5 CHAPTER

PROBABILITY

SECTION-1

SINGLE CHOICE QUESTIONS

1. A letter is chosen at random out of 'ASSININE' and one is chosen at random out of 'ASSASSIN'. Find the probability that the same letter is chosen on both occasions.

(A) $\frac{7}{16}$ (B) $\frac{7}{32}$

(C) $\frac{5}{16}$ (D) $\frac{9}{32}$

2. From a bag containing 10 balls, 7 balls are drawn simultaneously and replaced, then 5 balls are drawn. Find the probability that exactly 3 balls are common to the two drawings.

(A) $\frac{5}{12}$ (B) $\frac{7}{12}$

(C) $\frac{5}{18}$ (D) $\frac{13}{21}$

3. A man can take a step forward, backward, left or right with equal probability. Find the probability that after nine steps he will be just one step away from his initial position.

(A) $\frac{21347}{4^9}$ (B) $\frac{3865}{4^7}$

(C) $\frac{12345}{4^9}$ (D) $\frac{3969}{4^7}$

4. In a multiple choice question, there are five alternative answers, of which one or more than one are correct. A candidate will get marks on the question if he ticks all the correct answers. If he decides to tick answers at random, how many minimum chances should he be allowed so that the probability of his getting marks on the question exceeds $\frac{1}{8}$.

(A) 4
(B) 5
(C) 7
(D) 8

5. The probability that an item produced by a factory is defective is ‘p’. From a certain lot, a sample of ‘n’ items is drawn with replacement. If it contains no defective items, the lot is accepted, while if it has more than two defective items, the lot is rejected. If the sample has one or two defective items, an independent sample of ‘m’ items is drawn with replacement from the lot and combined with previous sample. If the combined sample does not contain more than two defective items, the batch is accepted. Find the probability that the batch is accepted.

(A) $(1-p)^n + np(1-p)^{n+m}$

(B) $(1-p)^n + np(1-p)^{n+m-1}$

(C) $(1-p)^n + np(1-p)^{n+m-2}(1+(m-1)p)) + {}^nC_2(1-p)^{m+n-2}p^2$

(D) $(1-p)^{n-2}\left((1-p)^2 + \frac{n(n-1)p^2}{2}\right) + np(1-p)^{n+m-2}(1+(m-1)p)$

6. Each packet of blades sold contains a coupon which is equally likely to bear the letters A, B or C. If ‘m’ packets are purchased, what is the probability that the coupons can not be to used to spell BAC.

(A) $\left(\frac{2}{3}\right)^m$
(B) $\frac{3.2^m - 2}{3^m}$
(C) $\frac{2^m}{3^{m-1}}$
(D) $\frac{2^m - 1}{3^{m-1}}$

7. Suppose m, n are real numbers randomly chosen in [0, 1]. Determine the probability that the distance between the roots of the equation $x^2 + mx + n = 0$ is not greater than 1.

(A) $\frac{2}{3}$

(B) $\frac{1}{6}$

(C) $\frac{1}{3}$

(D) $\frac{1}{2}$

8. If 'n' different things are distributed among x boys and y girls. Find the probability that the number of things received by girls is even.

(A) $1-\left(\frac{x-y}{x+y}\right)^n$

(B) $\frac{1}{2}-\frac{1}{2}\left(\frac{x-y}{x+y}\right)^n$

(C) $1-\frac{1}{2}\left(\frac{x-y}{x+y}\right)^n$

(D) $\frac{1}{2}+\frac{1}{2}\left(\frac{x-y}{x+y}\right)^n$

9. Starting at (0, 0) an object moves in coordinate plane by a sequence of steps, each of length one. Each step is left, right up or down, all four equally likely. Find the probability that the object reaches (2, 2) in six or fewer steps.

(A) $\frac{3}{64}$

(B) $\frac{1}{64}$

(C) $\frac{5}{64}$

(D) $\frac{5}{32}$

10. A natural number 'x' is chosen at random from the first 1000 natural numbers. If [·] denotes the greatest integer function, then the probability that

$\left[\frac{x}{2}\right]+\left[\frac{x}{3}\right]+\left[\frac{x}{5}\right]=\frac{31x}{30}$ is

(A) $\frac{31}{1000}$

(B) $\frac{4}{125}$

(C) $\frac{33}{1000}$

(D) $\frac{67}{1000}$

11. If P(A) = x, P(B) = y and x < y, then

(A) $P(A/B) \in \left[\frac{x-1}{y}, \frac{x}{y}\right]$

(B) $P(A/B) \in \left[\frac{x+y-1}{y}, \frac{x}{y}\right]$

(C) $P(A/B) \in \left[\frac{y-1}{y}, \frac{x}{y}\right]$

(D) $P(A/B) \in \left[\frac{x}{y}, \frac{x+1}{y}\right]$

12. If the papers of 4 students can be checked by any one of the 7 teachers. Then the probability that all 4 papers are checked by exactly 2 teachers is

(A) $\frac{18}{343}$

(B) $\frac{12}{343}$

(C) $\frac{2}{49}$

(D) $\frac{6}{49}$

13. A bag consists of n white and n red balls. Pairs of balls are drawn without replacement until the bag is empty. Then the probability that each pair consists of one white and one red ball is

(A) $\frac{2^n n!}{{}^{2n}C_n}$

(B) $\frac{2^n}{{}^{2n}C_n}$

(C) $\frac{2^n}{(2n)!}$

(D) $\frac{2^n}{(2n)!n!}$

14. From (4m +1) tickets numbered as 1, 2, 3,.....,4m + 1; three tickets are chosen at random. Then the probability that the numbers are in A.P. with even common difference is

(A) $\frac{2(2m-1)}{3(16m^2-1)}$

(B) $\frac{3(2m-1)}{m(16m^2-1)}$

(C) $\frac{3(2m-1)}{(16m^2-1)}$

(D) $\frac{3(2m-1)}{2(16m^2-1)}$

15. Consider a bag containing 10 balls of which 4 are black and remaining white . Now 5 balls are drawn from this bag and put in another bag (without noting the colour of balls). Finally one ball is drawn from the second bag and it is found to be white. Find the probability that 2 white balls had been drawn in the first draw.

(A) $\frac{10}{63}$ (B) $\frac{20}{121}$

(C) $\frac{4}{21}$ (D) $\frac{13}{63}$

16. There are two bags each containing 10 different books. A student draws out any number of books (atleast one) from first bag as well as from the second bag. The probability that the difference between the number of books drawn from the two bags does not exceed two is

(A) $\frac{{}^{20}C_{10}+2\left({}^{20}C_{11}+{}^{20}C_{12}\right)-110}{(2^{10}-1)^2}$ (B) $\frac{{}^{20}C_{10}+2\left({}^{20}C_{11}+{}^{20}C_{12}\right)}{(2^{10}-1)^2}$

(C) $\frac{{}^{20}C_{10}+{}^{20}C_{11}+2\left({}^{20}C_{12}\right)}{(2^{10}-1)^2}$ (D) $\frac{{}^{20}C_{10}+2\times\left({}^{20}C_{12}\right)-111}{(2^{10}-1)^2}$

17. If a and b are chosen randomly from the set consisting of numbers 1, 2, 3, 4, 5, 6 with replacement.

Then the probability that $\lim\limits_{x\to 0}\left(\frac{a^x+b^x}{2}\right)^{2/x}=6$ is

(A) $\frac{1}{18}$ (B) $\frac{5}{36}$

(C) $\frac{1}{9}$ (D) $\frac{1}{6}$

18. 'A' writes a letter to his friend 'B' and does not receive a reply. It is known that one out of 'n' letters does not reach its destination. The probability that 'B' didn't receive the letters is (It is certain that 'B' would have replied, if he had received the letter)

(A) $\frac{1}{2}$ (B) $\frac{1}{2n-1}$

(C) $\frac{2n-1}{n^2}$ (D) $\frac{n}{2n-1}$

19. India plays 2, 3 and 5 matches against Pakistan, Srilanka and Australia respectively. Probability that India win a match against Pakistan, Srilanka and Australia is 0.6, 0.5 and 0.4 respectively. If India win a match, then the probability that it was against Pakistan is

(A) $\frac{12}{47}$ (B) $\frac{13}{47}$

(C) $\frac{14}{47}$ (D) $\frac{15}{47}$

20. A certain kind of bacteria either die, split into two or split into three bacteria. All splits are exact copies. The probability of dying is $\frac{1}{4}$, the probability of splitting into two is $\frac{1}{2}$ and splitting into three is $\frac{1}{4}$.

The probability that it survives for infinite length of time is

(A) $\frac{5-\sqrt{13}}{2}$ (B) $\frac{4}{7}$

(C) $\frac{\sqrt{13}-3}{2}$ (D) $\frac{6-\sqrt{13}}{2}$

21. A fair die is thrown until a score of less than 5 points is obtained. The probability of obtaining not less than 2 points on the last throw is

(A) $\frac{1}{4}$ (B) $\frac{3}{4}$

(C) $\frac{4}{5}$ (D) $\frac{1}{5}$

22. From an urn containing 5 white and 5 black balls. 5 balls are transferred at random into an empty second urn from which one ball is drawn and it is found to be white. Then the probability that all balls transferred from the first urn are white is

(A) $\frac{1}{122}$ (B) $\frac{1}{125}$

(C) $\frac{1}{126}$ (D) $\frac{1}{131}$

23. Two distinct numbers are selected from the numbers {1, 2, 3,....,9}, then the probability that their product is a perfect square is

(A) $\frac{1}{9}$ (B) $\frac{2}{9}$

(C) $\frac{1}{3}$ (D) $\frac{4}{9}$

24. A bag contains three white, two blue and four red balls. If four balls are drawn one by one with replacement, then the probability that sample contains just one white ball is

(A) $\frac{16}{81}$ (B) $\frac{8}{81}$

(C) $\frac{32}{81}$ (D) $\frac{64}{81}$

25. In a multiple choice questions, there are 4 alternative answers of which one or more may be correct. A candidate will get marks in the question only if he ticks all the correct answers. The candidate decides to tick answers at random. If he is allowed upto 5 chances to answer the question, the probability that he will get the marks in the question is

(A) $\frac{1}{3}$ (B) $\frac{1}{5}$

(C) $\frac{1}{15}$ (D) $\frac{2}{3}$

26. P_1, P_2, P_3 and P_4 are four players playing in a knockout tournament and probability that P_1 will pair up with P_i is proportional to i and P_m wins with P_n if $m < n$; then the probability that P_2 will reach the second round is

(A) $\frac{2}{9}$ (B) $\frac{7}{9}$

(C) $\frac{4}{5}$ (D) $\frac{2}{3}$

27. Three distinct numbers are selected from numbers {1, 2, 3,....,15}, then the probability that their sum is a perfect cube of an integer is

