. ₹ 78,000 , ₹ 144
12. ₹ 38,400 , ₹ 17,052
13. ₹ 2,07,400

14. ₹ 13,435
15. ₹ 23,201.85
16. 12 years
17. 5% p.a.
18. ₹ 41,250
19. ₹ 49,740
20. ₹ 4550 , ₹ 1930
21. ₹ 2,00,000
22. ₹ 52,500
23. ₹ 4 years
24. ₹ 21,778.60

Exercise 3.1

1) (i) $y = 2 + 0.75x$
   (ii) $y =$ ₹ 11750
2) (i) $x = y + 6$ (ii) $y = 0.87x - 4.18$
3) (i) –0.8 (ii) – 0.4, –0.4 (iii) – 0.4
4) 12.73
5) (i) $y = 1.16x - 10.4$
   Estimate of $y = 99.8$
   (ii) $x = 0.59y + 26.65$,
   Estimate of $x = 70.9$
6) $y = -1.34x + 18.04$
7) $y = 0.3x + 62.1$
8) $y = 2x + 3$, $x = 0.5y - 1.5$
9) $y = -0.65x + 11.9$,
   $x = -1.3y + 16.4$
10) (i) $y = 2x - 1$, (ii) $y = 7$
11) (i) $y = 0.63x + 2.8$, (ii) $y = 9.1$
12) $y = 6.6x + 38.36$

Exercise 3.2

1) (i) – 0.6 (ii) 31.6 (iii) 53.9
2) (i) $5x + 24y = 3251$
   (ii) $6x + 5y = 1664$ (iii) $-\frac{5}{12}$
3) (i) $y = 0.36x + 35.6$ (ii) $x = 2.19y - 64.21$
   (iii) 0.8879
4) (i) $y = 3.2x + 58$, $x = 0.2y - 8$
   (ii) ₹ 106 lakh (iii) ₹ 16 lakh
5) (i) Inconsistent as $\frac{b_{xy} + b_{yx}}{2} <$ r
   (ii) Inconsistent as sign of $b_{yx.} b_{xy}$ and r are not same.
   (iii) Inconsistent as sign of $b_{yx.}$ and b_{xy} are not same
   (iv) Consistent.
6) $x = 0.82y + 10.24$
7) (i) $y = 14.375$ (ii) $x = 23.5$
8) (i) $y = 0.72x + 28.8$, $x = 0.5y + 40$.
   (ii) $x = 90$
9) $x = 0.14y + 5.528$, $x = 6.928$
10) $y = 182$
11) i) $x =$ ₹ 64 (ii) $y =$ ₹ 8.7
12) $x = 11.2$ (ii) $y = 15.8$

Exercise 3.3

1) $\bar{x} = 2, \bar{y} = 8.25, r = 0.6$
2) (i) $\bar{x} = 13, \bar{y} = 17$ (ii) $= 0.6$ (iii) $\sigma_y = 4$
3) $\bar{x} = 62.4, r = 0.8$
4) 4
5) (i) $r = \frac{-2}{3}$ (ii) $\frac{\sigma_x}{\sigma_y} = 1$
6) 32.5
7) $\bar{x} = 28, \bar{y} = 5.75, r = 0.5$
8) (i) $\bar{x} = 4, \bar{y} = 5.2$ (ii) 0.375 (iii) $\frac{8}{3}$
9) (i) $\bar{x} = 17$ (ii) $\bar{y} = 19$ (iii) $b_{yx} = \frac{3}{4}$
   iv) $b_{xy} = \frac{1}{2}$ (v) $r = 0.61$
10) (i) $\bar{x} = 30, \bar{y} = 40$ (ii) $r = \frac{2}{3}$
11) (i) x on y is $10x + 3y - 62 = 0$

(ii) $\bar{x}=5,\ \bar{y}=4$ (iii) $r=-0.6$

12) (i) $r=0.6$ (ii) $\bar{x}=10,\ \bar{y}=20$

13) (i) $\bar{x}=17$, (ii) $\bar{y}=19$, (iii) $b_{yx}=\frac{3}{4}$

(iv) $b_{xy}=\frac{1}{2}$ (v) $r=0.61$

14) (i) $\bar{x}=60,\ \bar{y}=100$ (ii) $y=137.5kg$

MISCELLANEOUS EXERCISE - 3

I) 1) c 2) a 3) b 4) a 5) b 6) b 7) a 8) c 9) c 10) b 11) b 12) b 13) a 14) b 15) b 16) c 17) a 18) b 19) a 20) b 21) a 22) d 23) b 24) b

