16. If the probability of X to fail in the examination is 0.3 and that for Y is 0.2, then the probability that either X or Y fail in the examination is

(a) 0.5 (b) 0.44
(c) 0.6 (d) None of these

17. If $P(A)=0.4$, $P(B)=x$, $P(A\cup B)=0.7$ and the events A and B are independent, then $x=$

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$
(c) $\frac{2}{3}$ (d) None of these

18. If A and B are two events of a random experiment, $P(A)=0.25$, $P(B)=0.5$ and $P(A\cap B)=0.15$, then $P(A\cap\overline{B})=$ **[MP PET 1987]**

(a) 0.1 (b) 0.35
(c) 0.15 (d) 0.6

19. If $P(A)=0.4$, $P(B)=x$, $P(A\cup B)=0.7$ and the events A and B are mutually exclusive, then $x=$ **[MP PET 19**

(a) $\frac{3}{10}$ (b) $\frac{1}{2}$
(c) $\frac{2}{5}$ (d) $\frac{1}{5}$

20. If A and B are any two events, then the probability that exactly one of them occur is **IIT 1984; RPET 1995, 2002; MP PET 2004]**

(a) $P(A)+P(B)-P(A\cap B)$
(b) $P(A)+P(B)-2P(A\cap B)$
(c) $P(A)+P(B)-P(A\cup B)$
(d) $P(A)+P(B)-2P(A\cup B)$

21. A coin is tossed twice. If events A and B are defined as :
A = head on first toss, B = head on second toss. Then the probability of $A\cup B=$

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$
(c) $\frac{1}{8}$ (d) $\frac{3}{4}$

22. If A and B are two mutually exclusive events, then $P(A+B)=$ **[MNR 1978; MP PET 1991, 92]**

(a) $P(A)+P(B)-P(AB)$ (b) $P(A)-P(B)$
(c) $P(A)+P(B)$ (d) $P(A)+P(B)+P(AB)$

23. The probability of happening at least one of the events A and B is 0.6. If the events A and B happens simultaneously with the probability 0.2, then $P(\overline{A})+P(\overline{B})=$ **[Roorkee 1989; IIT 1987; MP PET 1997; DCE 2001; J & K 2005]**

(a) 0.4 (b) 0.8
(c) 1.2 (d) 1.4

24. The chances to fail in Physics are 20% and the chances to fail in Mathematics are 10%. What are the chances to fail in at least one subject

(a) 28% (b) 38%
(c) 72% (d) 82%

25. If $P(A)=\frac{1}{4}$, $P(B)=\frac{5}{8}$ and $P(A\cup B)=\frac{3}{4}$, then $P(A\cap B)=$

(a) $\frac{1}{8}$ (b) 0
(c) $\frac{3}{4}$ (d) 1

26. If A and B are two independent events such that $P(A)=0.40$, $P(B)=0.50$. Find P(neither A nor B) **[MP PET 1989; J & K 2005]**

(a) 0.90 (b) 0.10
(c) 0.2 (d) 0.3

27. If A and B are two independent events, then $P(A+B)=$ **[MP PET 1992]**

(a) $P(A)+P(B)-P(A)P(B)$
(b) $P(A)-P(B)$
(c) $P(A)+P(B)$
(d) $P(A)+P(B)+P(A)P(B)$

28. If an integer is chosen at random from first 100 positive integers, then the probability that the chosen number is a multiple of 4 or 6, is

(a) $\frac{41}{100}$ (b) $\frac{33}{100}$
(c) $\frac{1}{10}$ (d) None of these

29. If the probability of a horse A winning a race is 1/4 and the probability of a horse B winning the same race is 1/5, then the probability that either of them will win the race is

(a) $\frac{1}{20}$ (b) $\frac{9}{20}$
(c) $\frac{11}{20}$ (d) $\frac{19}{20}$

30. If A and B an two events such that $P(A\cup B)=\frac{5}{6}$, $P(A\cap B)=\frac{1}{3}$ and $P(\overline{B})=\frac{1}{3}$, then $P(A)=$

(a) $\frac{1}{4}$ (b) $\frac{1}{3}$
(c) $\frac{1}{2}$ (d) $\frac{2}{3}$

31. If A and B are two events such that $P(A\cup B)+P(A\cap B)=\frac{7}{8}$ and $P(A)=2P(B)$, then $P(A)=$

(a) $\frac{7}{12}$ (b) $\frac{7}{24}$
(c) $\frac{5}{12}$ (d) $\frac{17}{24}$

32. The probabilities that A and B will die within a year are p and q respectively, then the probability that only one of them will be alive at the end of the year is

[CEE 1993; Pb. CET 2004]

(a) $p+q$ (b) $p+q-2qp$

(c) $p+q-pq$ (d) $p+q+pq$

33. A and B are two independent events. The probability that both A and B occur is $\frac{1}{6}$ and the probability that neither of them occurs is $\frac{1}{3}$. Then the probability of the two events are respectively

(a) $\frac{1}{2}$ and $\frac{1}{3}$ (b) $\frac{1}{5}$ and $\frac{1}{6}$

(c) $\frac{1}{2}$ and $\frac{1}{6}$ (d) $\frac{2}{3}$ and $\frac{1}{4}$

34. If A and B are two independent events such that $P(A\cap B')=\frac{3}{25}$ and $P(A'\cap B)=\frac{8}{25}$, then $P(A)=$

[IIT Screening]