(A) $\frac{5}{91}$ (B) $\frac{8}{91}$

(C) $\frac{39}{455}$ (D) $\frac{9}{91}$

28. A fair coin is tossed (2m + 1) times, the probability of getting at least 'm' consecutive heads is

(A) $\frac{m+1}{2^m}$ (B) $\frac{m+3}{2^{m+1}}$

(C) $\frac{(m+1)2^m-1}{2^{2m+1}}$ (D) $\frac{(m+3)2^m-1}{2^{2m+1}}$

29. When we throw a dice 4 times, the probability that the minimum number appearing on the dice is 2 and the maximum is 5 is

(A) $\frac{55}{648}$ (B) $\frac{47}{648}$

(C) $\frac{35}{648}$ (D) $\frac{16}{81}$

30. A seven digit number of $a_1a_2a_3a_4a_5a_6a_7$ (all digits distinct) is formed randomly. The probability that number formed satisfy $a_1 > a_2 > a_3 < a_4 < a_5 < a_6 < a_7$ is

(A) $\frac{11}{1572}$ (B) $\frac{1}{168}$

(C) $\frac{7}{1512}$ (D) $\frac{5}{1512}$

31. An urn contains 20 white marbles, 30 blue marbles and 50 red marbles. Ten marbles are selected, one at a time, with replacement. Then the probability that at least one colour will be missing from the 10 selected marbles is

(A) $\frac{8^{10}+7^{10}+5^{10}-3^{10}-2^{10}}{10^{10}}$ (B) $\frac{8^{10}+7^{10}-3^{10}-2^{10}}{10^{10}}$

(C) $\frac{7^{10}+5^{10}-3^{10}-2^{10}}{10^{10}}$ (D) $\frac{8^{10}+7^{10}+5^{10}-3^{10}-2^{10}-1}{10^{10}}$

32. Let A, B be independent events with P(A) = P(B) and $P(A \cup B) = \frac{1}{2}$, then P(A) is equal to

(A) $1-\frac{1}{\sqrt{2}}$ (B) $\frac{1}{\sqrt{2}}$

(C) $\sqrt{2}-1$ (D) $2-\sqrt{2}$

33. Events A and B belong to common sample space S and have probabilities P(A) = P(B) = $\frac{1}{3}$. It is also known that $P(\overline{A} \cap \overline{B}) = \frac{7}{18}$, then P(A/B) is equal to

(A) $\frac{1}{18}$ (B) $\frac{1}{2}$

(C) $\frac{1}{3}$ (D) $\frac{1}{6}$

34. A pack of cards is counted, face downwards, and it is found that one card is missing. Two cards are drawn and are found to be spades. Then the odds against the missing card being a spade is

(A) 39 : 11 (B) 28 : 11

(C) 36 : 11 (D) 50 : 11

35. Let {x, y} be a subset of the set {1, 2, 3,....,9, 10}. Then the probability that $|x - y| \leq 5$ is equal to

(A) $\frac{2}{9}$ (B) $\frac{5}{9}$

(C) $\frac{7}{9}$ (D) $\frac{8}{9}$

36. A die is rolled three times, the probability of getting larger number than the previous number is

(A) $\frac{1}{36}$ (B) $\frac{11}{216}$

(C) $\frac{5}{208}$ (D) $\frac{5}{54}$

37. An unbiased coin is tossed 12 times. The probability that at least 7 consecutive heads show up is

(A) $\frac{5}{256}$ (B) $\frac{1}{32}$

(C) $\frac{3}{128}$ (D) $\frac{7}{256}$

38. From a group of 'n' persons arranged in a circle 3 persons are selected at random. If the probability that no two adjacent persons are selected is $\frac{2}{7}$, then n =

(A) 7 (B) 8

(C) 9 (D) 10

39. Two integers *x* and *y* are chosen from the set {0, 1, 2, 3,....,2n–1, 2n}, with replacement. The probability that $|x - y| \leq n$, $n \in N$ is

(A) $\frac{3n^2+1}{(2n+1)^2}$ (B) $\frac{3n^2+3n-1}{(2n+1)^2}$

(C) $\frac{3n^2+3n+1}{(2n+1)^2}$ (D) $\frac{3n(n+1)}{(2n+1)^2}$

40. A letter is to come from either LONDON or CLIFTON. The postal mark on the letter legibly shows consecutive letters 'ON'. What is the probability that the letter has come from LONDON.

(A) $\frac{12}{17}$ (B) $\frac{11}{17}$

(C) $\frac{5}{17}$ (D) $\frac{13}{17}$

41. A man parks his car among 'n' cars standing in a row. His car not being parked at an end. On his return he finds that exactly *m* of the 'n' cars are still there. What is the probability that both the cars parked on two sides of his car have left.

(A) $\frac{(n-m)(n-m-1)(n-m-2)}{n(n-1)(n-2)}$ (B) $\frac{(n-m-1)(n-m-2)}{n(n-1)}$

(C) $\frac{m(m-1)}{n(n-1)}$ (D) $\frac{(n-m)(n-m-1)}{(n-1)(n-2)}$

42. A bag contains 6 white and 6 black balls. One by one the balls are drawn from the bag with replacement. Then the probability that 3rd time a white ball is drawn in 7th draw is

(A) $\frac{15}{64}$ (B) $\frac{3}{64}$

(C) $\frac{5}{128}$ (D) $\frac{15}{128}$

43. Two distinct numbers a and b are selected randomly from the set $\{2, 2^2, 2^3, ..., 2^{25}\}$. then the probability that $\log_a b$ is an integer is equal to

(A) $\frac{1}{10}$ (B) $\frac{31}{300}$

(C) $\frac{8}{75}$ (D) $\frac{11}{100}$

44. Twenty persons arrive in a town having 3 hotels A, B and C. If each person randomly chooses one of these hotels, then what is the probability that atleast two of them go in hotel A, atleast one in hotel B and atleast one in hotel C. (each hotel has capacity for more than 20 guests)

(A) $1-\left(\frac{12.2^{20}-42}{3^{20}}\right)$ (B) $1-\left(\frac{2^{20}-1}{3^{19}}\right)$

(C) $1-\left(\frac{10.2^{20}-40}{3^{20}}\right)$ (D) $1-\left(\frac{13.2^{20}-43}{3^{20}}\right)$

45. 7 persons are stopped on the road at random and asked about their birthdays. The probability that 3 of them are born on Wednesday, 2 on Thursday and remaining two on Friday is equal to

(A) $\frac{141}{7^7}$ (B) $\frac{45}{7^7}$

(C) $\frac{90}{7^6}$ (D) $\frac{30}{7^6}$

46. 3 distinct numbers are chosen from the set of first 15 natural numbers, then the probability that the numbers are in A.P. is equal to

(A) $\frac{51}{455}$ (B) $\frac{7}{65}$

(C) $\frac{10}{91}$ (D) $\frac{53}{455}$

47. A fair die is tossed 16 times, then the probability of getting prime outcomes as many times in the first 8 throws as in the last 8 throws is equal to

(A) $\frac{{}^{16}C_8}{2^{16}}$ (B) $\frac{{}^{15}C_7}{2^{16}}$

(C) $\frac{{}^{16}C_8}{2^{17}}$ (D) $\frac{{}^{15}C_7}{2^{17}}$

48. Let A, B, C be three events such that $P(A \cap B) = 0$, $P(A \cup B) = 1$, $P(A \cap C) = \frac{1}{5}$ and $P(C) = \frac{7}{15}$, then $P(B \cap C)$ is equal to

(A) $\frac{7}{15}$ (B) $\frac{4}{15}$

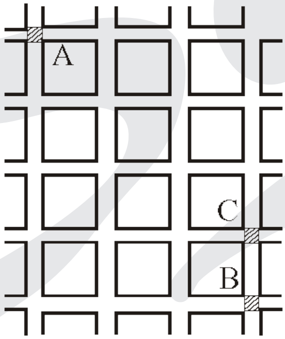
(C) $\frac{11}{15}$ (D) $\frac{1}{3}$

49. A person has to go through three successive tests. The probability of his passing first test is P. If he fails in one of the tests, then the probability of his passing next test is $\frac{P}{2}$, otherwise it remains the same. For selection, the person must pass at least two tests. The probability that the person is selected is

(A) $2P - P^3$ (B) $2P^2 - P^3$

(C) $P - P^3$ (D) $P^2 - P^3$

50. The adjoining figure is a map of a part of a city. The small rectangles are blocks and the spaces in between are streets. Each morning a student walks from intersection A to intersection B, always walking along the streets shown, always going east or south. For variety, at each intersection where he has choice, he chooses with probability $\frac{1}{2}$ (independent of all other choices) whether to go east or south. Find the probability that, on any given morning, he walks through intersection C.



(A) $\frac{2}{7}$ (B) $\frac{3}{7}$

(C) $\frac{1}{2}$ (D) $\frac{4}{7}$

51. A man throws a fair coin a number of times and get 2 points for each head he throws and 1 point for each tail. The probability that he gets exactly 6 points is

(A) $\frac{21}{32}$ (B) $\frac{23}{32}$

(C) $\frac{41}{64}$ (D) $\frac{43}{64}$

52. Two numbers x and y are chosen at random without replacement from the set {1, 2, 3, 4, ..., 100}. Then the probability that $x^4 - y^4$ is divisible by 5 is

(A) $\frac{67}{99}$ (B) $\frac{334}{495}$

(C) $\frac{62}{99}$ (D) $\frac{37}{99}$

53. A man sent 7 letters to his 7 friends. The letters are kept in the addressed envelopes at random. The probability that 3 friends receive correct letters and 4 letters go to wrong destinations is equal to

(A) $\frac{1}{8}$ (B) $\frac{1}{16}$

(C) $\frac{1}{24}$ (D) $\frac{1}{4}$

54. Three numbers are selected one by one at random without replacement from the set of numbers $\{1, 2, 3, \ldots.., n\}$. Then the probability that the third number lies between the first two, if the first number is known to be smaller than the second is equal to :

(A) $\frac{1}{6}$ (B) $\frac{1}{2}$

(C) $\frac{1}{3}$ (D) $\frac{1}{4}$

55. An unbaised coin is tossed. If the result is head, a pair of unbaised dice is rolled and the number obtained by adding the numbers on the two faces is noted. If the result is a tail, card is drawn from a well shuffled pack of eleven cards numbered 2, 3, 4, 5,.....,11, 12 is picked and the number on the card is noted. Then the probability that the noted number is 7 or 8 is equal to

(A) $\frac{195}{792}$ (B) $\frac{185}{792}$

(C) $\frac{191}{792}$ (D) $\frac{193}{792}$

SECTION-2

ONE OR MORE THAN ONE CORRECT QUESTIONS

1. If two squares are chosen at random on a chess board, then find the probability so that

(A) they have a side common is $\frac{1}{9}$
(B) they have a side common is $\frac{1}{18}$
(C) they have contact at a corner is $\frac{7}{144}$
(D) they have contact at a corner is $\frac{7}{72}$