II) 1) Negative

2) $y-\bar{y}=b_{yx}(x-\bar{x})$

3) $x-\bar{x}=b_{xy}(y-\bar{y})$

4) 2

5) –1

6) $\frac{c}{d}b_{uv}$

7) $\frac{d}{c}b_{vu}$

8) 2|r|

9) <1

10) r^2

III) 1) True 2) False 3) True 4) True 5) False 6) False 7) False 8) True 9) True 10) True.

IV)

1) $y = 2.588x + 8.2$ For $x = 1.5$ $y = 12.082$

2) $byx = -\frac{3}{2}$

3) $y = 8$

4) i) $r=\frac{1}{3}$ (ii) $6_y^2=\frac{16}{9}$

5) Equation of y on x is $2x + 3y = 6$ and equation of x on y is $5x + 7y – 12 = 0$

6) (i) r = –0.6, ii) $\bar{x}=1, \bar{y}=-1$

7) (i) $\bar{x}=4, \bar{y}=7$ (ii) r = – 0.5 (iii) 10 (iv) 4

8) $(x-4)=\frac{6}{11}(y-5)$

9) $y = 3.75x – 39$.

10) $y = 0.7x + 105$, $y = 133$

11) (i) $\bar{x}=10, \bar{y}=5$ (ii) $b_{yx} = 0.9$, $b_{xy} = 0.4$
iii) V(*X*) = 16 (iv) r = 0.6

12) r = –0.36 moderate negative correlation

Exercise 4.1

2. Equation of trend line:
$y_t = 4.182 + (1.036)u$. where $u = t – 1967$.

Year	Trend Value	Year	Trend Value
1962	–1.0000	1967	4.1818
1963	0.0364	1968	5.2182
1964	1.0727	1969	6.2545
1965	2.1091	1970	7.2909
1966	3.1455	1971	8.3273
		1972	9.3636

For the year 1975, trend value = 12.4732 (in ‘000 tones)

3.

Year	Trend Value	Year	Trend Value
1962	–	1968	5.2
1963	–	1969	6.4
1964	1.2	1970	7.6
1965	1.6	1971	–
1966	2.4	1972	–
1967	4		

5. Equation of trend line:

$y_t = 4.2 + (0.4485)u$, where $u = 2t - 3961$

Year	Trend Value	Year	Trend Value
1976	0.1636	1981	4.6485
1977	1.0606	1982	5.5455
1978	1.9576	1983	6.4424
1979	2.8545	1984	7.3394
1980	3.7515	1985	8.2364

For the year 1987, trend value = 10.0305.

6.

Year	Trend Value
1976	–
1977	–
1978	2.25
1979	2.75
1980	3.25
1981	3.875
1982	4.875
1983	6.25
1984	–
1985	–

8. Equation of Trend line:

$y_t = 5.6364 + (0.7909)\ u$, where, $u = t - 1981$

Year	Trend Value	Year	Trend Value
1976	1.1618	1982	6.4273
1977	2.4727	1983	7.2182
1978	3.2636	1984	8.0091
1979	4.0545	1985	8.8000
1980	4.8455	1986	9.5909
1981	5.6364		

The trend value for the year 1990 = 12.7545 (in million tonnes.)

9.