(a) $\frac{1}{5}$ (b) $\frac{3}{8}$

(c) $\frac{2}{5}$ (d) $\frac{4}{5}$

35. Let A and B be two events such that $P(A)=0.3$ and $P(A\cup B)=0.8$. If A and B are independent events, then $P(B)=$ **[IIT 1990; UPSEAT 2001, 02]**

(a) $\frac{5}{6}$ (b) $\frac{5}{7}$

(c) $\frac{3}{5}$ (d) $\frac{2}{5}$

36. For two given events A and B, $P(A\cap B)=$ **[IIT 1988]**

(a) Not less than $P(A)+P(B)-1$

(b) Not greater than $P(A)+P(B)$

(c) Equal to $P(A)+P(B)-P(A\cup B)$

(d) All of the above

37. $P(A\cup B)=P(A\cap B)$ if and only if the relation between $P(A)$ and $P(B)$ is

(a) $P(A)=P(\overline{A})$ (b) $P(A\cap B)=P(A'\cap B')$

(c) $P(A)=P(B)$ (d) None of these

38. The two events A and B have probabilities 0.25 and 0.50 respectively. The probability that both A and B occur simultaneously is 0.14. Then the probability that neither A nor B occurs is

(a) 0.39 (b) 0.25

(c) 0.904 (d) None of these

39. Twelve tickets are numbered 1 to 12. One ticket is drawn at random, then the probability of the number to be divisible by 2 or 3, is

(a) $\frac{2}{3}$ (b) $\frac{7}{12}$

(c) $\frac{5}{6}$ (d) $\frac{3}{4}$

40. Three athlete A, B and C participate in a race competetion. The probability of winning A and B is twice of winning C. Then the probability that the race win by A or B, is

(a) $\frac{2}{3}$ (b) $\frac{1}{2}$

(c) $\frac{4}{5}$ (d) $\frac{1}{3}$

41. If $P(A)=\frac{1}{2}$, $P(B)=\frac{1}{3}$ and $P(A\cap B)=\frac{7}{12}$, then the value of $P(A'\cap B')$ is

(a) $\frac{7}{12}$ (b) $\frac{3}{4}$

(c) $\frac{1}{4}$ (d) $\frac{1}{6}$

42. In a city 20% persons read English newspaper, 40% read Hindi newspaper and 5% read both newspapers. The percentage of non-reader either paper is

(a) 60% (b) 35%

(c) 25% (d) 45%

43. The probability that at least one of A and B occurs is 0.6. If A and B occur simultaneously with probability 0.3, then $P(A')+P(B')=$

(a) 0.9 (b) 1.15

(c) 1.1 (d) 1.2

44. The probability that a man will be alive in 20 years is $\frac{3}{5}$ and the probability that his wife will be alive in 20 years is $\frac{2}{3}$. Then the probability that at least one will be alive in 20 years, is

(a) $\frac{13}{15}$ (b) $\frac{7}{15}$

(c) $\frac{4}{15}$ (d) None of these

45. Given two mutually exclusive events A and B such that $P(A)=0.45$ and $P(B)=0.35$, then $P(A \text{ or } B)=$

[AI CBSE 1979]

(a) 0.1 (b) 0.25

(c) 0.15 (d) 0.8

46. If A and B are any two events, then $P(A\cup B)=$

[MP PET 1995]

(a) $P(A)+P(B)$

(b) $P(A)+P(B)+P(A\cap B)$

(c) $P(A)+P(B)-P(A\cap B)$

(d) $P(A).P(B)$

47. If $A_1, A_2, ... A_n$ are any n events, then

(a) $P(A_1\cup A_2\cup ...\cup A_n)=P(A_1)+P(A_2)+...+P(A_n)$

(b) $P(A_1\cup A_2\cup ...\cup A_n)>P(A_1)+P(A_2)+...+P(A_n)$

(c) $P(A_1\cup A_2\cup ...\cup A_n)\le P(A_1)+P(A_2)+...+P(A_n)$

(d) None of these

48. In a class of 125 students 70 passed in Mathematics, 55 in Statistics and 30 in both. The probability that a student selected at random from the class has passed in only one subject is

(a) $\frac{13}{25}$ (b) $\frac{3}{25}$

(c) $\frac{17}{25}$ (d) $\frac{8}{25}$

49. *A, B, C* are any three events. If $P(S)$ denotes the probability of S happening then $P(A\cap(B\cup C))=$ **[EAM**

(a) $P(A)+P(B)+P(C)-P(A\cap B)-P(A\cap C)$

(b) $P(A)+P(B)+P(C)-P(B)P(C)$

(c) $P(A\cap B)+P(A\cap C)-P(A\cap B\cap C)$

(d) None of these

50. Let E_1, E_2, E_3 be three arbitrary events of a sample space S. Consider the following statements which of the following statements are correct

(a) P (only one of them occurs) $=P(\overline{E}_1E_2E_3+E_1\overline{E}_2E_3+E_1E_2\overline{E}_3)$

(b) P (none of them occurs) $=P(\overline{E}_1+\overline{E}_2+\overline{E}_3)$

(c) P (atleast one of them occurs) $=P(E_1+E_2+E_3)$

(d) P (all the three occurs) $=P(E_1+E_2+E_3)$

where $P(E_1)$ denotes the probability of E_1 and $\overline{E}_1$ denotes complement of E_1.