2. Of three independent events E_1,E_2,E_3, the chance that only E_1 occurs is a, that only E_2 occurs is b, and only E_3 occurs is c and probability of none of E_1, E_2, E_3 occuring is x. Then

(A) $P(E_2) = \frac{x}{b+x}$
(B) $P(E_2) = \frac{b}{b+x}$
(C) $x^2 = (a + x)(b + x)(c + x)$
(D) $P(E_3) = \frac{x}{c+x}$

3. P_1, P_2, P_3,....,P_8 are 8 players participating in a tournament. If $i < j$, then P_i will win the match against P_j. Players are paired up randomly for first round and winners of this round again paired up for the second and so on. Then the probability that

(A) P_4 reaches the final is $\frac{4}{35}$
(B) P_6 reaches the final is 0
(C) P_1 wins the tournament is 1
(D) P_6 reaches the semifinal is $\frac{2}{7}$

4. In a city, a person own independently a sedan car with probability $\frac{3}{10}$ and a SUV with probability $\frac{4}{10}$. If he has sedan only, then he keeps a driver with probability $\frac{6}{10}$, whereas if he owns SUV only, then he keeps a driver with probability $\frac{7}{10}$, whereas if he keeps both type of cars then his probability of keeping a driver is $\frac{9}{10}$. Then

(A) Probability that person keeps a driver is $\frac{412}{1000}$

(B) Probability that person keeps a driver is $\frac{71}{125}$

(C) Given that person keeps driver, then probability that he owns SUV is $\frac{54}{103}$

(D) Given that person keeps driver, then probability that he owns SUV is $\frac{76}{103}$

5. Cards are drawn one by one at random without replacement from a well shuffled pack of 52 cards until 2 aces are obtained for the first time. The probability that 18 draws are required for this is

(A) $\frac{{}^{48}C_{16} \times {}^{4}C_{2}}{{}^{52}C_{17}} \times \frac{1}{35}$ (B) $\frac{{}^{48}C_{16} \times {}^{4}C_{1}}{{}^{52}C_{17}} \times \frac{3}{35}$

(C) $\frac{1}{78}$ (D) $\frac{17 \times {}^{34}C_{2}}{{}^{52}C_{4}}$

6. The probability that a student passes at least one of the three examinations A, B, C is $\frac{3}{4}$. The probability that he passes atleast two of them is $\frac{1}{2}$ and the probability he passes exactly two of them is $\frac{2}{5}$. If a, b, c are the probabilities of the student passing in A, B, C respectively, then

(A) $abc = \frac{1}{10}$ (B) $a + b + c = \frac{27}{20}$

(C) $a + b + c = \frac{23}{20}$ (D) $abc = \frac{1}{20}$

7. Let $A_1, A_2, \ldots, A_n$ be independent events of the same sample space, then $P(A_1 \cup A_2 \cup A_3 \cup \ldots \cup A_n)$ is equal to

(A) $\prod_{i=1}^{n}(1 - P(A_i))$ (B) $1 - \prod_{i=1}^{n}(1 - P(A_i))$

(C) $1 - P(\overline{A_1 \cap A_2 \cap A_3 \cap \ldots\ldots \cap A_n})$ (D) $1 - P(\overline{A}_1 \cap \overline{A}_2 \cap \overline{A}_3 \cap \ldots\ldots \cap \overline{A}_n)$

8. A, B, C are alternately and in this order, rolling a fair die. The first one to roll an even number wins and the game is ended, then

(A) $P(A) = \frac{4}{7}$

(B) $P(C) = \frac{1}{7}$

(C) $P(B)P(C) = \frac{1}{14}$

(D) $P(B) = \frac{3}{7}$

9. A fair die is rolled 'n' times. If P(n) denotes the probability that there are atleast two equal numbers among the result obtained, then

(A) $P(2) = \frac{1}{6}$

(B) $P(4) = \frac{13}{18}$

(C) $P(6) = \frac{319}{324}$

(D) $P(3) = \frac{4}{9}$

10. The probability of getting number of even numbered outcomes more than number of odd numbered outcomes by throwing a fair die 16 times is equal to

(A) $1 - \frac{{}^{16}C_8}{2^{16}}$

(B) $\frac{1}{2} - \frac{{}^{16}C_8}{2^{17}}$

(C) $\frac{1}{2} - \frac{{}^{15}C_7}{2^{16}}$

(D) $1 - \frac{{}^{15}C_7}{2^{15}}$

11. Ram has 4 bats namely B_1, B_2, B_3, B_4. He randomly selects one of the three bats which was not used in previous match. If for his first match the chosen bat was B_1 and P(n) denotes the probability that he chooses B_1 in n^{th} match, then

(A) $P(3) = \frac{1}{3}$

(B) $P(5) = \frac{7}{27}$

(C) $P(6) = \frac{10}{81}$

(D) $P(7) = \frac{61}{243}$

12. A certain coin lands head with probability P. Let Q denote the probability that when the coin is tossed four times, the number of heads obtained is even. Then

(A) There is no value of P, if $Q = \frac{1}{4}$.

(B) There is exactly one value of P if $Q = \frac{3}{4}$.

(C) There are exactly two values of P, if $Q = \frac{3}{5}$.

(D) There are exactly four values of P if $Q = \frac{4}{5}$.

13. A and B throw alternately with a pair of dice. A wins if he throws a sum 6 before B throws 7 and B wins if he throws a 7 before A throws 6. If A starts the game, then

(A) Probability that A wins is $\frac{31}{61}$

(B) Probability that B wins is $\frac{31}{61}$

(C) Probability that A wins is $\frac{30}{61}$

(D) Probability that B wins is $\frac{30}{61}$

14. Consider the system of equations $ax + by = 0$ and $cx + dy = 0$ where $a, b, c, d \in \{1, 2\}$. Then the probability that the system of equations has

(A) unique solution is $\frac{1}{2}$

(B) unique solution is $\frac{5}{8}$

(C) non trivial solutions is $\frac{3}{8}$

(D) non trivial solutions is $\frac{1}{2}$

15. A, B, C are three events for which $P(A) = 0.4$, $P(B) = 0.6$, $P(C) = 0.5$, $P(A \cup B) = 0.75$, $P(A \cap C) = 0.35$ and $P(A \cap B \cap C) = 0.2$. If $P(A \cup B \cup C) \geq 0.75$, then $P(B \cap C)$ can take values

(A) 0.15

(B) 0.2

(C) 0.3

(D) 0.4

16. If n different objects are distributed among 'n+2' persons, then

(A) Probability that exactly 2 persons will get nothing is $\dfrac{(n+1)!}{2(n+2)^{n-1}}$

(B) Probability that exactly 2 persons will get nothing is $\dfrac{(n+1)!}{(n+2)^{n-1}}$

(C) Probability that exactly 3 persons will get nothing is $\dfrac{{}^{n+2}C_3\,{}^{n}C_2(n-1)!}{(n+2)^n}$

(D) Probability that exactly 3 persons will get nothing is $\dfrac{(n+1)n^2(n-1)^2}{12(n+2)^{n-1}}$

17. Three missiles A, B and C whose probabilities of hitting the target are $\frac{2}{3}, \frac{1}{3}, \frac{2}{5}$ respectively are shot at an enemy ship simultaneously. A majority of hits is required to destroy the ship. If the ship is destroyed, then

(A) the probability that missile B failed to hit the target is $\frac{1}{5}$

(B) the probability that missile B failed to hit the target is $\frac{2}{5}$

(C) the probability that at least one of B or C hit the target is 1

(D) the probability that at least one of the missile B or C failed to hit the target is 7/10

SECTION-3

COMPREHENSION TYPE QUESTIONS

COMPREHENSION (Q.1 TO Q.3) :

A party of 'n' men of whom A, B are two are sitting in a row. what is the chance that

1. A, B are next to one another

(A) $\frac{1}{n(n-1)}$ (B) $\frac{2}{n(n-1)}$ (C) $\frac{1}{n}$ (D) $\frac{2}{n}$

2. Exactly 'm' men are between them

(A) $\frac{2(n-m)}{n(n-1)}$ (B) $\frac{2(n-m-1)}{n(n-1)}$ (C) $\frac{2(n-m-2)}{n(n-1)}$ (D) $\frac{2}{n-m}$

3. Not more than 'm' men are between them

(A) $\frac{(m+1)(2n-m-2)}{n(n-1)}$ (B) $\frac{(n-m-2)(n-m-1)}{n(n-1)}$

(C) $\frac{(n-m)(n-m-1)}{n(n-1)}$ (D) $\frac{m(n-2m-2)}{n(n-1)}$

COMPREHENSION (Q.4 TO Q.5) :

The values of a and b are equally possible in the square $|a| \le 1, |b| \le 1$. Consider the events

A = { The roots of quadratic expression $x^2 + 2ax + b$ are real }

B = { The roots of $x^2 + 2ax + b$ are positive }.

4. P(A) =

(A) $\frac{2}{3}$ (B) $\frac{1}{3}$ (C) $\frac{1}{6}$ (D) $\frac{3}{8}$

5. P(B) =

(A) $\frac{3}{8}$ (B) $\frac{2}{9}$ (C) $\frac{1}{6}$ (D) $\frac{1}{12}$

COMPREHENSION (Q.6 TO Q.7) :

A player throws an ordinary die with faces numbered 1 to 6. Whenever he throws a 1, he gets a further throw. Let the sum of numbers obtained is their score.

