EXERCISE 16.1

1. {HHH, HHT, HTH, THH, TTH, HTT, THT, TTT}
2. $\{(x, y) : x, y = 1,2,3,4,5,6\}$
   or {(1,1), (1,2), (1,3), ..., (1,6), (2,1), (2,2), ..., (2,6), ..., (6, 1), (6, 2), ..., (6,6)}
3. {HHHH, HHHT, HHTH, HTHH, THHH, HHTT, HTHT, HTTH, THHT, THTH, TTHH, HTTT, THTT, TTHT, TTTH, TTTT}
4. {H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6}
5. {H1, H2, H3, H4, H5, H6, T}
6. $\{XB_1, XB_2, XG_1, XG_2, YB_3, YG_3, YG_4, YG_5\}$
7. {R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, W6, B1, B2, B3, B4, B5, B6}
8. (i) {BB, BG, GB, GG} (ii) {0, 1, 2}
9. {RW, WR, WW}
10. [HH, HT, T1, T2, T3, T4, T5, T6}
11. {DDD, DDN, DND, NDD, DNN, NDN, NND, NNN}
12. {T, H1, H3, H5, H21, H22, H23, H24, H25, H26, H41, H42, H43, H44, H45, H46, H61, H62, H63, H64, H65, H66}
13. {(1,2), (1,3), (1,4), (2,1), (2,3), (2,4), (3,1), (3,2), (3,4), (4,1), (4,2), (4,3)}
14. {1HH, 1HT, 1TH, 1TT, 2H, 2T, 3HH, 3HT, 3TH, 3TT, 4H, 4T, 5HH, 5HT, 5TH, 5TT, 6H, 6T}
15. $\{TR_1, TR_2, TB_1, TB_2, TB_3, H1, H2, H3, H4, H5, H6\}$
16. {6, (1,6), (2,6), (3,6), (4,6), (5,6), (1,1,6), (1,2,6), ..., (1,5,6), (2,1,6). (2,2,6), ..., (2,5,6), ..., (5,1,6), (5,2,6), ... }

EXERCISE 16.2

1. No.
2. (i) {1, 2, 3, 4, 5, 6} (ii) ϕ (iii) {3, 6} (iv) {1, 2, 3} (v) {6}
   (vi) {3, 4, 5, 6}, $A \cup B = \{1, 2, 3, 4, 5, 6\}$, $A \cap B = \phi$, $B \cup C = \{3, 6\}$, $E \cap F = \{6\}$, $D \cap E = \phi$,
   $A - C = \{1, 2,4,5\}$, $D - E = \{1,2,3\}$, $E \cap F' = \phi$, $F' = \{1, 2\}$
3. A = {(3,6), (4,5), (5, 4), (6,3), (4,6), (5,5), (6,4), (5,6), (6,5), (6,6)}
   B = {(1,2), (2,2), (3, 2), (4,2), (5,2), (6,2), (2,1), (2,3), (2,4), (2,5), (2,6)}
   C = {(3,6), (6,3), (5, 4), (4,5), (6,6)}
   A and B, B and C are mutually exclusive.
4. (i) A and B; A and C; B and C; C and D (ii) A and C (iii) B and D
5. (i) "Getting at least two heads", and "getting at least two tails"
   (ii) "Getting no heads", "getting exactly one head" and "getting at least two heads"

(iii) "Getting at most two tails", and "getting exactly two tails"
(iv) "Getting exactly one head" and "getting exactly two heads"
(v) "Getting exactly one tail", "getting exactly two tails", and getting exactly three tails"

Note There may be other events also as answer to the above question.

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

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

C = {(1, 1), (1,2), (1,3), (1,4), (2,1), (2,2), (2,3), (3,1), (3,2), (4,1)}

(i) $A' = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6), (3,1), (3,2), (3,3), (3,4), (3,5), (3,6), (5,1), (5,2), (5,3), (5,4), (5,5), (5,6)\} = B$

(ii) $B' = \{(2,1), (2,2), (2,3), (2,4), (2,5), (2,6), (4,1), (4,2), (4,3), (4,4), (4,5), (4,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\} = A$