51. One card is drawn from a pack of 52 cards. The probability that it is a queen or heart is

(a) $\frac{1}{26}$ (b) $\frac{3}{26}$

(c) $\frac{4}{13}$ (d) $\frac{3}{13}$

52. The probabilities of occurrence of two events are respectively 0.21 and 0.49. The probability that both occurs simultaneously is 0.16. Then the probability that none of the two occurs is

(a) 0.30 (b) 0.46

(c) 0.14 (d) None of these

53. Let A and B be events for which $P(A)=x$, $P(B)=y$, $P(A\cap B)=z$, then $P(\overline{A}\cap B)$ equals **[AMU 1999]**

(a) $(1-x)y$ (b) $1-x+y$

(c) $y-z$ (d) $1-x+y-z$

54. The probability of solving a question by three students are $\frac{1}{2},\frac{1}{4},\frac{1}{6}$ respectively. Probability of question is being solved will be

(a) $\frac{33}{48}$ (b) $\frac{35}{48}$

(c) $\frac{31}{48}$ (d) $\frac{37}{48}$

55. Let A and B are two independent events. The probability that both A and B occur together is 1/6 and the probability that neither of them occurs is 1/3. The probability of occurrence of A is

(a) 0 or 1 (b) $\frac{1}{2}$ or $\frac{1}{3}$

(c) $\frac{1}{2}$ or $\frac{1}{4}$ (d) $\frac{1}{3}$ or $\frac{1}{4}$

56. One card is drawn randomly from a pack of 52 cards, then the probability that it is a king or spade is **[RPET 2001]**

(a) $\frac{1}{26}$ (b) $\frac{3}{26}$

(c) $\frac{4}{13}$ (d) $\frac{3}{13}$

57. If $P(A)=0.25$, $P(B)=0.50$ and $P(A\cap B)=0.14$, then $P(A\cap\overline{B})$ is equal to **[RPET 2001]**

(a) 0.61 (b) 0.39

(c) 0.48 (d) None of these

58. If A and B are any two events, then $P(\overline{A}\cap B)=$ **[MP PET 2001]**

(a) $P(\overline{A})\ P(\overline{B})$ (b) $1-P(A)-P(B)$

(c) $P(A)+P(B)-P(A\cap B)$ (d) $P(B)-P(A\cap B)$

59. In two events $P(A\cup B)=5/6$, $P(A^c)=5/6$, $P(B)=2/3$, then A and B are

(a) Independent (b) Mutually exclusive

(c) Mutually exhaustive (d) Dependent

60. The probability that at least one of the events A and B occurs is 3/5. If A and B occur simultaneously with probability 1/5, then $P(A')+P(B')$ is **[DCE 2002]**

(a) $\frac{2}{5}$ (b) $\frac{4}{5}$

(c) $\frac{6}{5}$ (d) $\frac{7}{5}$

61. If A and B are arbitrary events, then **[DCE 2002]**

(a) $P(A\cap B)\geq P(A)+P(B)$ (b) $P(A\cup B)\leq P(A)+P(B)$

(c) $P(A\cap B)=P(A)+P(B)$ (d) None of these

62. If A and B are events such that $P(A\cup B)=3/4$, $P(A\cap B)=1/4$, $P(\overline{A})=2/3$, then $P(\overline{A}\cap B)$ is **[AIEEE 2002]**

(a) $\frac{5}{12}$ (b) $\frac{3}{8}$

(c) $\frac{5}{8}$ (d) $\frac{1}{4}$

63. A random variable X has the probability distribution

X	1	2	3	4	5	6	7	8
$P(X)$	0.15	0.23	0.12	0.10	0.20	0.08	0.07	0.05

For the events $E=\{X$ is prime number$\}$ and $F=\{X<4\}$, the probability of $P(E\cup F)$ is

(a) 0.50 (b) 0.77
(c) 0.35 (d) 0.87

64. If $P(A) = P(B) = x$ and $P(A \cap B) = P(A' \cap B') = \frac{1}{3}$, then $x =$

[UPSEAT 2003]

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$
(c) $\frac{1}{4}$ (d) $\frac{1}{6}$

65. If $P(A \cup B) = 0.8$ and $P(A \cap B) = 0.3$, then $P(\overline{A}) + P(\overline{B}) =$

[EAMCET 2003]

(a) 0.3 (b) 0.5
(c) 0.7 (d) 0.9

66. In a certain population 10% of the people are rich, 5% are famous and 3% are rich and famous. The probability that a person picked at random from the population is either famous or rich but not both, is equal to **[UPSEAT 2004]**

(a) 0. 07 (b) 0.08
(**c**) 0. 09 (d) 0. 12

67. A card is drawn from a pack of cards. Find the probability that the card will be a queen or a heart **[RPET 2003]**

(a) $\frac{4}{3}$ (b) $\frac{16}{3}$
(c) $\frac{4}{13}$ (d) $\frac{5}{3}$

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

[AIEEE 2005]

(a) Independent but not equally likely
(b) Mutually exclusive and independent
(c) Equally likely and mutually exclusive
(d) Equally likely but not independent

69. Let S be a set containing n elements and we select 2 subsets A and B of S at random then the probability that $A \cup B = S$ and $A \cap B = \phi$ is

(a) 2^n (b) n^2
(c) $1/n$ (d) $1/2^n$

70. Let A and B are two events and $P(A') = 0.3$, $P(B) = 0.4, P(A \cap B') = 0.5$, then $P(A \cup B')$ is

[Orissa JEE 2005]