6. The probability of obtaining a total score of exactly 'r' , where $2 \le r \le 6$ is

(A) $\frac{1}{5}\left(\frac{1}{6}\right)^{r-1}$ (B) $\frac{5}{6}\left(1-\frac{1}{6^r}\right)$ (C) $\frac{1}{5}\left(1-\frac{1}{6^r}\right)$ (D) $\frac{1}{5}\left(1-\frac{1}{6^{r-1}}\right)$

7. The probability of obtaining a total score of exactly 'r' where $r > 6$ is

(A) $\frac{1}{5}(6^5-1)\left(\frac{1}{6}\right)^{r-1}$ (B) $\frac{1}{5}\left(\left(\frac{1}{6}\right)^{r-5}-\left(\frac{1}{6}\right)^{r-1}\right)$

(C) $\frac{5}{6}\left(\left(\frac{1}{6}\right)^{r-6}-\left(\frac{1}{6}\right)^{r-1}\right)$ (D) $\frac{1}{5}\left(\frac{1}{6}\right)^{r-6}$

COMPREHENSION (Q.8 TO Q.9) :

A die is rolled and probability of showing any number is directly proportional to that number. If prime number appears then a ball is chosen from urn A containing 2 white and 3 black balls other wise a ball is chosen from urn B containing 3 white and 2 black balls. Then

8. The probability of drawing a black ball is

(A) $\frac{49}{105}$ (B) $\frac{10}{21}$ (C) $\frac{51}{105}$ (D) $\frac{52}{105}$

9. If a white ball is drawn, then the probability that it is from urn B is

(A) $\frac{32}{53}$ (B) $\frac{33}{53}$ (C) $\frac{35}{53}$ (D) $\frac{36}{53}$

COMPREHENSION (Q.10 TO Q.11) :

Initially a bag was known to contain some one rupee (‘0’ or more) and some fifty paisa (‘0’ or more) coins.
In all bag was known to have 4 coins. Two coins were randomly drawn from the bag and both found to be one rupee coin. (initially all number of rupee coins in the bag are equiprobable)

10. If these coins are replaced, what is the probability the next drawn coin is fifty paisa coin.

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{1}{8}$ (D) $\frac{3}{8}$

11. If these coins are not replaced, what is the probability the next drawn coin is fifty paisa coin

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{1}{8}$ (D) $\frac{3}{8}$

COMPREHENSION (Q.12 TO Q.14) :

A cube having all of its sides pointed is cut by two horizontal two vertical and other two also vertical in other direction so as to form 27 equal cubes. Of these cubes, a cube is randomly selected.

12. The probability that the cube selected has none of its side pointed is

(A) $\frac{2}{27}$ (B) $\frac{1}{9}$ (C) 0 (D) $\frac{1}{27}$

13. The probability that the cube selected has two sides pointed is

(A) $\frac{1}{27}$ (B) $\frac{2}{9}$ (C) $\frac{4}{9}$ (D) $\frac{8}{27}$

14. The probability that the cube selected has only one side pointed is

(A) $\frac{2}{9}$ (B) $\frac{8}{27}$ (C) $\frac{4}{9}$ (D) $\frac{1}{9}$

COMPREHENSION (Q.15 TO Q.16) :

There are two die D_1 and D_2 both having six faces. D_1 has 3 faces marked with 1, 2 faces marked with 2 and 1 face marked with 3. D_2 has 1 face marked with 1, 2 faces marked with 2 and 3 faces makred with 3. Both dice are thrown once. Let P(x) be the probability of getting the sum equal to x. Then

15. P(3) =

(A) $\frac{1}{12}$ (B) $\frac{1}{9}$ (C) $\frac{5}{36}$ (D) $\frac{2}{9}$

16. Which is the correct order

(A) $P(2) < P(6) < P(3) < P(4) < P(5)$

(B) $P(6) = P(2) < P(3) = P(5) < P(4)$

(C) $P(6) = P(2) < P(5) < P(3) < P(4)$

(D) $P(6) = P(2) < P(3) < P(5) < P(4)$

COMPREHENSION (Q.17 TO Q.19) :

A chess match between two grand masters X and Y is won by whoever first wins a total of two games. X's probability of winning, drawing or losing any particular game are p, q, r respectively. The games are independent and $p + q + r = 1$, then

17. The probability that X wins the match after (n) games ($n \geq 5$) is

(A) $n\,p^2q^{n-3}(q + (n-1)r)$

(B) $(n-1)p^2 q^{n-2}$

(C) $p^2(n-2)q^{n-3}(q + (n-1)r)$

(D) $p^2q^{n-3}(n-1)\,(q + (n-2)r)$

18. The probability that Y wins the match after 6th game

(A) $5q^3r^2(q + 4p)$ (B) $6q^3r^2(q + 5p)$ (C) $4q^3r^2(q + 5p)$ (D) $5q^4r^2$

19. The probability that Y wins the match is

(A) $\frac{r^2(3p+r)}{(1-q)^3}$ (B) $\frac{r^2(2p+r)}{(1-q)^3}$ (C) $\frac{r^2(p+3r)}{(1-q)^3}$ (D) $\frac{r^2(p+2r)}{(1-q)^3}$

COMPREHENSION (Q.20 TO Q.22) :

A biased coin, for which probability of getting head is $\frac{2}{3}$ and that of tail is $\frac{1}{3}$, is tossed till the difference of number of head and tail is *r* and this event is denoted by A_r, $r \geq 2$.

20. If r = 2, then the probability that the game ends with more number of heads than tails is

(A) $\frac{4}{9}$ (B) $\frac{2}{9}$ (C) $\frac{7}{9}$ (D) $\frac{4}{5}$

21. For r = 2, it is given that game ends with a head then the probability it ends in minimum number of throws is

(A) $\frac{4}{5}$ (B) $\frac{5}{9}$ (C) $\frac{4}{9}$ (D) $\frac{7}{9}$

22. If B is the event that last two throws show either two consecutive head or tail, then $P(B/A_r)$ is

(A) $\frac{4}{5}$ (B) $1-\left(\frac{5}{9}\right)^r$ (C) $1-\left(\frac{4}{9}\right)^r$ (D) 1

COMPREHENSION (Q.23 TO Q.24) :

A simple board game has four fields A, B, C and D. Once you end up on field A you have won and once you end up on field B, you have lost. From fields C and D you move to other fields by tossing a coin. If you are on field C and you throw a head, then you move to field A, otherwise to field D. From field D, you move to field C if you throw a head, and otherwise you move to field B.

23. Suppose that you start in field D, then the probability that you will win is

(A) $\frac{1}{4}$ (B) $\frac{1}{6}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$

24. Suppose that you start in field C; then the probability that you will win is

(A) $\frac{5}{6}$ (B) $\frac{1}{2}$ (C) $\frac{3}{4}$ (D) $\frac{2}{3}$

Comprehension (Q.25 to Q.26) :

Let $A = \{1, 2, 3, 4,......,25\}$ and $B = \{x, y\}$, $B \subset A$. Then

25. The probability that $x^2 - y^2$ is divisible by 7 is equal to

(A) $\frac{7}{30}$ (B) $\frac{71}{300}$ (C) $\frac{18}{75}$ (D) $\frac{73}{300}$

26. The probability that $x^2 - y^2$ is divisible by 5 is equal to

(A) $\frac{1}{3}$ (B) $\frac{1}{4}$ (C) $\frac{1}{2}$ (D) $\frac{1}{5}$

Comprehension (Q.27 to Q.29) :

Starting at (0, 0) an object moves in coordinate plane by a sequence of steps, each of length one. Each step is left, right, up or down, all four are equally likely. Find the probability that the object reaches (2, 2) in

27. Exactly 4 steps

(A) $\frac{3}{128}$ (B) $\frac{5}{256}$ (C) $\frac{3}{64}$ (D) $\frac{7}{128}$

28. Exactly 6 steps

(A) $\frac{3}{128}$ (B) $\frac{5}{256}$ (C) $\frac{3}{64}$ (D) $\frac{7}{128}$

29. Exactly 5 steps

(A) $\frac{3}{128}$ (B) $\frac{1}{32}$ (C) $\frac{5}{128}$ (D) 0

COMPREHENSION (Q.30 TO Q.31) :

Each face of a cube is to be coloured with exactly one colour from blue, green or red. Then the probability that

30. No. two adjacent faces are painted with the same colour is equal to

(A) $\frac{4}{243}$ (B) $\frac{2}{729}$ (C) $\frac{2}{243}$ (D) $\frac{2}{81}$

31. All the colours are used to paint the cube given that each pair of opposite faces are painted with a different colour is equal to

(A) $\frac{1}{9}$ (B) $\frac{2}{9}$ (C) $\frac{4}{9}$ (D) $\frac{8}{9}$

COMPREHENSION (Q.32 TO Q.33) :

A bag contains 3 red, 3 blue and 4 white balls. A ball is drawn at random and is replaced back together with a ball of a different colour (which can only be red, blue or white) so that there are now 11 balls in the bag. Then

32. The probability that the number of white balls will remain greater than the number of red balls is equal to

(A) $\frac{7}{20}$ (B) $\frac{2}{5}$ (C) $\frac{11}{20}$ (D) $\frac{13}{20}$

33. If another ball is drawn from the bag containing 11 balls and found to be red, then the probability that the first ball was also red is equal to

(A) $\frac{12}{61}$ (B) $\frac{16}{63}$ (C) $\frac{16}{67}$ (D) $\frac{18}{67}$

COMPREHENSION (Q.34 TO Q.36) :

Let a and b be two numbers chosen at random from the set {1, 2, 3,....,n} with replacement. Let $P_n(p)$ denotes the probability that $a^{p-1} - b^{p-1}$ is divisible by p, where p is a prime number. Then

34. Let [·] represents greatest integer function, then $P_n(p)$ is equal to

(A) $1-\frac{1}{n}\left[\frac{n}{p}\right]+\frac{2}{n^2}\left[\frac{n}{p}\right]^2$

(B) $1-\frac{2}{n}\left[\frac{n}{p}\right]+\frac{1}{n^2}\left[\frac{n}{p}\right]^2$

(C) $1+\frac{1}{n}\left[\frac{n}{p}\right]+\frac{2}{n^2}\left[\frac{n}{p}\right]^2$

(D) $1-\frac{2}{n}\left[\frac{n}{p}\right]+\frac{2}{n^2}\left[\frac{n}{p}\right]^2$

35. $P_{25}(3)$ is equal to

(A) $\frac{353}{625}$ (B) $\frac{357}{625}$ (C) $\frac{361}{625}$ (D) $\frac{364}{625}$

36. $\lim_{n\to\infty} P_n(p)$ is equal to

(A) $1-\frac{2}{p}+\frac{2}{p^2}$ (B) $1+\frac{1}{p}+\frac{2}{p^2}$ (C) $1-\frac{2}{p}+\frac{1}{p^2}$ (D) $1-\frac{1}{p}+\frac{2}{p^2}$

COMPREHENSION (Q.37 TO Q.39) :

There are two sets of well shuffled pack of 52 cards namely set P and set Q such that each set contains 52 cards.

37. Two cards are drawn from set P and two cards are drawn from set Q, then the probability that exactly one card is identical among the cards drawn is equal to

(A) $\frac{25}{663}$ (B) $\frac{50}{663}$ (C) $\frac{1}{13}$ (D) $\frac{32}{867}$

38. Two cards are drawn from set P and other two are drawn from set Q, then the probability that exactly one of them is a card of heart is equal to

(A) $\frac{301}{876}$ (B) $\frac{245}{576}$ (C) $\frac{247}{578}$ (D) $\frac{251}{578}$

39. If both the sets are mixed together such that now there are 104 cards and 3 cards are drawn at random, then the probability that they all belong to same set is equal to.

