What is the probability that a leap year selected at random will contain 53 Sundays.

(a) A leap year selected at random will contain either 53 Sundays or 53 Mondays to

(i) (ii) $\frac{2}{7}$ (iii) $\frac{3}{7}$

[Delhi *B.A.* (Hons.) 2003]

(b) $\frac{3}{7}$ (i.e. iii)

[*B.A.* (Intermediate) 19]

5. In a single throw of two dice, what is the probability of getting

(i) a total of 8 ; and (ii) Total different from 8 :

Ans. (i) 5/36. (ii) 31/36.

6. Prove that in a single throw with a pair of dice, the probability of getting the sum of 10 is equal to 1/12. probability of getting the sum of 7 is equal to 1/6 and

7. In a single throw of two dice, find

(i) P (odd number on first dice and 6 on the second),

(iii) P (a total of 11), (iv) P (a total of 9 or 11),

(ii) P (a number > 4 on each die).

(v) P (a total greater than 8)

Ans. (i) $\frac{1}{12}$. (ii) $\frac{1}{9}$. (iii) $\frac{1}{18}$. (iv) $\frac{1}{6}$. (v) $\frac{5}{18}$.

8. In the play of two dice, the thrower loses if his first throw is 2, 4 or 12. He wins if his first throw is a 5 or 11. Find the ratio between his probability of losing and probability of winning in the first throw.

[C.A. (Foundation), Dec. 1993 ; Delhi Univ. B.Com. (Hons.) 1998]

Hint. Number of favourable cases for getting

(i) 2, 4 or 12 is $1 + 3 + 1 = 5$; (ii) 5 or 11 is $4 + 2 = 6$

Ans. Required Probability $= \frac{5/36}{6/36} = \frac{5}{6}$.

9. If a pair of dice is thrown, find the probability that the sum of the digits on them is neither 7 nor 11.

[C.A. (Foundation), Nov. 1995]

Ans. $(7/9) = 0.78$.

10. Tickets are numbered from 1 to 100. They are well shuffled and a ticket is drawn at random. What is the probability that the drawn ticket has :

(a) an even number ? (b) a number 5 or a multiple of 5 ?

(c) a number which is greater than 75 ? (d) a number which is a square ?

Ans. (a) 0·5, (b) 0·2, (c) 0·25, (d) 0·10.

11. There are 17 balls, numbered from 1 to 17 in a bag. If a person selects one ball at random, what is the probability that the number printed on the ball will be an even number greater than 9 ?

Ans. 4 / 17.

12. An integer is chosen at random from the first 200 positive integers. What is the probability that integer chosen is divisible by 6 or 8 ?

Ans. 1/4.

13. One ticket is drawn at random from a bag containing 30 tickets numbered from 1 to 30. Find the probability that

(i) It is multiple of 5 or 7 ; (ii) It is multiple of 3 or 5.

Ans. (i) 1/3, (ii) 7/15.

14. A number is chosen from each of the two sets :

1, 2, 3, 4, 5, 6, 7, 8, 9, ; 1, 2, 3, 4, 5, 6, 7, 8, 9.

If p_1 is the probability that the sum of the two numbers be 10 and p_2 the probability that their sum be 8, find $p_1 + p_2$.

Ans. 16 / 81.

15. A bag contains 7 white and 9 black balls. Two balls are drawn in succession at random. What is the probability that one of them is white and the other is black ?

Ans. 21/40

16. A bag contains eight balls, five being red and three white. If a man selects two balls at random, what is the probability that he will get one ball of each colour ?

Ans. $\frac{^5C_1 \times ^3C_1}{^8C_2} = \frac{15}{28}$

17. A bag contains 5 white and 3 black balls. Two balls are drawn at random one after the other without replacement. Find the probability that balls drawn are black.

Ans. $\frac{3}{28}$

18. A bag contains 4 white, 5 red and 6 green balls. Three balls are drawn at random. What is the probability that a white, a red and a green ball are drawn ?

Ans. 24 / 91.

19. A bag contains 8 black, 3 red and 9 white balls. If 3 balls are drawn at random, find the probability that

(a) all are black,
(b) 2 are black and 1 is white,
(c) 1 is of each colour,
(d) the balls are drawn in the order black, red and white,
(e) None is red.

Ans. (a) $\frac{14}{285}$, (b) $\frac{21}{95}$, (c) $\frac{18}{95}$, (d) $\frac{3}{95}$, (e) $\frac{34}{57}$.

20. The Federal Match Company has forty female employees and sixty male employees. If two employees are selected at random, what is the probability that

(i) both will be males,
(ii) both will be females,
(iii) there will be one of each sex ?

Since the three events are collectively exhaustive and mutually exclusive, what is the sum of the probabilities ?

Ans. (i) 0·357, (ii) 0·157, (iii) 0·4848. ; 1.

21. Among the 90 pieces of mail delivered to an office, 50 are addressed to the accounting department and 40 are addressed to the marketing department. If two of these pieces of mail are delivered to the manager's office by mistake and the selection is random, what are the probabilities that :

(i) Both of them should have been delivered to the accounting department;
(ii) Both of them should have been delivered to the marketing department;
(iii) One should have been delivered to the accounting department and the other to be marketing department.