(a) 0.5 (b) 0.8
(c) 1 (d) 0.1

Conditional probability, Baye's theorem

1. Two dice are thrown. What is the probability that the sum of the numbers appearing on the two dice is 11, if 5 appears on the first

(a) $\frac{1}{36}$ (b) $\frac{1}{6}$
(c) $\frac{5}{6}$ (d) None of these

2. If $P(A) = \frac{1}{2}, P(B) = \frac{1}{3}$ and $P(A \cap B) = \frac{1}{4}$, then $P\left(\frac{B}{A}\right) =$

(a) 1 (b) 0
(c) $\frac{1}{2}$ (d) $\frac{1}{3}$

3. If A and B are two events such that $P(A) \neq 0$ and $P(B) \neq 1$, then $P\left(\frac{\overline{A}}{\overline{B}}\right) =$

[IIT 1982; RPET 1995, 2000; DCE 2000; UPSEAT 2001]

(a) $1 - P\left(\frac{A}{B}\right)$ (b) $1 - P\left(\frac{\overline{A}}{B}\right)$
(c) $\frac{1 - P(A \cup B)}{P(\overline{B})}$ (d) $\frac{P(\overline{A})}{P(\overline{B})}$

4. In a single throw of two dice what is the probability of obtaining a number greater than 7, if 4 appears on the first dice

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$
(c) $\frac{1}{12}$ (d) None of these

5. If A and B are two events such that $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$ and $P(A \cap B) = \frac{1}{5}$, then $P\left(\frac{\overline{B}}{\overline{A}}\right) =$

(a) $\frac{37}{40}$ (b) $\frac{37}{45}$
(c) $\frac{23}{40}$ (d) None of these

6. If A and B are two events such that $P(A) = \frac{3}{8}$, $P(B) = \frac{5}{8}$ and $P(A \cup B) = \frac{3}{4}$, then $P\left(\frac{A}{B}\right) =$

(a) $\frac{2}{5}$ (b) $\frac{2}{3}$
(c) $\frac{3}{5}$ (d) None of these

7. If the events A and B are mutually exclusive, then $P\left(\frac{A}{B}\right) =$

(a) 0 (b) 1
(c) $\frac{P(A \cap B)}{P(A)}$ (d) $\frac{P(A \cap B)}{P(B)}$

8. If A and B are two events such that $A \subseteq B$, then $P\left(\frac{B}{A}\right) =$

(a) 0 (b) 1
(c) 1/2 (d) 1/3

9. If A and B are two independent events, then $P\left(\frac{A}{B}\right) =$

(a) 0 (b) 1
(c) $P(A)$ (d) $P(B)$

10. If E and F are independent events such that $0 < P(E) < 1$ and $0 < P(F) < 1$, then

(a) E and F^c (the complement of the event F) are independent
(b) E^c and F^c are independent
(c) $P\left(\frac{E}{F}\right) + P\left(\frac{E^c}{F^c}\right) = 1$
(d) All of the above

11. If $4\,P(A) = 6\,P(B) = 10\,P(A \cap B) = 1$, then $P\left(\frac{B}{A}\right) =$ **[MP PET 2003]**

(a) $\frac{2}{5}$ (b) $\frac{3}{5}$
(c) $\frac{7}{10}$ (d) $\frac{19}{60}$

12. For a biased die, the probabilities for different faces to turn up are

Face :	1	2	3	4	5	6
Probability :	0.2	0.22	0.11	0.25	0.05	0.17

The die is tossed and you are told that either face 4 or face 5 has turned up. The probability that it is face 4 is

(a) $\frac{1}{6}$ (b) $\frac{1}{4}$
(c) $\frac{5}{6}$ (d) None of these

13. A pair has two children. If one of them is boy, then the probability that other is also a boy, is

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$
(c) $\frac{1}{3}$ (d) None of these

14. Three coins are tossed. If one of them shows tail, then the probability that all three coins show tail, is

(a) $\frac{1}{7}$ (b) $\frac{1}{8}$
(c) $\frac{2}{7}$ (d) $\frac{1}{6}$

15. If A and B are two independent events such that $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{5}$, then

(a) $P\left(\frac{A}{B}\right) = \frac{1}{2}$ (b) $P\left(\frac{A}{A \cup B}\right) = \frac{5}{6}$
(c) $P\left(\frac{A \cap B}{A' \cup B'}\right) = 0$ (d) All of the above

16. For two events A and B, if $P(A) = P\left(\frac{A}{B}\right) = \frac{1}{4}$ and $P\left(\frac{B}{A}\right) = \frac{1}{2}$, then

(a) A and B are independent (b) $P\left(\frac{A'}{B}\right) = \frac{3}{4}$
(c) $P\left(\frac{B'}{A'}\right) = \frac{1}{2}$ (d) All of the above

17. A biased die is tossed and the respective probabilities for various faces to turn up are given below

Face :	1	2	3	4	5	6
Probability :	0.1	0.24	0.19	0.18	0.15	0.14

If an even face has turned up, then the probability that it is face 2 or face 4, is

(a) 0.25 (b) 0.42
(c) 0.75 (d) 0.9

18. If two events A and B are such that $P(A^c) = 0.3, P(B) = 0.4$ and $P(AB^c) = 0.5$, then $P[B/(A \cup B^c)]$ is equal to **[IIT 1994]**

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$
(c) $\frac{1}{4}$ (d) None of these

19. A letter is known to have come either from LONDON or CLIFTON; on the postmark only the two consecutive letters ON are legible. The probability that it came from LONDON is