(A) $\frac{25}{103}$ (B) $\frac{25}{206}$ (C) $\frac{51}{206}$ (D) $\frac{27}{103}$

COMPREHENSION (Q.40 TO Q.41) :

There are 'n' blacks balls and 2 white balls in a bag. An uninvolved person Mr. C draws balls one by one from the bag without replacement. Mr. A wins as soon as 2 black balls are drawn and Mr. B wins as soon as 2 white balls are drawn. Let A(n) and B(n) represent the probability that Mr. A and Mr. B wins respectively. Then

40. The value of $\lim\limits_{n\to\infty}$ (A(2)A(3)A(4)......A(n)) is equal to

(A) $\frac{1}{5}$ (B) $\frac{1}{10}$ (C) $\frac{1}{4}$ (D) $\frac{2}{5}$

41. The value of $\lim\limits_{n\to\infty}$ (B(1) + B(2) + B(3) + ... + B(n)) is equal to

(A) 1 (B) 2 (C) 3 (D) 5

COMPREHENSION (Q.42 TO Q.43) :

A slip of paper is given to A, who marks it with either a plus sign or a minus sign, the probability of his writing a plus sign is $\frac{1}{3}$. He then passes the slip to B, who may leave it unchanged or change the sign before passing it to C. Next C passes the slip to D after perhaps changing the sign. Finally D passes it to an honest judge after perhaps changing the sign. It is known that B, C, D each change the sign with probability $\frac{2}{3}$.

42. The probability that judge see a plus sign on the slip is equal to

(A) $\frac{4}{9}$ (B) $\frac{38}{81}$ (C) $\frac{40}{81}$ (D) $\frac{41}{81}$

43. If the judge see a plus sign on the slip, then the probabilitythat A originally wrote a plus sign is equal to

(A) $\frac{13}{41}$ (B) $\frac{14}{41}$ (C) $\frac{13}{40}$ (D) $\frac{11}{40}$

Comprehension (Q.44 to Q.46) :

An urn contains 3 white balls, 5 black balls and 2 red balls. Two persons draw balls in turn, without replacement. The first person to draw a white ball wins the game. If a red ball is drawn, the game is a tie. Then

44. The probability that player who begins the game is the winner is equal to

(A) $\frac{67}{168}$ (B) $\frac{333}{840}$

(C) $\frac{73}{210}$ (D) $\frac{83}{210}$

45. The probability that the second participant is the winner is equal to

(A) $\frac{43}{210}$ (B) $\frac{87}{420}$

(C) $\frac{77}{420}$ (D) $\frac{11}{70}$

46. The probability that the game is a tie is equal to

(A) $\frac{1}{5}$ (B) $\frac{2}{5}$

(C) $\frac{3}{5}$ (D) $\frac{4}{5}$

SECTION-4

MATCH THE COLUMN :

1. In a tournament, there are twelve players $S_1, S_2, \ldots, S_{12}$ and divided into six pairs at random. From each game a winner is decided on the basis of a game played between the two players of the pair. Assuming all the players are of equal strength, then match the following :

	Column-I		Column-II
(A)	Probability that S_2 is among the losers is	(P)	$\frac{5}{2}$
(B)	Probability that exactly one of S_3 and S_4 is among the losers is	(Q)	$\frac{1}{2}$
(C)	Probability that both S_2 and S_4 are among the winners is	(R)	$\frac{6}{11}$
(D)	Probability that S_4 and S_5 not playing against each other is	(S)	$\frac{10}{11}$
		(T)	$\frac{3}{11}$

2. Triangle is formed by joining the vertices of a cube.

	Column-I		Column-II
(A)	Probability that the triangle is isosceles or equilateral is greater than	(P)	$\frac{3}{14}$
(B)	Probability that the triangle is isosceles but not equilateral is smaller than	(Q)	$\frac{2}{7}$
(C)	Probability that the triangle is scalene is greater than	(R)	$\frac{3}{7}$
(D)	Probability that the triangle is right angled is greater than or equal to	(S)	$\frac{4}{7}$
		(T)	$\frac{6}{7}$

3. There are 16 equally skilled players $S_1, S_2, S_3, ...,S_{16}$ playing a knockout tournament. They are divided into 8 pairs at random. From each pair a winner is decided on the basis of a game played between the two players of the pair, and they enter into the next round. the tournament proceed in the similar way.

	Column-I		Column-II
(A)	Probability that exactly one of S_1 & S_2 is among the 4 winners of 2^{nd} round is	(P)	$\frac{1}{30}$
(B)	The probability that S_1 wins the tournament given that S_2 enters in the semifinals is	(Q)	$\frac{1}{20}$
(C)	The probability that S_1 wins the tournament given that S_2 enters into final is	(R)	$\frac{1}{10}$
(D)	The probability that S_1 is among the 4 winners of 2nd round given that S_2 wins the first round is	(S)	$\frac{7}{30}$
		(T)	$\frac{2}{5}$

4.

	Column-I		Column-II
(A)	A 7 digit number is formed using any 7 distinct digits selected from 1, 2, 3,....,9. The probability that it is divisible by 9 is less than or equal to	(P)	$\frac{1}{16}$
(B)	A pack of cards contain 4 aces, 4 kings, 4 queens and 4 jacks. Two cardsare drawn, then probability that there is atleast one ace is greater than or equal to	(Q)	$\frac{1}{9}$
(C)	Integers m and n are chosen at random between 1 and 98 (both inclusive).Then the probability that $7^m + 3^n$ is greater than or equal to	(R)	$\frac{1}{5}$
(D)	A coin is tossed 5 times. The probability that the result in the fifth toss is different from all the first four tosses is less than or equal to	(S)	$\frac{1}{4}$
		(T)	$\frac{9}{20}$

5. There are 6 pairs of children's gloves in a box. Each pair is of a different colour. Suppose the right gloves are distributed at random to 6 children, and then the left gloves also are distributed to them at random. Then

	Column-I		Column-II
(A)	The probability that no child gets a matching pair is	(P)	$\frac{11}{30}$
(B)	The probability that every body get a matching pair is	(Q)	$\frac{19}{30}$
(C)	The probability that exactly one child gets a matching pair is	(R)	$\frac{691}{720}$
(D)	Atleast 2 children gets matching pairs is	(S)	$\frac{1}{720}$
		(T)	$\frac{53}{144}$

6. Three distinct numbers are selected from $\{1, 2, 3, 4, 5, 6\}$. Then the probability that

	Column-I		Column-II
(A)	they are in A.P. is equal to	(P)	$\frac{1}{20}$
(B)	they are in G.P. is equal to	(Q)	$\frac{1}{10}$
(C)	they are in H.P. is equal to	(R)	$\frac{3}{20}$
(D)	they form the 3 sides of a triangle is equal to	(S)	$\frac{3}{10}$
		(T)	$\frac{7}{20}$

7. A bag contains some white and some black balls, all combinations being equally likely. The total number of balls in the bag is 12. Four balls are drawn at random from the bag without replacement. Then

	Column-I		Column-II
(A)	The probability that all the four balls are black is equal to	(P)	$\frac{1}{5}$
(B)	If the bag contains 10 black and 2 white balls, then the probability that all four balls are black is equal to	(Q)	$\frac{70}{429}$
(C)	The probability that two balls are black and two balls are white is equal to	(R)	$\frac{1}{4}$
(D)	If all the four balls are black, then the probability that the bag contains 10 black balls is equal to	(S)	$\frac{14}{33}$

8. Five unbaised cubical dice are rolled simultaneously. Let 'm' and 'n' respectively denote the smallest and the largest number appearing on the upper faces of the dice. Now match the probabilities given in the column-II corresponding to the events given in column-I.

	Column-I		Column-II
(A)	P(m = 3) is equal to	(P)	$\left(\frac{2}{3}\right)^5-\left(\frac{1}{2}\right)^4+\left(\frac{1}{3}\right)^5$
(B)	P(n = 4) is equal to	(Q)	$\left(\frac{2}{3}\right)^5-\left(\frac{1}{2}\right)^5+\left(\frac{1}{3}\right)^5$
(C)	P(m = 2 and n = 5) is equal to	(R)	$\left(\frac{5}{6}\right)^5-\left(\frac{1}{3}\right)^5$
(D)	$P(2 \le m \le 4)$ is equal to	(S)	$\left(\frac{5}{6}\right)^5-\left(\frac{1}{2}\right)^5$
		(T)	$\left(\frac{2}{3}\right)^5-\left(\frac{1}{2}\right)^5$

9. A box contains 25 tickets, each with a different number from 1 to 25. Four tickets are drawn at random and without replacement. Let a,b, c, d be the numbers of the tickets drawn.

	Column-I		**Column-II**
(A)	The probability that min (a, b, c, d) < 10 is equal to	(P)	$\frac{189}{2530}$
(B)	The probability that the second smallest number chosen is 10 is equal to	(Q)	$\frac{286}{575}$
(C)	The probability that the sum of a + b + c + d is odd is equal to	(R)	$\frac{207}{230}$
(D)	The probability that the product of abcd is even is equal to	(S)	$\frac{217}{230}$
		(T)	$\frac{1083}{1265}$

SECTION-5

SUBJECTIVE TYPE QUESTIONS

1. If a, b, c are numbers obtained by throwing a dice thrice, such that $a^2 + b^2 + c^2 \leq ab + bc + ca$, then the probability that a point (a, b, c) lies inside the tetrahedran formed by coordinate planes and $x + y + z = 12$ is p. Then 16p is equal to

2. Let $f(x) = x^3 + ax^2 + bx + c$, where a, b, c are chosen respectively by throwing a die three times. The probability that f(x) is an strictly increasing function $\forall x \in R$ is equal to $\frac{a}{b}$, where a, b are coprime natural numbers, then b – a is equal to

3. 8 players $P_1, P_2, ... P_8$ of equal strength play in a knockout tournament. Assuming that players in each round are paired randomly. Then the probability that the player P_1 losses to the eventual winner is $\frac{m}{n}$, where m, n are relatively prime natural numbers, then n-m is equal to

4. A pack of playing card consist of 51 cards. Cards are drawn one by one without replacement. If first 4 cards drawn consist of only one face card, then the probability that the missing card being face card is $\frac{a}{b}$, where a, b are relatively prime natural numbers. Then b – 4a is equal to

5. A 7 digit number with all digits distinct is randomly formed using digits {1, 2, 3,....7}. The probability that formed number is such that product of any four consecutive digits is divisible by 10 is P, then the value of [10P] is (where [·] denote greatest integer function)

6. On each evening a boy either watches Doordarshan channel or Ten sports. The probability that he watches Ten sports is $\frac{4}{5}$. If he watches Doordarshan, there is a probability of $\frac{3}{4}$ that he will fall asleep, while it is $\frac{1}{4}$ when he watches Ten sports. On one evening, the boy is found to be asleep while watching TV. The probability that the body watched Doordarshan is $\frac{m}{n}$, where m, n are coprime, then $|m - n|$ is equal to

7. A fair coin is fossed 10 times and the outcomes are listed. Let E_i be the event that the i^{th} outcome is a head and E_m be the event that the list contains exactly 'm' heads. If E_i and E_m are independent, then m is equal to