Year	Trend Value	Year	Trend Value
1976	–	1982	7.3333
1977	2.6667	1983	6.0000
1978	3.3333	1984	7.6667
1979	4.0000	1985	8.0000
1980	5.3333	1986	–
1981	6.3333		

10. (i)

Year	Trend Value	Year	Trend Value
1962	–	1969	5
1963	–	1970	6
1964	0.8	1971	7
1965	1.4	1972	7.6
1966	2.2	1973	8.2
1967	3	1974	8.8
1968	4	1975	–
		1976	–

MISCELLANEOUS EXERCISE - 4

I) 1. (d) 2. (c) 3. (c) 4. (c) 5. (a) 6. (d) 7. (a) 8. (a) 9. (b) 10. (a)

II) 1. trend 2. seasonal 3. cyclical 4. irregular 5. assume 6. does not assume 7. graphical 8. moving average 9. least square 10. trend

III) 1. F 2. T 3. F 4. F 5. F 6. T 7. F 8. F 9. F 10. F

IV) 2. Euqation of trend line.

$y_t = 6.3333 + (0.6333)\ u$, where $u = t - 1978$

Year	Trend Value	Year	Trend Value
1974	3.8	1979	6.9667
1975	4.4333	1980	7.6000
1976	5.0667	1981	8.2333
1977	5.7	1982	8.8667
1978	6.3333		

3.

Year	Trend Value	Year	Trend Value
1974	–	1979	6.8
1975	–	1980	7
1976	6	1981	–
1977	7	1982	–
1978	7	1986	–

5. Equation of trend line:

$y_t = 3.1667 + (0.2797)u$, where $u = 2t - 3953$.

Year	Trend Value	Year	Trend Value
1971	0.0897	1977	3.4464
1972	0.6492	1978	4.0058
1973	1.2086	1979	4.5653
1974	1.7681	1980	5.1247
1975	2.3275	1981	5.6841
1976	2.8867	1982	6.2436

6.

Year	Trend Value
1971	–
1972	–
1973	1.25
1974	1.75
1975	2.25
1976	3
1977	3.75
1978	3.875
1979	3.875
1980	4.5
1981	–
1982	–

8. Equation of trend line:

$yt = 5.1 + (0.4758)u$, where $u = \frac{2t-3965}{5}$

Year	Trend Value	Year	Trend Value
1960	0.8182	1985	5.5758
1965	1.7697	1990	6.5273
1970	2.7212	1995	7.4788
1975	3.6727	2000	8.4303
1980	4.6242	2005	9.3818

Trend value for the year 2010 = 10.3338%

9.

Year	Trend Value
1960	–
1965	–
1970	3
1975	3.75
1980	4.375
1985	5.25
1990	6.25
1995	7.375
2000	–
2005	–

11. Equation of trend line:

$y_t = 4.8750 + (0.4702)u$, where $u = 2t - 3961$

Year	Trend Value	Year	Trend Value
1977	1.5833	1981	5.3452
1978	2.5238	1982	6.2857
1979	3.4643	1983	7.2262
1980	4.4048	1984	8.1667

Trend value for the year 1988 = 11.928 (in ten thousands).

12.

Year	Trend Value	Year	Trend Value
1977	–	1981	7.3333
1978	1.3333	1982	6.3333
1979	3.6667	1983	5.6667
1980	7.0000	1984	–

14. Equation of trend line:

$y_t = 5.2222 + (0.667)\, u$, where $u = t - 1979$

Year	Trend Value	Year	Trend Value
1975	2.5556	1980	5.8889
1976	3.2222	1981	6.5556
1977	3.8889	1982	7.2222
1978	4.5556	1983	7.8889
1979	5.2222	1994	–

Trend value for the year 1984 = 8.5557.

15.

Year	Trend Value
1975	–
1976	–
1977	4.5
1978	5.125
1979	5.625
1980	5.375
1981	6
1982	–
1983	–

17. Equation of trend line:

$yt = 4.286 + (-1.571)u$, where $u = \dfrac{t-1995}{5}$

Year	Trend Value	Year	Trend Value
1980	9.0000	2000	2.7143
1985	7.4286	2005	1.1429
1990	5.8571	2010	0.427
1995	4.2857		

Trend value for the year 2012 = –1.0554 (per '000).

18.

Year	Trend Value	Year	Trend Value
1980	–	2000	2.6667
1985	7.3333	2005	1.3333
1990	5.3333	2010	–
1995	4		

19. Equation of trend line:

$y_t = 2.4 + (0.2848)\, u$, where $u = 2t - 3927$

Year	Trend Value	Year	Trend Value
1959	–0.1636	1964	2.6848
1960	0.4061	1965	3.2545
1961	0.9758	1966	3.8242
1962	1.5455	1967	4.3939
1963	2.1152	1968	4.9636

20.