(a) $\frac{5}{17}$ (b) $\frac{12}{17}$
(c) $\frac{17}{30}$ (d) $\frac{3}{5}$

20. Let $0 < P(A) < 1$, $0 < P(B) < 1$ and $P(A \cup B) = P(A) + P(B) - P(A)\,P(B)$. Then **[IIT 1995]**

(a) $P(B/A) = P(B) - P(A)$
(b) $P(A^c \cup B^c) = P(A^c) + P(B^c)$
(c) $P(A \cup B)^c = P(A^c)\,P(B^c)$
(d) $P(A/B) = P(A)$

21. For a biased die the probabilities for different faces to turn up are given below

Face :	1	2	3	4	5	6
Probabilit	0.1	0.32	0.21	0.15	0.05	0.17

y :						

The die is tossed and you are told that either face 1 or 2 has turned up. Then the probability that it is face 1, is **[IIT 1981]**

(a) $\frac{5}{21}$ (b) $\frac{5}{22}$

(c) $\frac{4}{21}$ (d) None of these

22. In a certain town, 40% of the people have brown hair, 25% have brown eyes and 15% have both brown hair and brown eyes. If a person selected at random from the town, has brown hair, the probability that he also has brown eyes, is

[MNR 1988]

(a) $\frac{1}{5}$ (b) $\frac{3}{8}$

(c) $\frac{1}{3}$ (d) $\frac{2}{3}$

23. There are 3 bags which are known to contain 2 white and 3 black balls; 4 white and 1 black balls and 3 white and 7 black balls respectively. A ball is drawn at random from one of the bags and found to be a black ball. Then the probability that it was drawn from the bag containing the most black balls is

(a) $\frac{7}{15}$ (b) $\frac{5}{19}$

(c) $\frac{3}{4}$ (d) None of these

24. In an entrance test there are multiple choice questions. There are four possible answers to each question of which one is correct. The probability that a student knows the answer to a question is 90%. If he gets the correct answer to a question, then the probability that he was guessing, is

(a) $\frac{37}{40}$ (b) $\frac{1}{37}$

(c) $\frac{36}{37}$ (d) $\frac{1}{9}$

25. A coin is tossed three times in succession. If E is the event that there are at least two heads and F is the event in which first throw is a head, then $P\left(\frac{E}{F}\right)=$ **[MP PET 1996]**

(a) $\frac{3}{4}$ (b) $\frac{3}{8}$

(c) $\frac{1}{2}$ (d) $\frac{1}{8}$

26. A and B are two events such that $P(A)= 0.8$, $P(B)=0.6$ and $P(A\cap B)=0.5$, then the value of $P(A/B)$ is

(a) $\frac{5}{6}$ (b) $\frac{5}{8}$

(c) $\frac{9}{10}$ (d) None of these

27. If $\overline{E}$ and $\overline{F}$ are the complementary events of events E and F respectively and if $0<P(F)<1$, then **[IIT 1998]**

(a) $P(E/F)+P(\overline{E}/F)=1$

(b) $P(E/F)+P(E/\overline{F})=1$

(c) $P(\overline{E}/F)+P(E/\overline{F})=1$

(d) $P(E/\overline{F})+P(\overline{E}/\overline{F})=1$

28. For two events A and B, if $P(A)=P\left(\frac{A}{B}\right)=\frac{1}{4}$ and $P\left(\frac{B}{A}\right)=\frac{1}{2}$, then **[MP PET 2003]**

(a) A and B are independent (b) $P\left(\frac{A'}{B}\right)=\frac{3}{4}$

(c) $P\left(\frac{B'}{A'}\right)=\frac{1}{2}$ (d) All of these

29. Two cards are drawn one by one from a pack of cards. The probability of getting first card an ace and second a coloured one is (before drawing second card first card is not placed again in the pack) **[UPSEAT 1999; 2003]**

(a) $\frac{1}{26}$ (b) $\frac{5}{52}$

(c) $\frac{5}{221}$ (d) $\frac{4}{13}$

30. One dice is thrown three times and the sum of the thrown numbers is 15. The probability for which number 4 appears in first throw

(a) $\frac{1}{18}$ (b) $\frac{1}{36}$

(c) $\frac{1}{9}$ (d) $\frac{1}{3}$

31. One ticket is selected at random from 100 tickets numbered 00, 01, 02, ... 98, 99. If X and Y denote the sum and the product of the digits on the tickets, then $P(X=9/Y=0)$ equals

(a) $\frac{1}{19}$ (b) $\frac{2}{19}$

(c) $\frac{3}{19}$ (d) None of these

32. A man is known to speak the truth 3 out of 4 times. He throws a die and reports that it is a six. The probability that it is actually a six, is

(a) $\frac{3}{8}$ (b) $\frac{1}{5}$

(c) $\frac{3}{4}$ (d) None of these

33. A bag 'A' contains 2 white and 3 red balls and bag 'B' contains 4 white and 5 red balls. One ball is drawn at random from a randomly chosen bag and is found to be red. The probability that it was drawn from bag 'B' was

[BIT Ranchi 1988; IIT 1976]

(a) $\frac{5}{14}$ (b) $\frac{5}{16}$

(c) $\frac{5}{18}$ (d) $\frac{25}{52}$

34. A bag X contains 2 white and 3 black balls and another bag Y contains 4 white and 2 black balls. One bag is selected at random and a ball is drawn from it. Then the probability for the ball chosen be white is **[EAMCET 2003]**