8. A pack of playing cards was found to contain only 51 cards. If the first 13 cards which are examined are all black. If the probability that the missed one is red is equal to $\frac{p}{q}$ where p, q are relatively prime natural numbers, then p + q is equal to

9. In an organisation number of women are μ times that of men. If α things are to be distributed among them. Then the probability that the number of things received by men are odd is $\frac{1}{2}-\left(\frac{1}{2}\right)^{\alpha+1}$. Find μ

10. A positive integer is randomly selected. Let the probability that $x^{n+1} - x^n + 1$ is divisible by $x^2 - x + 1$ be P, then the value of $\frac{1}{P}$ is

11. If p, q are chosen randomly with replacement from the set $\{1, 2, 3, \ldots, 9, 10\}$. The probability that the roots of the equation $x^2 + px + q = 0$ are real is equal to $\frac{m}{n}$, where m, n are relatively prime natural numbers then $|m - n|$ is equal to

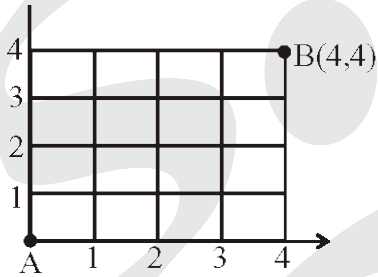
12. If all the letters of the word 'MATHEMATICS' are arranged arbitrarily. The probability that C comes before E, E before H, H before I and I before S is $\frac{1}{N}$, then N is equal to

13. If $\{x, y\}$ is a subset of the first 30 natural numbers. Then the probability that $x^3 + y^3$ is divisible by 3 is equal to $\frac{m}{n}$ where m, n are relatively prime natural numbers, then $m + n$ is equal to

14. In a tournament, there are five teams participating such that each team plays one game with every other team. Each team has a 50% chance of winning any game it plays. (There are noties). Then the probability that the tournament will produces neither an undefeated team nor a winless team is $\frac{m}{n}$, where m, n are coprime natural numbers. Then $m + n$ is equal to

15. A box contains 3 red balls, 4 white balls and 3 blue balls. Balls are drawn from the box one at a time, at random, without replacement. Then the probability that all three red balls will be drawn before any white ball is obtained is $\frac{m}{n}$, where m, n are coprime natural numbers, then $n - m$ is equal to :

16. Two persons P and Q are respectively located at A(0, 0) and B(4, 4) in the given figure. They start moving simultaneously toward each other and at a speed of one segment per minute. 'P' moves either to the right or up and 'Q' moves either left or down. The probability that they will meet on their path is $\frac{m}{n}$, where m, n are relatively prime natural numbers, then m + n is equal to :



17. A fair red die has three faces numbered 1, two faces numbered 2, and one faces numbered 3. A fair blue die has one face numbered 1, two faces numbered 2, and three faces numbered 3. The probability of the sum which is most likely to occur upon throwing both the dice is $\frac{m}{n}$, where m, n are relatively prime natural numbers, then m + n is equal to

18. A tetrahedral fair dice whose faces are numbered 1, 2, 3 and 4. The die is thrown and the face on which the pyramid lands is considered the 'winning' number. If the dice is thrown four times and the scores noted. The probability of obtaining a score of 10 is $\frac{m}{n}$ where m, n are relatively prime natural numbers, then m + n is equal to

19. A fair coin is flipped 15 times and it is observed that there are 10 heads and 5 tails. By a run of heads we mean a consecutive sequence of heads. For example, the sequence of outcomes

HHTHTHHHHHHTHTT

has four runs of heads, the first has 2 heads, the second 1 head, the third 6 heads and the fourth 1 head. The probability that there are 4 runs of heads is $\frac{m}{n}$ where m, n are relatively prime natural numbers, then m + n is equal to

20. 200 moviegoers quene up for tickets at the box office. The price of admission is Rs. 100 and the cashier has no change initially. Of the moviegoers, 100 have rupee 100 note only and 100 have rupee 200 note only. The probability that all of the moviegoers can collect their tickets without facing any problem of change is $\frac{1}{p}$, then p is equal to

21. A bag has 10 balls, 6 balls are drawn in an attempt and replaced. Then another draw of 5 balls is made from the bag, the probability that exactly two balls are common to both the draws is $\frac{m}{n}$, where m, n are coprime natural numbers, then n is equal to

22. 32 players ranked 1 to 32 are playing a knochout tournament. Assume that in every match between two players, the better ranked player wins. The probability that ranked 1 and ranked 2 players are winner and runner up respectively is $\frac{m}{n}$ where m, n are relatively prime natural numbers, then m + n is equal to

23. Let a bag contains 5 white and 10 black balls and 4 balls are selected randomly from it and kept aside. Now a next draw of a ball is made. Then the probability that this drawn ball is white is $\frac{m}{n}$, where m, n are coprime natural numbers then m + n is equal to :

24. In the above problem, the drawn 4 balls are put in a empty bag. Now a ball is drawn randomly from this new bag and it is found white. The probability that this was the only white which was transferred from first bag to second one is $\frac{m}{n}$, where m, n are coprime natural numbers, then n – m is equal to :

Answer Key

Single Choice Questions:

1. B	**2.** A	**3.** D	**4.** A	**5.** C	**6.** D
7. C	**8.** D	**9.** A	**10.** C	**11.** B	**12.** D
13. B	**14.** D	**15.** B	**16.** D	**17.** C	**18.** D
19. A	**20.** A	**21.** B	**22.** C	**23.** A	**24.** C
25. A	**26.** B	**27.** A	**28.** D	**29.** A	**30.** D
31. B	**32.** A	**33.** D	**34.** A	**35.** C	**36.** D
37. D	**38.** B	**39.** C	**40.** A	**41.** D	**42.** D
43. B	**44.** D	**45.** D	**46.** B	**47.** A	**48.** B
49. B	**50.** D	**51.** D	**52.** A	**53.** B	**54.** C
55. D					

One or More Than One Correct Questions

1. B,C	**2.** B,C	**3.** B,C,D	**4.** A,C	**5.** B,D	**6.** A,B
7. B,D	**8.** A,BC	**9.** A,B,C,D	**10.** B,C	**11.** A,B,D	**12.** A,C
13. B,C	**14.** B,C	**15.** A,B,C	**16.** A,C,D	**17.** B,C,D	

Comprehension Type Questions

1. D	**2.** B	**3.** A	**4.** A	**5.** D	**6.** D
7. A	**8.** D	**9.** B	**10.** C	**11.** B	**12.** D
13. C	**14.** A	**15.** D	**16.** B	**17.** D	**18.** A
19. A	**20.** D	**21.** B	**22.** D	**23.** C	**24.** D
25. D	**26.** A	**27.** A	**28.** A	**29.** D	**30.** C
31. D	**32.** D	**33.** D	**34.** D	**35.** A	**36.** A
37. B	**38.** C	**39.** A	**40.** B	**41.** C	**42.** D
43. A	**44.** D	**45.** A	**46.** B		

MATCH THE COLUMN

1. (A) → (Q) ; (B) → (R) ; (C) → (P) ; (D) → (S)
2. (A) → (P, Q, R) ; (B) → (S, T) ; (C) → (P, Q) ; (D) → (P, Q, R, S, T)
3. (A) → (T) ; (B) → (Q) ; (C) → (P) ; (D) → (S)
4. (A) → (Q, R, S, T) ; (B) → (P, Q, R, S, T) ; (C) → (P, Q, R, S) ; (D) → (P)
5. (A) → (T) ; (B) → (S) ; (C) → (P) ; (D) → (R)
6. (A) → (S) ; (B) → (P) ; (C) → (Q) ; (D) → (T)
7. (A) → (P) ; (B) → (S) ; (C) → (P) ; (D) → (Q)
8. (A) → (T) ; (B) → (T) ; (C) → (P) ; (D) → (R)
9. A → T ; B → P ; C → Q ; D → S

SUBJECTIVE TYPE QUESTIONS

1. 8	**2.** 5	**3.** 5	**4.** 4	**5.** 9	**6.** 4
7. 5	**8.** 5	**9.** 3	**10.** 6	**11.** 19	**12.** 120
13. 4	**14.** 49	**15.** 34	**16.** 163	**17.** 25	**18.** 75
19. 203	**20.** 101	**21.** 21	**22.** 47	**23.** 4	**24.** 61

Previous Year Questions

SECTION-1

1. A multiple choice examinaton has 5 questions. Each question has three alternative answers of which exactly one is correct. The probability that a student will get 4 or more correct answers just by guessing is: **[IIT JEE Main 2013]**

(A) $\frac{10}{3^5}$ (B) $\frac{17}{3^5}$

(C) $\frac{13}{3^5}$ (D) $\frac{11}{3^5}$

2. Let A and B be two events such that $P(\overline{A \cup B}) = \frac{1}{6}, P(A \cap B) = \frac{1}{4}$ and $P(\overline{A}) = \frac{1}{4}$, where $\overline{A}$ stands for the complement of the event A.

Then the events A and B are **[IIT JEE Main 2014]**

(A) Independent and equally likely.
(B) Mutually exclusive and independent.
(C) Equally likely but not independent.
(D) Independent but not equally likely.

3. If 12 identical balls are to be placed in 3 identical boxes, then the probability that one of the boxes contains exactly 3 balls is : **[IIT JEE Main 2015]**

(A) $22\left(\frac{1}{3}\right)^{11}$ (B) $\frac{55}{3}\left(\frac{2}{3}\right)^{11}$

(C) $55\left(\frac{2}{3}\right)^{10}$ (D) $220\left(\frac{1}{3}\right)^{12}$

4. Let two fair six-faced dice A and B be thrown simultaneously. If E_1 is the event that die A shows up four, E_2 is the event that die B shows up two and E_3 is the event that the sum of numbers on both dice is odd, then which of the following statements is NOT true ? **[IIT JEE Main 2016]**

(A) E_1 and E_2 are independent
(B) E_2 and E_3 are independent
(C) E_1 and E_3 are independent
(D) E_1, E_2 and E_3 are independent

5. A box contains 15 green and 10 yellow balls. If 10 balls are randomly drawn, one-by-one, with replacement, then the variance of the number of green balls drawn is : **[IIT JEE Main 2017]**

(A) 4
(B) $\frac{6}{25}$
(C) $\frac{12}{5}$
(D) 6

6. If two different numbers are taken from the set {0, 1, 2, 3, ..., 10} ; then the probability that their sum as well as absolute difference are both multiple of 4, is : **[IIT JEE Main 2017]**

(A) $\frac{14}{45}$
(B) $\frac{7}{55}$
(C) $\frac{6}{55}$
(D) $\frac{12}{55}$

7. For three events A, B and C, P(Exactly one of A or B occurs)
= P(Exactly one of B or C occurs)
= P(Exactly one of C or A occurs) = $\frac{1}{4}$ and P(All the three events occur simultaneously) = $\frac{1}{16}$.