Year	Trend Value	Year	Trend Value
1959	–	1964	1.67
1960	1	1965	1.67
1961	2	1966	2.33
1962	2	1967	4.33
1963	1.33	1968	–

Exercise 5.1

1. 165.45
2. 137.5
3. 130.41
4. 170.7
5. 130
6. 132.08
7. 140
8. 75
9. 124.29
10. 130.71
11. 155.28
12. $x = 15$
13. $y = 60$

Exercise 5.2

1. $P_{01}(L) = 164.29$, $P_{01}(P) = 164.18$, $P_{01}(D - B) = 164.24$, $P_{01}(M - E) = 164.24$.

2. $P_{o1}(L) = 161.11$, $P_{o1}(P) = 161.82$, $P_{o1}(D–B) = 161.46$, $P_{o1}(Al – E) = 161.42$.

3. $P_{o1}(w) = 72.11$

4. $P_{o1}(w) = 132.07$

5. $P_{o1}(D–B) = 65$, $P_{o1}(F) = 60$.

6. $P_{o1}(L) = 250$, $P_{o1}(P) = 230$, $P_{o1}(D – B) = 240$, P_{o1} (id – E) = 238.24.

7. $P_{o1}(P) = 168.04$

8. P_{o1} (L) = 250.

9. $x = 2$.

10. $P_{o1}.(D – B) = \frac{5}{4} P_{o1}(F)$

11. $P_{o1}(P) = 8$ and $P_{o1}(L) = 2$ or vice versa

Exercise 5.3

1. 135.04	2. 116.25	3. 113.3
4. 77	5. 205.88	6. 169.33
7. $x = 18$	8. $y = 6$	9. ₹ 16000

MISCELLAISEOUS EXERCISE - 5

I) 1. (c) 2. (c) 3. (d) 4. (c) 5. (c) 6. (d) 7. (c) 8. (d) 9. (c) 10. (a) 11. (a) 12. (a) 13. (a) 14. (a) .

II) 1. $\frac{\sum p_1}{\sum p_0} \times 100$

2. $\frac{\sum q_1}{\sum q_0} \times 100$

3. $\frac{\sum p_1 q_1}{\sum p_0 q_0} \times 100$

4. $\frac{\sum p_1 w}{\sum p_0 w} \times 100$

5. $\frac{\sum q_1 w}{\sum q_0 w} \times 100$

6. $\frac{\sum p_1 q_1 w}{\sum p_0 q_0 w} \times 100$

7. $\frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

8. $\frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$

9. $\frac{1}{2}\left[\frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1}\right] \times 100$

10. $\sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100$

11. $\frac{\sum p_1 (q_0 + q_1)}{\sum p_0 (q_0 + q_1)} \times 100$

12. $\frac{\sum p_1 \sqrt{q_0 q_1}}{\sum p_0 \sqrt{q_0 q_1}} \times 100$

III) 1.T 2.F 3.F 4.F 5.F 6.F 7.F 8.F 9.F 10.F

IV)
1. 154.55
2. 135.48
3. 121.43
4. 42
5. $P_{oi}(L) = 136.19$ $P_{o1}(P) = 137$
6. $P_{o1}(D – B) = 182$
7. $P_{o1}(M – E) = 107.14$
8. $P_{oi}(W) = 170$
9. $P_{01}(L) = 181.82$, $P_{01}(P) = 172.22$
10. $x = 6$
11. $x = 16.6$
12. 10.75
13. P01(D – B) = 20.5, P01(F) = 20
14. $P_{01}(P) = 155.4$