(a) $\frac{2}{15}$ (b) $\frac{7}{15}$

(c) $\frac{8}{15}$ (d) $\frac{14}{15}$

35. Bag A contains 4 green and 3 red balls and bag B contains 4 red and 3 green balls. One bag is taken at random and a ball is drawn and noted it is green. The probability that it comes bag B

(a) $\frac{2}{7}$ (b) $\frac{2}{3}$

(c) $\frac{3}{7}$ (d) $\frac{1}{3}$

Binomial distribution

1. 8 coins are tossed simultaneously. The probability of getting at least 6 heads is **[AISSE 1985; MNR 1985**

(a) $\frac{57}{64}$ (b) $\frac{229}{256}$

(c) $\frac{7}{64}$ (d) $\frac{37}{256}$

2. In a box containing 100 eggs, 10 eggs are rotten. The probability that out of a sample of 5 eggs none is rotten if the sampling is with replacement is **[MP PET 1991; MNR 1986; RPET 1995; UPSEAT 2000]**

(a) $\left(\frac{1}{10}\right)^5$ (b) $\left(\frac{1}{5}\right)^5$

(c) $\left(\frac{9}{5}\right)^5$ (d) $\left(\frac{9}{10}\right)^5$

3. If the probability that a student is not a swimmer is 1/5, then the probability that out of 5 students one is swimmer is

(a) ${}^5C_1\left(\frac{4}{5}\right)^4\left(\frac{1}{5}\right)$ (b) ${}^5C_1\frac{4}{5}\left(\frac{1}{5}\right)^4$

(c) $\frac{4}{5}\left(\frac{1}{5}\right)^4$ (d) None of these

4. In a box of 10 electric bulbs, two are defective. Two bulbs are selected at random one after the other from the box. The first bulb after selection being put back in the box before making the second selection. The probability that both the bulbs are without defect is **[MP PET 1987]**

(a) $\frac{9}{25}$ (b) $\frac{16}{25}$

(c) $\frac{4}{5}$ (d) $\frac{8}{25}$

5. A fair coin is tossed n times. If the probability that head occurs 6 times is equal to the probability that head occurs 8 times, then n is equal to **[Kurukshetra CEE 1998; AMU 2000]**

(a) 15 (b) 14

(c) 12 (d) 7

6. If three dice are thrown together, then the probability of getting 5 on at least one of them is

(a) $\frac{125}{216}$ (b) $\frac{215}{216}$

(c) $\frac{1}{216}$ (d) $\frac{91}{216}$

7. If a dice is thrown 7 times, then the probability of obtaining 5 exactly 4 times is

(a) ${}^7C_4\left(\frac{1}{6}\right)^4\left(\frac{5}{6}\right)^3$ (b) ${}^7C_4\left(\frac{1}{6}\right)^3\left(\frac{5}{6}\right)^4$

(c) $\left(\frac{1}{6}\right)^4\left(\frac{5}{6}\right)^3$ (d) $\left(\frac{1}{6}\right)^3\left(\frac{5}{6}\right)^4$

8. If x denotes the number of sixes in four consecutive throws of a dice, then $P(x=4)$ is

(a) $\frac{1}{1296}$ (b) $\frac{4}{6}$

(c) 1 (d) $\frac{1295}{1296}$

9. A man make attempts to hit the target. The probability of hitting the target is $\frac{3}{5}$. Then the probability that A hit the target exactly 2 times in 5 attempts, is

(a) $\frac{144}{625}$ (b) $\frac{72}{3125}$

(c) $\frac{216}{625}$ (d) None of these

10. If a dice is thrown 5 times, then the probability of getting 6 exact three times, is

(a) $\frac{125}{388}$ (b) $\frac{125}{3888}$

(c) $\frac{625}{23328}$ (d) $\frac{250}{2332}$

11. The binomial distribution for which mean = 6 and variance = 2, is

(a) $\left(\frac{2}{3}+\frac{1}{3}\right)^6$ (b) $\left(\frac{2}{3}+\frac{1}{3}\right)^9$

(c) $\left(\frac{1}{3}+\frac{2}{3}\right)^6$ (d) $\left(\frac{1}{3}+\frac{2}{3}\right)^9$

12. A dice is thrown ten times. If getting even number is considered as a success, then the probability of four successes is

(a) ${}^{10}C_4\left(\frac{1}{2}\right)^4$ (b) ${}^{10}C_4\left(\frac{1}{2}\right)^6$

(c) ${}^{10}C_4\left(\frac{1}{2}\right)^8$ (d) ${}^{10}C_6\left(\frac{1}{2}\right)^{10}$

13. If the mean and variance of a binomial variate X are 2 and 1 respectively, then the probability that X takes a value greater than 1, is

(a) $\frac{2}{3}$ (b) $\frac{4}{5}$

(c) $\frac{7}{8}$ (d) $\frac{15}{16}$

14. At least number of times a fair coin must be tossed so that the probability of getting at least one head is at least 0.8, is

(a) 7 (b) 6

(c) 5 (d) None of these

15. A biased coin with probability $p, 0 < p < 1$, of heads is tossed until a head appears for the first time. If the probability that the number of tosses required is even is $\frac{2}{5}$, then $p =$

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$

(c) $\frac{1}{4}$ (d) None of these

16. The probability of a bomb hitting a bridge is $\frac{1}{2}$ and two direct hits are needed to destroy it. The least number of bombs required so that the probability of the bridge beeing destroyed is greater then 0.9, is