(iii) $A \cup B = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6), (3,1), (3,2), (3,3), (3,4), (3,5), (3,6), (5,1), (5,2), (5,3), (5,4), (5,5), (5,6), (2,1), (2,2), (2,3), (2,5), (2,6), (4,1), (4,2), (4,3), (4,4), (4,5), (4,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\} = S$

(iv) $A \cap B = \phi$

(v) $A - C = \{(2,4), (2,5), (2,6), (4,2), (4,3), (4,4), (4,5), (4,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$

(vi) $B \cup C = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6), (2,1), (2,2), (2,3), (3,1), (3,2), (3,3), (3,4), (3,5), (3,6), (4,1), (5,1), (5,2), (5,3), (5,4), (5,5), (5,6)\}$

(vii) $B \cap C = \{(1,1), (1,2), (1,3), (1,4), (3,1), (3,2)\}$

(viii) $A \cap B' \cap C' = \{(2,4), (2,5), (2,6), (4,2), (4,3), (4,4), (4,5), (4,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$

7. (i) True (ii) True (iii) True (iv) False (v) False (vi) False

EXERCISE 16.3

1. (a) Yes (b) Yes (c) No (d) No (e) No **2.** $\frac{3}{4}$

3. (i) $\frac{1}{2}$ (ii) $\frac{2}{3}$ (iii) $\frac{1}{6}$ (iv) 0 (v) $\frac{5}{6}$ **4.** (a) 52 (b) $\frac{1}{52}$ (c) (i) $\frac{1}{13}$ (ii) $\frac{1}{2}$

5. (i) $\frac{1}{12}$ (ii) $\frac{1}{12}$ **6.** $\frac{3}{5}$

7. Rs 4.00 gain, Rs 1.50 gain, Re 1.00 loss, Rs 3.50 loss, Rs 6.00 loss.

$P(\text{Winning Rs } 4.00) = \frac{1}{16}$, $P(\text{Winning Rs } 1.50) = \frac{1}{4}$, $P(\text{Losing Re. } 1.00) = \frac{3}{8}$

$P(\text{Losing Rs } 3.50) = \frac{1}{4}$, $P(\text{Losing Rs } 6.00) = \frac{1}{16}$.

8. (i) $\frac{1}{8}$ (ii) $\frac{3}{8}$ (iii) $\frac{1}{2}$ (iv) $\frac{7}{8}$ (v) $\frac{1}{8}$ (vi) $\frac{1}{8}$ (vii) $\frac{3}{8}$ (viii) $\frac{1}{8}$ (ix) $\frac{7}{8}$

9. $\frac{9}{11}$ **10.** (i) $\frac{6}{13}$ (ii) $\frac{7}{13}$ **11.** $\frac{1}{38760}$

12. (i) No, because $P(A \cap B)$ must be less than or equal to $P(A)$ and $P(B)$, (ii) Yes

13. (i) $\frac{7}{15}$ (ii) 0.5 (iii) 0.15 **14.** $\frac{4}{5}$

15. (i) $\frac{5}{8}$ (ii) $\frac{3}{8}$ **16.** No **17.** (i) 0.58 (ii) 0.52 (iii) 0.74

18. 0.6 **19.** 0.55 **20.** 0.65

21. (i) $\frac{19}{30}$ (ii) $\frac{11}{30}$ (iii) $\frac{2}{15}$

Miscellaneous Exercise on Chapter 16

1. (i) $\frac{{}^{20}C_5}{{}^{60}C_5}$ (ii) $1 - \frac{{}^{30}C_5}{{}^{60}C_5}$ **2.** $\frac{{}^{13}C_3 \cdot {}^{13}C_1}{{}^{52}C_4}$

3. (i) $\frac{1}{2}$ (ii) $\frac{1}{2}$ (iii) $\frac{5}{6}$ **4.** (a) $\frac{999}{1000}$ (b) $\frac{{}^{9990}C_2}{{}^{10000}C_2}$ (c) $\frac{{}^{9990}C_{10}}{{}^{10000}C_{10}}$

5. (a) $\frac{17}{33}$ (b) $\frac{16}{33}$ **6.** $\frac{2}{3}$

7. (i) 0.88 (ii) 0.12 (iii) 0.19 (iv) 0.34 **8.** $\frac{4}{5}$

9. (i) $\frac{33}{83}$ (ii) $\frac{3}{8}$ **10.** $\frac{1}{5040}$