15. P_{01} (L) = 166.67,
P_{01} (P) = 87.5, P_{01} (D – B) = 127.085,
P_{01}(M–E) = 121.42.

16. P_{01} = 153.85,P_{01}
(P) = 87.5.P_{01}(D – B) = 120.68, P_{01}
(M–E) = 117.24

17. $\sum p_1 q_0$ = 228, P_{01}(L) = 190

18. 106.42

19. 86.5

20. 295.25, Its. 29,525

21. X = 15

22. ₹ 18,900

Exercise 6.1

1. Maximize z = $30x + 20y$ Subject to
$10x + 6y \leq 60$, $5x + 4y \leq 35$, $x \geq 0$, $y \geq 0$

2. Minimize z = $3x + 2y$ Subject to
$2x + y \geq 14$, $2x + 3y \geq 22$, $x + y \geq 1$, $x \geq 0$,
$y \geq 0$

3. Maximize P = $350x + 400y$ subject to
$3x + 2y \leq 120$, $2x + 5y \leq 160$, $x \geq 0$, $y \geq 0$

4. Maximize z = $10x + 15y$ Subject to
$2x + 3y \leq 36$, $5x + 2y \leq 50$, $2x + 6y \leq 60$
$x \geq 0$, $y \geq 0$

5. Maximize P = $13.5x + 55y$ Subject to
$x + 2y \leq 10$, $3x + 4y \leq 12$,
$x \geq 0$, $y \geq 0$

6. Maximize z = $500x + 750y$ Subject to
$2x + 3y \leq 40$, $x + 4y \leq 70$, $x \geq 0$, $y \geq 0$

7. Minimize z = $4.5x + 3.5y$ Subject to
$4x + 6y \geq 18$, $14x + 12y \geq 28$, $9x + 8y \geq 14$
$x \geq 0$, $y \geq 0$

8. Maximize z = $x_1 + x_2$ Subject to
$x_1/60 + x_2/90 \leq 1$, $5x_1 + 8x_2 \leq 600$, $x \geq 0$,
$y \geq 0$

9. Minimize C = $20x_1 + 6x_2$ Subject to
$x_1 \geq 4$, $x_2 \leq 2$, $x_1 + x_2 \geq 5$, $x_1 \geq 0$, $x_2 \geq 0$

Exercise 6.2

1. $x = 4$, $y = 2$, $z = 60$
2. $x = 0$, $y = 6$, $z = 36$
3. $x = 4.5$, $y = 2.5$, $z = 59$
4. $x = 2$, $y = 3$, $z = 95$
5. $x = 4$, $y = 5$, $z = 37$
6. $x = 0$, $y = 5$, $z = 5$
7. $x = 1.5$, $y = 4$, $z = 52$
8. $x = 2$, $y = 0.5$, $z = 22.5$

MISCELLAISEOUS EXERCISE - 6

I)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
d	c	b	c	a	d	c	b	a	b	b	b	a	c	c

II) 1) I 2) III 3) vertex
4) III and IV 5) $y > x$
6) $x \geq 3$, $y \geq 2$, 7) $x \geq 2y$
8) $x \leq 40$

III) 1), 4), 5), 6), 7) are true and 2), 3) are false.

IV) Subject to

1. $x_1 = 4.5$, $x_2 = 3$ Max z = 40.5
2. $x = 3$, $y = 18$, Min z = 48
3. infinite number of optimum solution on the line $3x + 5y = 10$ between A (45/16, 5/16) and B(0,2)
4. $x_1 = 2$, $x_2 = 1$ Min. z = 7.
5. $x = 4$, $y = 3$ Max z = 25
6. $x = 10$, $y = 15$ Max z = 1350
7. $x = 3$, $y = 18$ Min z = 48.
8. Max z = $140x + 210y$ Subject to
$3x + 3y \leq 36$, $5x + 2y \leq 50$, $2x + 6y \leq 60$

$x, y \geq 0$ where x = No of tables = 3
y = no of chairs = 9.
Max z = maximum profit = ₹ 2310/–

9. Maximize z = $180x + 220y$ Subject to
$6x + 4y \leq 120$, $3x + 10y \leq 180$
$x \geq 0, y \geq 0$ Ans. $x = 10, y = 15$.