(a) 8 (b) 7

(c) 6 (d) 9

17. If X follows a binomial distribution with parameters $n = 6$ and p. If $9P(X=4) = P(X=2)$, then $p =$

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$

(c) $\frac{1}{4}$ (d) 1

18. A die is tossed thrice. If getting a four is considered a success, then the mean and variance of the probability distribution of the number of successes are **[DSSE 1987]**

(a) $\frac{1}{2}, \frac{1}{12}$ (b) $\frac{1}{6}, \frac{5}{12}$

(c) $\frac{5}{6}, \frac{1}{2}$ (d) None of these

19. A die is tossed twice. Getting a number greater than 4 is considered a success. Then the variance of the probability distribution of the number of successes is **[AISSE 1979]**

(a) $\frac{2}{9}$ (b) $\frac{4}{9}$

(c) $\frac{1}{3}$ (d) None of these

20. A die is thrown three times. Getting a 3 or a 6 is considered success. Then the probability of at least two successes is **[DSSE 1981]**

(a) $\frac{2}{9}$ (b) $\frac{7}{27}$

(c) $\frac{1}{27}$ (d) None of these

21. In a simultaneous toss of four coins, what is the probability of getting exactly three heads

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$

(c) $\frac{1}{4}$ (d) None of these

22. A coin is tossed successively three times. The probability of getting exactly one head or 2 heads, is **[AISSE 1990]**

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$

(c) $\frac{3}{4}$ (d) None of these

23. The items produced by a firm are supposed to contain 5% defective items. The probability that a sample of 8 items will contain less than 2 defective items, is **[MP PET 1993]**

(a) $\frac{27}{20}\left(\frac{19}{20}\right)^7$ (b) $\frac{533}{400}\left(\frac{19}{20}\right)^6$

(c) $\frac{153}{20}\left(\frac{1}{20}\right)^7$ (d) $\frac{35}{16}\left(\frac{1}{20}\right)^6$

24. The probability that a man can hit a target is $\frac{3}{4}$. He tries 5 times. The probability that he will hit the target at least three times is

(a) $\frac{291}{364}$ (b) $\frac{371}{464}$

(c) $\frac{471}{502}$ (d) $\frac{459}{512}$

25. A fair coin is tossed a fixed number of times. If the probability of getting 7 heads is equal to that of getting 9 heads, then the probability of getting 3 heads is

(a) $\frac{35}{2^{12}}$ (b) $\frac{35}{2^{14}}$

(c) $\frac{7}{2^{12}}$ (d) None of these

26. A contest consists of predicting the results win, draw or defeat of 7 football matches. A sent his entry by predicting at random. The probability that his entry will contain exactly 4 correct predictions is

(a) $\frac{8}{3^7}$ (b) $\frac{16}{3^7}$

(c) $\frac{280}{3^7}$ (d) $\frac{560}{3^7}$

27. If there are n independent trials, p and q the probability of success and failure respectively, then probability of exactly r successes

or

Let p be the probability of happening an event and q its failure, then the total chance of r successes in n trials is

[MP PET 1999]

(a) ${}^nC_{n+r}p^rq^{n-r}$ (b) ${}^nC_rp^{r-1}q^{r+1}$

(c) ${}^nC_rq^{n-r}p^r$ (d) ${}^nC_rp^{r+1}q^{r-1}$

28. A die is tossed thrice. A success is getting 1 or 6 on a toss. The mean and the variance of number of successes

[AI CBSE 1985]

(a) $\mu = 1, \sigma^2 = 2/3$ (b) $\mu = 2/3, \sigma^2 = 1$

(c) $\mu = 2, \sigma^2 = 2/3$ (d) None of these

29. If X follows a binomial distribution with parameters $n = 6$ and p and $4(P(X=4)) = P(X=2)$, then $p =$

[EAMCET 1994]

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$

(c) $\frac{1}{6}$ (d) $\frac{1}{3}$

30. The value of C for which $P(X=k) = Ck^2$ can serve as the probability function of a random variable X that takes 0, 1, 2, 3, 4 is [EAMCET 1994]

(a) $\frac{1}{30}$ (b) $\frac{1}{10}$

(c) $\frac{1}{3}$ (d) $\frac{1}{15}$

31. In a bag there are three tickets numbered 1, 2, 3. A ticket is drawn at random and put back and this is done four times. The probability that the sum of the numbers is even, is

(a) $\frac{41}{81}$ (b) $\frac{39}{81}$

(c) $\frac{40}{81}$ (d) None of these

32. In tossing 10 coins, the probability of getting exactly 5 heads is

(a) $\frac{9}{128}$ (b) $\frac{63}{256}$

(c) $\frac{1}{2}$ (d) $\frac{193}{256}$

33. The probability that a bulb produced by a factory will fuse after 150 days of use is 0.05. What is the probability that out of 5 such bulbs none will fuse after 150 days of use

(a) $1-\left(\frac{19}{20}\right)^5$ (b) $\left(\frac{19}{20}\right)^5$

(c) $\left(\frac{3}{4}\right)^5$ (d) $90\left(\frac{1}{4}\right)^5$

34. A dice is thrown 5 times, then the probability that an even number will come up exactly 3 times is

(a) $\frac{5}{16}$ (b) $\frac{1}{2}$

(c) $\frac{3}{16}$ (d) $\frac{3}{2}$

35. The records of a hospital show that 10% of the cases of a certain disease are fatal. If 6 patients are suffering from the disease, then the probability that only three will die is