[Delhi Univ. M.Com.]

Ans. (i) $\frac{^{50}C_2}{^{90}C_2} = 0·3059$; $\frac{^{40}C_2}{^{90}C_2} = 0·1948$; $\frac{^{50}C_1 \times ^{40}C_1}{^{90}C_2} = 0·4994$

22. If a single draw is made from a pack of 52 cards, what is the probability of securing either an ace or a jack of clubs.

Ans. 1 / 26.

23. (a) Four cards are drawn from a full pack of cards. Find the probability that two are spades and two hearts ?

(b) From a pack of 52 cards, 4 are accidentally dropped. Find the chance that

(i) they will consist of a knave, a queen, a king and ace.
(ii) they are the 4 honours of the same suit.
(iii) they be one from each suit,
(iv) two of them are red and two are black.

Ans. (a) $\frac{^{13}C_2 \times ^{13}C_2}{^{52}C_4} = \frac{468}{20825}$. (b) (i) $\frac{256}{^{52}C_4}$, (ii) $\frac{4}{^{52}C_4}$, (iii) $\frac{(^{13}C_1)^4}{^{52}C_4}$, (iv) $\frac{^{26}C_2 \times ^{26}C_2}{^{52}C_4}$.

24. What is the probability of getting 9 cards of the same suit in one hand at a game of bridge ?

Ans. $4 \times ^{13}C_9 \times ^{39}C_4 / ^{52}C_4$.

25. The letters of the word *Triangle* are arranged at random. Find the probability that the word so formed

(i) starts with T,
(ii) ends with E,
(iii) starts with T and ends with E.

Ans. (i) $\frac{1}{8}$, (ii) $\frac{1}{8}$, (iii) $\frac{1}{56}$.

26. In a random arrangement

12.36

Hint. $P(A) = P(A) - P(A) \cdot P(B)$

Also $P(A) \times P(B) \neq 0$

$\therefore P(A) \times P(B) = 0$ or $P(B) = 0$

(b) Prove that two mutually exclusive events with positive probabilities cannot be independent.

[Delhi Univ. B.A. (Econ. Hons.)]

10. A statistical experiment consists of asking 3 housewives at random if they wash their dishes with detergent. List the elements of the sample space S using the letter Y for 'yes' and N for 'no'. List the elements of the event : "The second woman interviewed uses brand X". Find the probability of this event if it is assumed the elements of S are equally likely to occur.

(a) Distinguish between independent and mutually exclusive events. When will the events A and B be independent and mutually exclusive ?

[Delhi Univ. B.A. (Econ. Hons.)]

Ans. 1/2.

11. Explain what is meant by sample space.

An unbiased coin is tossed three times. Construct the sample space S. If E_1 denotes the event of 'getting heads', E_2 the event of 'getting at least two tails' and E_3 the event of 'getting tail in the first toss', write down elements of these events and find the probabilities of their occurrence, assuming that all the elements of S are equally likely to occur.

Ans. 3/8.   1/2.   1/2.

12. Define the concepts of conditional probability and independent events.

13. If two dice are thrown, what is the probability that the sum of the numbers on the dice is

    (i) greater than 8   and   (ii) neither 7 nor 11 ?

A researcher has to consult a recently published book. The probability of its being available is 0.5 for library A and 0.7 for library B. Assuming the two events to be statistically independent, find out the probability of the book being available in library A and not available in library B ?

[C.A. (Foundation), May 1999]

Ans. 0.15.

Ans. (i) 5/18   (ii) 7/9.

14. Consider a random experiment in which two dice are tossed. Construct the Sample Space S. Define the following events :

  E_1 : Sum of the points on the two dice is 6   ; E_2 : Sum of the points on the two dice is even

  E_3 : Sum of the points on the two dice is odd   ; E_4 : Sum of the points on the two dice is greater than 12

  E_5 : Sum of the points on the two dice is divisible by 3

  E_6 : Sum of the points is greater than or equal to 2 and less than or equal to 12.

Write the elements of these events and find the probabilities of their occurrence, assuming that all the elements of S are equally likely.

Ans. 5/36.   1/2,   1/2,   0,   1/3,   1.

15. A card is drawn at random from a well shuffled pack of cards. What is the probability that it is a heart or a queen ?

Ans. 4/13.

16. A piece of electronic equipment has two essential parts A and B. In the past, part A failed 30% of the times, part B failed 20% of the times and both parts failed simultaneously 5% of the times.

Assuming that both parts must operate to enable the equipment to function, what is the probability that the equipment will function ?

Ans. 1 − (0.30 + 0.20 − 0.05) = 0.55.

17. In a certain college, the students engage in various sports in the following proportions :

  Football (F) : 60% of all students;   Basketball (B) : 50% of all students :

  Both football and basketball   :   30% of all students.

If a student is selected at random, what is the probability that he will :

  (i) play football or basketball ?   (ii) play neither sports ?

Ans. (i) 0.80,   (ii) 0.20.