Then the probability that at least one of the events occurs, is : **[IIT JEE Main 2017]**

(A) $\frac{7}{64}$
(B) $\frac{3}{16}$
(C) $\frac{7}{32}$
(D) $\frac{7}{16}$

8. A bag contains 4 red and 6 black balls. A ball is drawn at random from the bag, its colour is observed and this ball along with two additional balls of the same colour are returned to the bag. If now a ball is drawn at random from the bag, then the probability that this drawn ball is red, is : **[JEE Main 2018]**

(A) $\frac{3}{4}$ (B) $\frac{3}{10}$

(C) $\frac{2}{5}$ (D) $\frac{1}{5}$

SECTION-2

1. (a) If the integers m and n are chosen at random from 1 to 100, then the probability that a number of the form $7^m + 7^n$ is divisible by 5 equals

(A) $\frac{1}{4}$ (B) $\frac{1}{7}$

(C) $\frac{1}{8}$ (D) $\frac{1}{49}$

(b) The probability that a student passes in Mathematics, Physics and Chemistry are m, p and c respectively. Of these subjects, the student has a 75% chance of passing in at least one, a 50% chance of passing in at least two, and a 40% hance of passing in exactly two, which of the following relations are true?

(A) $p + m + c = \frac{19}{20}$ (B) $p + m + c = \frac{27}{20}$

(C) $pmc = \frac{1}{10}$ (D) $pmc = \frac{1}{4}$

(c) Eight players P_1, P_2, P_3, ...P_8 play a knock-out tournament. It is known that whenever the players P_i and P_j play, the player P_i will win if $i < j$. Assuming that the players are paired at random in each round, what is the probability that the player P_4 reaches the final. **[JEE ‘ 99, 2 + 3 + 10 (out of 200)]**

2. Four cards are drawn from a pack of 52 playing cards. Find the probability of drawing exactly one pair. **[REE'99, 6]**

3. A coin has probability 'p' of showing head when tossed. It is tossed 'n' times. Let p_n denote the probability that no two (or more) consecutive heads occur. Prove that,

$$p_1 = 1\ ,\ p_2 = 1 - p^2\ \&\ p_n = (1 - p)\, p_{n-1} + p\,(1 - p)\, p_{n-2}\ ,\ \text{for all } n \geq 3.$$

[JEE ' 2000 (Mains), 5]

4. A and B are two independent events. The probability that both occur simultaneously is 1/6 and the probability that neither occurs is 1/3. Find the probabilities of occurance of the events A and B separately.

[REE ' 2000 (Mains), 3]

5. Two cards are drawn at random from a pack of playing cards. Find the probability that one card is a heart and the other is an ace. **[REE ' 2001 (Mains), 3]**

6. (a) An urn contains 'm' white and 'n' black balls. A ball is drawn at random and put back into the urn along with K additional balls of the same colour as that of the ball drawn. A ball is again drawn at random. What is the probability that the ball drawn now is white.

(b) An unbiased die, with faces numbered 1, 2, 3, 4, 5, 6 is thrown n times and he list of n numbers showing up is noted. What is the probability that among the numbers 1, 2, 3, 4, 5, 6, only three numbers appear in the list.

[JEE ' 2001 (Mains), 5 + 5]

7. A box contains N coins, m of which are fair and the rest are biased. The probability of getting a head when a fair coin is tossed is 1/2, while it is 2/3 when a biased coin is tossed. A coin is drawn from the box at random and is tossed twice. The first time it shows head and the second time it shows tail. What is the probability that the coin drawn is fair? **[JEE '2002 (mains)]**

8. (a) A person takes three tests in succession. The probability of his passing the first test is p, that of his passing each successive test is p or p/2 according as he passes or fails in the preceding one. He gets selected provided he passes at least two tests. Determine the probability that the person is selected.

(b) In a combat, A targets B, and both B and C target A. The probabilities of A, B, C hitting their targets are 2/3 , 1/2 and 1/3 respectively. They shoot imultaneously and A is hit. Find the probability that B hits his target whereas C oes not. **[JEE' 2003, Mains-2 + 2 out of 60]**

9. (a) Three distinct numbers are selected from first 100 natural numbers. The probability that all the three numbers are divisible by 2 and 3 is

(A) $\frac{4}{25}$ (B) $\frac{4}{35}$

(C) $\frac{4}{55}$ (D) $\frac{4}{1155}$

(b) If A and B are independent events, prove that $P(A \cup B) \cdot P(A' \cap B') \le P(C)$, where C is an event defined that exactly one of A or B occurs.

(c) A bag contains 12 red balls and 6 white balls. Six balls are drawn one by one without replacement of which atleast 4 balls are white. Find the probability that in the next two draws exactly one white ball is drawn (leave the answer in terms of ${}^nC_r$). **[JEE 2004, 3 + 2 + 4]**

10. (a) A six faced fair dice is thrown until 1 comes, then the probability that 1 comes in even number of trials is **[JEE 2005 (Scr)]**

(A) 5/11 (B) 5/6

(C) 6/11 (D) 1/6

(b) A person goes to office either by car, scooter, bus or train probability of which being $\frac{1}{7}, \frac{3}{7}, \frac{2}{7}$ and $\frac{1}{7}$ respectively. Probability that he reaches office late, if he takes car, scooter, bus or train is $\frac{2}{9}, \frac{1}{9}, \frac{4}{9}$ and $\frac{1}{9}$ respectively. Given that he reached office in time, then what is the probability that he travelled by a car.

[JEE 2005 (Mains), 2]

COMPREHENSION (Q.11 TO Q.13) :

There are n urns each containing $n + 1$ balls such that the i^{th} urn contains i white balls and $(n + 1 – i)$ red balls. Let u_i be the event of selecting i^{th} urn, $i = 1, 2, 3, ..., n$ and w denotes the event of getting a white ball.

11. (a) If $P(u_i) \propto i$ where $i = 1, 2, 3,....., n$ then $\lim_{n\to\infty} P(w)$ is equal to

(A) 1 (B) 2/3

(C) 3/4 (D) 1/4

(b) If $P(u_i) = c$, where c is a constant then $P(u_n/w)$ is equal to

(A) $\frac{2}{n+1}$ (B) $\frac{1}{n+1}$

(C) $\frac{n}{n+1}$ (D) $\frac{1}{2}$

(c) If n is even and E denotes the event of choosing even numbered urn ($P(u_i) = \frac{1}{n}$), then the value of $P(w/E)$, is **[JEE 2006, 5 marks each]**

(A) $\frac{n+2}{2n+1}$ (B) $\frac{n+2}{2(n+1)}$

(C) $\frac{n}{n+1}$ (B) $\frac{1}{n+1}$

12. (a) One Indian and four American men and their wives are to be seated randomly around a circular table. Then the conditional probability that the Indian man is seated adjacent to his wife given that each American man is seated adjacent to his wife is

(A) 1/2 (B) 1/3

(C) 2/5 (D) 1/5

(b) Let E^c denote the complement of an event E. Let E, F, G be pairwise independent events with $P(G) > 0$ and $P(E \cap F \cap G) = 0$. Then $P(E^c \cap F^c \mid G)$ equals

(A) $P(E^c) + P(F^c)$ (B) $P(E^c) – P(F^c)$

(C) $P(E^c) – P(F)$ (D) $P(E) – P(F^c)$

(c) Let $H_1, H_2, ... , H_n$ be mutually exclusive and exhaustive events with $P(H_i) > 0$, $i = 1, 2, ..., n$. Let E be any other event with $0 < P(E) < 1$.

Statement-1: $P(H_i / E) > P(E / H_i) \cdot P(H_i)$ for $i = 1, 2, ..., n$.

because

Statement-2: $\sum_{i=1}^{n} P(H_i) = 1$ **[JEE 2007, 3+3+3]**

(A) Statement-1 is true, statement-2 is true; statement-2 is a correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true; statement-2 is NOT a correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

13. (a) An experiment has 10 equally likely outcomes. Let A and B be two non-empty events of the experiment. If A consists of 4 outcomes, the number of outcomes that B must have so that A and B are independent, is

(A) 2, 4 or 8 (B) 3, 6, or 9

(C) 4 or 8 (D) 5 or 10

(b) Consider the system of equations

$$ax + by = 0,\ cx + dy = 0, \text{ where } a, b, c, d \in \{0, 1\}.$$

STATEMENT-1 : The probability that the system of equations has a unique solution is $\frac{3}{8}$.

and

STATEMENT-2 : The probability that the system of equations has a solution is 1. **[JEE 2008, 3+3]**

(A) Statement-1 is True, Statement-2 is True ; statement-2 is a correct explana tion for statement-1

(B) Statement-1 is True, Statement-2 is True ; statement-2 is NOT a correct explanation for statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

COMPREHENSION (Q.14 TO Q.16) : **[JEE 2009]**

A fair die is tossed repeatedly until a six is obtained. Let X denote the number of tosses required.

14. The probability that x = 3 equals

(A) $\frac{25}{216}$ (B) $\frac{25}{36}$

(C) $\frac{5}{36}$ (D) $\frac{125}{216}$

15. The probability that $X \geq 3$ equals

(A) $\frac{125}{216}$ (B) $\frac{25}{36}$

(C) $\frac{5}{36}$ (D) $\frac{5}{216}$

16. The conditional probability that $X \geq 6$ given $X > 3$ equals

(A) $\frac{125}{216}$ (B) $\frac{25}{216}$

(C) $\frac{5}{36}$ (D) $\frac{5}{36}$

17. Let ω be a complex cube root of unity with $\omega \neq 1$. A fair die is thrown three times. If r_1, r_2 and r_3 are the numbers obtained on the die, then the probability that $\omega^{r_1} + \omega^{r_2} + \omega^{r_3} = 0$ is **[JEE 2010]**

(A) $\frac{1}{18}$ (B) $\frac{1}{9}$

(C) $\frac{2}{9}$ (D) $\frac{1}{36}$

18. A signal which can be green or red with probability $\frac{4}{5}$ and $\frac{1}{5}$ respectively, is received by station A and then transmitted to station B. The probability of each station receiving the signal correctly is 3/4. If the signal received at station B is green, then the probability that the original signal was green is **[JEE 2010]**

(A) $\frac{3}{5}$ (B) $\frac{6}{7}$

(C) $\frac{20}{23}$ (D) $\frac{9}{20}$

COMPREHENSION (Q.19 TO Q.20) : **[JEE 2011]**

Let U_1 and U_2 be two urns such that U_1 contains 3 white and 2 red balls, and U_2 contains only 1 white ball. A fair coin is tossed. If head appears then 1 ball is drawn at random from U_1 and put into U_2. However, if tail appears then 2 balls are drawn at random from U_1 and put into U_2. Now 1 ball is drawn at random from U_2.