10. Minimize z = $4x + 6y$ Subject to
$x + 2y \geq 80$, $3x + y \geq 75$, $x \geq 0, y \geq 0$
Ans. $x = 14, y = 33$

11. Maximize z = $2000x + 3000y$ Subject to
$3x + 3y \leq 36$, $5x + 2y \leq 50$, $2x + 6y \leq 60$,
$x \geq 0, y \geq 0$ Ans. $x = 3, y = 9$

12. Minimize z = $800x + 640y$ Subject to
$4x + 2y \geq 16$, $12x + 2y \geq 24$
$2x + 6y \geq 18$, $x \geq 0, y \geq 0$
Ans. Minimum cost = ₹ 3680/–
when $x = 3, y = 2$

13. Maximize z = $75x + 125y$ subject to
$4x + 2y \leq 208$, $2x + 4y \leq 152$, $x \geq 0, y \geq 0$
Ans $x = 44$, $y = 16$

14) Max z = $3x + 4y$, s.t. $x + y \leq 450$, $2x + y \leq 600$ $x, y \geq 0$
Maximum Profit = ₹ 1800/– at (0, 450)

15. Max z = $20x + 30y$, s.t. $3x + 2y \leq 210$, $2x + 4y \leq 300$ $x, y \geq 0$
Maximum Profit = ₹ 2400/– at (30, 60)

Exercise 7.1

1. P → II Q →1V, R → I, S → III Total cost = ₹ 99
2. 1 →I, 2→Ill, 3→IV, 4 → II, 5 → V Total milage = 39 miles
3. 1→C, 2→E 3→A, 4→D, 5→B Total profit = ₹ 214
4. M1→A, M2 → B, M3 → E, M4 → D, M5 → C Total cost = ₹ 12
5. 1 → A, 2 → C, 3 → B, 4 → D Total Profit = ₹ 61
6. M1 → A, M2→ B, M3 → E, M4 →D Total cost = ₹ 32

Exercise 7.2

1. Optimal sequence is : 4 –1–3 – 2 – 5 – 6
Idle time for turning operation = 1 min
Total elapsed time = 43 minutes Idle time for threading = 6 minutes

2. Optimal sequence is : I — III — II Total
Idle time for department A = 4 days
elapsed time = 23 days Idle time for department B = 8 days

3. Optimal sequence is : 1 –2– 3
Idle time for data entry operation = 100 min.
Total elapsed time = 490 minutes — Idle time for filing = 140 min.

4. Optimal sequence is : B – D – C – E – A
Idle time for machine X = 4 hrs
Total elapsed time = 60 hrs. Idle time for machine Y = 6 hrs.

5. Optimal sequence is : VII – I – IV – V – III – II – VI OR VII – I – IV – V – II – III – VI
Idle time for machine A = 5 units.
Idle time for machine B = 13. Total elapsed time = 91 units.

6.

1) Optimal sequence is : V – III – II – VI – VII – IV – I OR III – V – II – VI – VII – IV – I Total elapsed time = 61 hrs Idle time for machine B = 38 hrs. Idle time for machine A = 7 hrs. Idle time for machine C = 15 hrs.

2) Total elapsed time = 40
OR 5 – 4 – 3 – 2 – 1

2 – 5 – 4 – 3 – 1 Total elapsed time = 40 hrs. Idle time for machine A = 8 hrs. Idle time for machine C = 12 hrs machine B = 25 hrs.

7. Optimal sequence is : D – A – E – B – C OR A – D – E – B – C OR E – D – A – B – C Total elapsed time = 51 hrs. Idle time for machine P = 19 hrs. Idle time for machine Q = 31 hrs. Ideal time for machine R = 9 hrs.

MISCELLANEOUS EXERCISE - 7

I)

1	2	3	4	5	6	7	8	9	10
c	b	c	d	b	d	a	a	d	c

11	12	13	14
a	a	b	b

II)

1. Number of rows is not equal to the number of columns.
2. Balanced
3. Square
4. Square
5. Zero
6. Total elapsed time
7. Idle time
8. Maximum
9. Multiple
10. A–D–B–C

III) 1. False 2. True 3. False 4. True 5. False 6. True 7. True 8. False 9. True 10. False

PART - I

IV)

1. A → I, B →III, C →II, D → IV; Minimum man hours = 37
2. A →II, B →III, C → V, D →I, E → IV; Minimum distance travelled = 525 kms
3. A → V, B →II, C → IV, D → III, E →I; Maximum Sale = 65 units
4. P→IV, Q → III, R → V, S →I, T →II;
5. A → IV, B → III, C → II, D → V, E →I
   A → IV, B→ III, C →V, D → II E → I;
6. E_1 →1, E_2 →IV, E_3 → II, E_4 → V, E_5 → III Minimum number of days = 27.

PART - II

1. Optimal sequence: 3–4–5–7–2–6–1;
   Idle time for cutting = 2 hrs;
   Total elapsed time = 46 hrs; Idle time for sewing = 4 hrs.
2. Optimal sequence: II–IV–V–III–1;
   Idle time for Lathe = 4 hrs;
   Total elapsed time = 21 hrs Idle time for surface grinder = 3 hrs
3. Optimal sequence: III–V–II–VI–I–IV–VII;
   Idle time for machine A = 3 hrs;
   Total elapsed time 55 hrs Idle time for machine B = 9 hrs
4. Optimal sequence: 3–2–5–4–1; OR 3–2–1–4–5 OR 3–2–5–1–4
   Idle time for machine A = 18 hrs;
   Idle time for machine B = 62 hrs
   Idle time for machine C = 38 hrs
   Total elapsed time 102 hrs.
5. Optimal sequence is : 3–1–4–2;
   Idle time for Shaping = 12 min.;
   Idle time for Trapping = 31 min.
   Idle time for Drilling = 51 min.
   Total elapsed time = 74 min.

Exercise 8.1

1. {–6, –4, –2, 0, 2, 4, 6}
2. {0, 1, 2}
3. (i) Probability distribution. All entries are positive and add to 1. (ii) Not a probability distribution. Probability cannot be negative.

(iii) Probability distribution. All entries are positive and add to 1. (iv) Probability distribution. All entries are positive and add to 1. (v) Not a probability distribution. Probabilities do not add to 1. (vi) Not a probability distribution.Probabilites do not add to 1.

4. (i)

x	0	1	2
$P(x)$	1/4	1/2	1/4

(ii)

x	0	1	2	3
$P(x)$	1/8	3/8	3/8	1/8

(iii)

x	0	1	2	3	4
$P(x)$	1/16	1/4	3/8	1/4	1/16

5.

x	0	1	2
$P(x)$	4/9	4/9	1/9

6.

x	0	1	2
P(x)	$(4/5)^4$	$4(4/5)^3$ $(1/5)$	$6(4/5)^2$ $(1/5)^2$
x	3	4	
P(x)	4 $(4/5)(1/5)^3$	$(1/5)^4$	

7.

x	0	1	2
$P(x)$	9/16	3/8	1/16

8. (i) 1/10 (ii) 3/10 (iii)3/10 (iv)1/5 = 0.2
9. –0.05, 2.2475
10. 7/2 = 3.5 m 35/12
11. 1.5
12. 1/3
13. 14/3 = 4.667
14. 35/6 = 5.8333,
15.

x	14	15	16	17
P $(X = x)$	2/15	1/15	2/15	3/15
x	18	19	20	21
P $(X = x)$	1/15	2/15	3/15	1/15

Mean = 17.5333, Variance = 4.9

16. 0.7, 0.21

Exercise 8.2

1. (i) p. d. f. (ii) not p. d. f.
2. (i) 2.25/16, (ii) 3/16 (iii) 3/4
3. (i) p. d. f. (ii) 1/256 (iii) 5/16
4. (i) 1/2, 3/64 (ii) 6, (a) 11/32, (b) 1/2
5. (i)1/4 (ii) 1/2 (iii) 7/16
6. (i) 2/5 (ii) 1/5
7. k = 3/32 (i) 1/2 (ii) 11/16 (iii) 81/128
8. (i) $x^2/16$ for $0 < x < 4$ (ii) 1/64, 2.89/16, 1
9. (i) 1/8 (ii) 0, (iii) 1 (iv) 7/8
10. (i) 1/log(3), (ii) 2/log (3),