19. The probability of the drawn ball from U_2 being white is

(A) $\frac{13}{30}$ (B) $\frac{23}{30}$

(C) $\frac{19}{30}$ (D) $\frac{11}{30}$

20. Given that the drawn ball from U_2 is white, the probability that head appeared on the coin is

(A) $\frac{17}{23}$ (B) $\frac{11}{23}$

(C) $\frac{15}{23}$ (D) $\frac{12}{23}$

21. Let E and F be two independent events. The probability that exactly one of them occurs is $\frac{11}{25}$ and the probability of none of them occurring is $\frac{2}{25}$. If P(T) denotes the probability of occurrence of the event T, then **[JEE 2011]**

(A) $P(E) = \frac{4}{5}$, $P(F) = \frac{3}{5}$ (B) $P(E) = \frac{1}{5}$, $P(F) = \frac{2}{5}$

(C) $P(E) = \frac{2}{5}$, $P(F) = \frac{1}{5}$ (D) $P(E) = \frac{3}{5}$, $P(F) = \frac{4}{5}$

22. A ship is fitted with three engines E_1, E_2 and E_3. The engines function independently of each other with respective probabilities $\frac{1}{2}, \frac{1}{4}$ and $\frac{1}{4}$. For the ship to be operational at least two of its engines must function. Let X denote the event that the ship is operational and let X_1, X_2 and X_3 denote respectively the events that the engines E_1, E_2 and E_3 are functioning. Which of the following is (are) true ?

[JEE 2012]

(A) $P\left[x_1^c \middle| X\right] = \frac{3}{16}$

(B) P (Exactly two engines of the ship are functioning $|X) = \frac{7}{8}$

(C) $P[X|X_2] = \frac{5}{16}$

(D) $P[X|X_1] = \frac{7}{16}$

23. Four fair dice D_1, D_2, D_3 and D_4 each having six faces numbered 1, 2, 3, 4, 5, and 6, are rolled simultaneously. The probability that D_4 shows a number appearing on D_1, D_2 and D_3 is : **[JEE 2012]**

(A) $\frac{91}{216}$ (B) $\frac{108}{216}$

(C) $\frac{125}{216}$ (D) $\frac{127}{216}$

24. Let X and Y be two events such that $P(X | Y) = \frac{1}{2}$, $P(Y | X) = \frac{1}{3}$ and

$P(X \cap Y) = \frac{1}{6}$.

Which of the following is (are) correct? **[JEE 2012]**

(A) $P(X \cup Y) = \frac{2}{3}$ (B) X and Y are independent

(C) X and Y are not independent (D) $P(X^C \cap Y) = \frac{1}{3}$

25. Four persons independently solve a certain problem correctly with probabilities $\frac{1}{2}, \frac{3}{4}, \frac{1}{4}, \frac{1}{8}$. Then the probability that the problem is solved correctly by at least one of them is : **[JEE 2013]**

(A) $\frac{235}{256}$ (B) $\frac{21}{256}$

(C) $\frac{3}{256}$ (D) $\frac{253}{256}$

COMPREHENSION (Q.26 TO Q.27) **[JEE 2013]**

A box B_1 contains 1 white ball, 3 red balls and 2 black balls. Another box B_2 contains 2 white balls, 3 red ball and 4 black balls. A third box B_3 contains 3 white balls, 4 red balls and 5 black balls.

26. If 2 balls are drawn (without replacement) from a randomly selected box and one of the balls is white and the other ball is red, the probability that these 2 balls are drawn from box B_2 is

(A) $\frac{116}{181}$ (B) $\frac{126}{181}$

(C) $\frac{65}{181}$ (D) $\frac{55}{181}$

27. If 1 ball is drawn from each of the boxes B_1, B_2 and B_3, the probability that all 3 drawn balls are of the same colour is

(A) $\frac{82}{648}$ (B) $\frac{90}{648}$

(C) $\frac{558}{648}$ (D) $\frac{566}{648}$

28. Of the three independent events E_1, E_2 and E_3, the probability that only E_1 occurs is α, only E_2 occurs is β and only E_3 occurs is γ. Let the probability p that none of events E_1, E_2 or E_3 occurs satisfy the equations $(\alpha - 2\beta)\, p = \alpha\beta$ and $(\beta - 3\gamma)\, p = 2\beta\gamma$. All the given probabilities are assumed to lie in the interval (0, 1)

Then $\dfrac{\text{Probability of occurrence of } E_1}{\text{Probability of occurrence of } E_3} =$ **[JEE 2013]**

29. Three boys and two girls stand in a queue. The probability, that the number of boys ahead of every girl is at least one more than the number of girls ahead of her, is :

[IIT JEE Advance 2014]

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$

(C) $\frac{2}{3}$ (D) $\frac{3}{4}$

COMPREHENSION (Q.30 TO Q.31) **[IIT JEE ADVANCE 2014]**

Box 1 contains three cards bearing numbers 1, 2, 3 ; box 2 contains five cards bearing numbers 1, 2, 3, 4, 5 ; and box 3 contains seven cards bearing numbers 1, 2, 3, 4, 5, 6, 7. A card is drawn from each of the boxes. Let x_1 be the number on the card drawn from the i^{th} box, i = 1, 2, 3.

30. The probability that $x_1 + x_2 + x_3$ is odd, is :

(A) $\frac{29}{105}$ (B) $\frac{53}{105}$

(C) $\frac{57}{105}$ (D) $\frac{1}{2}$

31. The probability that x_1, x_2, x_3 are in an arithmetic progression, is :

(A) $\frac{9}{105}$ (B) $\frac{10}{105}$

(C) $\frac{11}{105}$ (D) $\frac{7}{105}$

32. The minimum number of times a fair coin needs to be tossed, so that the probability of getting at least two heads is at least 0.96, is **[IIT JEE Advance 2015]**

COMPREHENSION (Q.33 TO Q.34) **[IIT JEE ADVANCE 2015]**

Let n_1 and n_2 be the number of red and black balls, respectively, in box I. Let n_3 and n_4 be the number of red and black balls, respectively, in box II.

33. One of the two boxes, box I and box II, was selected at random and a ball was drawn randomly out of this box. The ball was found to be red. If the probability that this red ball was drawn from box II is $\frac{1}{3}$, then the correct option(s) with the possible values of n_1, n_2, n_3 and n_4 is(are)

(A) $n_1 = 3, n_2 = 3, n_3 = 5, n_4 = 15$ (B) $n_1 = 3, n_2 = 6, n_3 = 10, n_4 = 50$

(C) $n_1 = 8, n_2 = 6, n_3 = 5, n_4 = 20$ (D) $n_1 = 6, n_2 = 12, n_3 = 5, n_4 = 20$

34. A ball is drawn at random from box I and transferred to box II. If the probability of drawing a red ball from box I, after this transfer, is $\frac{1}{3}$, then the correct option(s) with the possible values of n_1 and n_2 is(are)

(A) $n_1 = 4$ and $n_2 = 6$ (B) $n_1 = 2$ and $n_2 = 3$

(C) $n_1 = 10$ and $n_2 = 20$ (D) $n_1 = 3$ and $n_2 = 6$

35. Let X and Y be two events such that $P(X) = \frac{1}{3}, P(X \mid Y) = \frac{1}{2}$ and $P(Y \mid X) = \frac{2}{5}$. Then

[IIT JEE Advance 2017]

(A) $P(Y) = \frac{4}{15}$ (B) $P(X' \mid Y) = \frac{1}{2}$

(C) $P(X \cap Y) = \frac{1}{5}$ (D) $P(X \cup Y) = \frac{2}{5}$

36. Three randomly chosen nonnegative integers x, y and z are found to satisfy the equation x + y + z = 10.0 Then the probability that z is even, is :

[IIT JEE Advance 2017]

(A) $\frac{36}{55}$ (B) $\frac{6}{11}$

(C) $\frac{5}{11}$ (D) $\frac{1}{2}$

Comprehension (Q.37 to Q.38) :

There are five students S_1, S_2, S_3, S_4 and S_5 in a music class and for them there are five seats R_1, R_2, R_3, R_4 and R_5 arranged in a row, where initially the seat R_i is allotted to the student S_i , i = 1, 2, 3, 4, 5. But, on the examination day, the five students are randomly allotted the five seats. **[JEE Advanced 2018]**

37. The probability that, on the examination day, the student S_1 gets the previously allotted seat R_1, and **NONE** of the remaining students gets the seat previously allotted to him/her is

(A) $\frac{3}{40}$ (B) $\frac{1}{8}$

(C) $\frac{7}{40}$ (D) $\frac{1}{5}$

38. For i = 1, 2, 3, 4 let T_i denote the event that the students S_i and S_{i+1} do **NOT** sit adjacent to each other on the day of the examination. Then, the probability of the event $T_1 \cap T_2 \cap T_3 \cap T_4$ is

(A) $\frac{1}{15}$ (B) $\frac{1}{10}$

(C) $\frac{7}{60}$ (D) $\frac{1}{5}$

Answer Key

Section-1

1. D	**2.** D	**3.** B	**4.** D	**5.** C	**6.** C
7. D	**8.** C				

Section-2

1. **(a)** A **(b)** B, C **(c)** 4/35

2. 0.304 **4.** $\frac{1}{2}$ & $\frac{1}{3}$ or $\frac{1}{3}$ & $\frac{1}{2}$

5. $\frac{1}{26}$ **6.** **(a)** $\frac{m}{m+n}$; **(b)** $\frac{{}^6C_3\left(3^n - 3.2^n + 3\right)}{6^n}$ **7.** $\frac{9m}{m+8N}$

8. (a) $p^2(2-p)$; (b) 1/2

9. (a) D , **(c)** $\dfrac{{}^{12}C_2\,{}^{6}C_4\,{}^{10}C_1\,{}^{2}C_1 + {}^{12}C_1\,{}^{6}C_5\,{}^{11}C_1\,{}^{1}C_1}{{}^{12}C_2\left({}^{12}C_2\,{}^{6}C_4 + {}^{12}C_1\,{}^{6}C_5 + {}^{12}C_0\,{}^{6}C_6\right)}$

10. **(a)** A, **(b)** $\dfrac{1}{7}$

11. (a) B, (b) A, (c) B

12. **(a)** C; **(b)** C; **(c)** D

13. **(a)** D, **(b)** B		**14.** A	**15.** B	**16.** D	**17.** C
18. C	**19.** B	**20.** D	**21.** AD	**22.** B, D	**23.** A
24. A, B	**25.** A	**26.** D	**27.** A	**28.** 6	**29.** A
30. B	**31.** C	**32.** 8	**33.** A, B		
34. C, D	**35.** AB	**36.** B	**37.** A	**38.** C	