(iii) $\frac{4[log3-1]}{[log3]^2}$, $F(x) = \frac{\log x}{\log 3}$, $1 < x < 3$

Exercise 8.3

1. (i) 0.375 (ii)0.3125 (iii)0.6875
2. 5/72
3. $1.3 \times (0.9)^3$
4. (i) 1/1024 (ii) 45/512 (iii) $(3/4)^5 = 0.2373$
5. (i) $(0.8)^5$ (ii) $(1.8)(0.8)^4$ (iii)$1 - (1.8)(0.8)^4$ (iv) $1 - (0.8)^5$
6. $(9/10)^4$
7. 11/243
8. $(7/3)\ (5/6)^5$
9. (i) 4 , 2.4 (ii) 6, 2.4 (iii) 2/5, 6 (iv) 1.6

Exercise 8.4

1. 0.7357
2. 0.0126
3. 0.8012
4. (i) 0.1465 (ii) 0.2381
5. (i) 0.2231 (ii) 0.1911
6. (i) 0.3678 (ii) 0.6322
7. (i) 0.1744 (ii) 0.3875 (iii) 0.4236

MISCELLANEOUS EXERCISE - 8

I) 1. d 2. a 3. b 4. d 5. c
6. b 7. b 8. a 9. b 10. a

II)

1. Counting 2. Measurement
3. 1 4. 1
5. 0 6. Centre of gravity
7. Distribution function
8. Remains constant / independent
9. Poisson

III) 1. False 2. True 3. True 4. True 5. True
6. False 7. True 8. True 9. True

SOLVED EXAMPLES

PART - I

1. (i) Discrete, {0,1,2,....., 100000}
(ii) Continuous (iii) Continuous
(iv) Discrete {0,1,2,3,4,5}. (v) Continuous.
2. (i) 1/21 (ii) 10/21, 1/7, 6/7
3. (i)0.5 (ii) 0.7 (iii) 0.55 (iv) 0.45
4. Bothe probabilities are 1/2 and therefore are equal.
5. a = 1/4

x	1	2	3	4	5
$P(x)$	1/20	3/20	1/4	1/2	1/20
$F(x)$	1/20	1/5	9/20	19/20	1

6. The distribution of X is binomial with n = 4 and p = 1/2. The formula of its p. m. f. is as follows. $P(X = x) = \binom{4}{x}\frac{1}{2^4}$.

The probability distribution of X is tabulated below.

x	0	1	2	3	4
$P(x)$	1/16	1/4	3/8	1/4	1/16

7. (i)

x	0	1	2
$P(x)$	4/9	4/9	1/9

(ii)

x	0	1	2
$P(x)$	25/36	10/36	1/36

8. (i) 1/10 (ii) 3/10 (iii) 17/100 (iv) 3/10
9. $P(-1 \le x \le 2) = 0.55$

x	-3	-2	-1	0	1	2	3	4
$F(x)$	0.1	0.3	0.5	0.65	0.75	0.85	0.9	1
$P(x)$	0.1	0.2	0.2	0.15	0.10	0.10	0.05	0.10

10. (i) 11/5, 14/25 (ii) 1/5, 14/25
(iii) $(n + 1)/2$, $(n^2 - 1)/12$ (iv) 2.5, 1.25
11. ₹ 5.5, ₹ 8.25
12. 0, 1
13. (i) 1/2 (ii) 11/16 (iii) 81/128
14. Both probabilities are 1/4 and hence are equal.
15. $k = \theta, 1/e, \frac{1}{\theta}\log 2$
16. $k = 1/4$, $F(2) = \frac{1}{\sqrt{2}}$, $P(X \ge 1) = 1/2$
17. 1/2

PART - II

1. (i) $2(0.8)^9$ (ii) $1 - (0.8)^{10}$ (iii) $1 - (8.2)(0.2)^9$
2. (i) $p = 1/2$, $\text{Var}(X) = 2.5$ (ii) (i) $n = 10$, $p = 1/2$
3. (i) 1/4, (ii) 1/16
4. $\frac{128}{625}$
5. 0.784
6. 0.9477
7. 0.3456
8. $\frac{1}{64}$
9. (i) 0.729
10. (i) 0.729 (ii) 0.243
11. (i) 0.4096
    (ii) 0.8192
12. (i) $\frac{560}{2187}$ (ii) $\frac{416}{729}$
13. m = 1, v(x) = 1
14) m = 2