[MP PET 1998]

(a) 1458×10^{-5} (b) 1458×10^{-6}

(c) 41×10^{-6} (d) 8748×10^{-5}

36. Assuming that for a husband-wife couple the chances of their child being a boy or a girl are the same, the probability of their two children being a boy and a girl is

[MP PET 1998]

(a) $\frac{1}{4}$ (b) 1

(c) $\frac{1}{2}$ (d) $\frac{1}{8}$

37. The probability that a student is not a swimmer is 1/5. What is the probability that out of 5 students, 4 are swimmers

[DCE 1999]

(a) ${}^5C_4\left(\frac{4}{5}\right)^4\frac{1}{5}$ (b) $\left(\frac{4}{5}\right)^4\frac{1}{5}$

(c) ${}^5C_1\frac{1}{5}\left(\frac{4}{5}\right)^4\times{}^5C_4$ (d) None of these

38. An experiment succeeds twice as often as it fails. Find the probability that in 4 trials there will be at least three success

[AMU 1999]

(a) $\frac{4}{27}$ (b) $\frac{8}{27}$

(c) $\frac{16}{27}$ (d) $\frac{24}{27}$

39. The mean and variance of a binomial distribution are 6 and 4. The parameter n is

(a) 18 (b) 12

(c) 10 (d) 9

40. Five coins whose faces are marked 2, 3 are tossed. The chance of obtaining a total of 12 is

[MP PET 2001; Pb. CET 2000]

(a) $\frac{1}{32}$ (b) $\frac{1}{16}$

(c) $\frac{3}{16}$ (d) $\frac{5}{16}$

41. A bag contains 2 white and 4 black balls. A ball is drawn 5 times with replacement. The probability that at least 4 of the balls drawn are white is

(a) $\frac{8}{141}$ (b) $\frac{10}{243}$

(c) $\frac{11}{243}$ (d) $\frac{8}{41}$

42. A coin is tossed $2n$ times. The chance that the number of times one gets head is not equal to the number of times one gets tail is

(a) $\frac{(2n!)}{(n!)^2}\left(\frac{1}{2}\right)^{2n}$ (b) $1-\frac{(2n!)}{(n!)^2}$

(c) $1-\frac{(2n!)}{(n!)^2}\cdot\frac{1}{4^n}$ (d) None of these

43. The mean and variance of a binomial distribution are 4 and 3 respectively, then the probability of getting exactly six successes in this distribution is

(a) ${}^{16}C_6\left(\frac{1}{4}\right)^{10}\left(\frac{3}{4}\right)^6$ (b) ${}^{16}C_6\left(\frac{1}{4}\right)^6\left(\frac{3}{4}\right)^{10}$

(c) ${}^{12}C_6\left(\frac{1}{4}\right)^{10}\left(\frac{3}{4}\right)^6$ (d) ${}^{12}C_6\left(\frac{1}{4}\right)^6\left(\frac{3}{4}\right)^6$

44. A die is tossed 5 times. Getting an odd number is considered a success. Then the variance of distribution of success is

[AIEEE 2002]

(a) $\frac{8}{3}$ (b) $\frac{3}{8}$

(c) $\frac{4}{5}$ (d) $\frac{5}{4}$

45. If two coins are tossed 5 times, then the probability of getting 5 heads and 5 tails is

(a) $\frac{63}{256}$ (b) $\frac{1}{1024}$

(c) $\frac{2}{205}$ (d) $\frac{9}{64}$

46. In a binomial distribution the probability of getting a success is 1/4 and standard deviation is 3, then its mean is

[EAMCET 2002]

(a) 6 (b) 8

(c) 12 (d) 10

47. A coin is tossed 10 times. The probability of getting exactly six heads is

(a) $\frac{512}{513}$ (b) $\frac{105}{512}$

(c) $\frac{100}{153}$ (d) ${}^{10}C_6$

48. If a dice is thrown twice, the probability of occurrence of 4 at least once is

(a) $\frac{11}{36}$ (b) $\frac{7}{12}$

(c) $\frac{35}{36}$ (d) None of these

49. The mean and variance of a random variable X having a binomial distribution are 4 and 2 respectively, then $P(X=1)$ is

(a) 1/32 (b) 1/16

(c) 1/8 (d) 1/4

50. A coin is tossed n times. The probability of getting head at least once is greater than 0.8, then the least value of n is

[EAMCET 2003]

(a) 2 (b) 3

(c) 4 (d) 5

51. A coin is tossed 3 times. The probability of getting exactly two heads is **[SCRA 1980; MNR 1979]**

(a) $\frac{3}{8}$ (b) $\frac{1}{2}$

(c) $\frac{1}{4}$ (d) None of these

52. One coin is thrown 100 times. The probability of coming tail in odd number

(a) $\frac{1}{2}$ (b) $\frac{1}{8}$

(c) $\frac{3}{8}$ (d) None of these

53. A coin is tossed 3 times. The probability of obtaining at least two heads is

or

Three coins are tossed all together. The probability of getting at least two heads is

(a) $\frac{1}{8}$ (b) $\frac{3}{8}$

(c) $\frac{1}{2}$ (d) $\frac{2}{3}$

54. A dice is thrown two times. If getting the odd number is considered as success, then the probability of two successes is

(a) $\frac{1}{2}$ (b) $\frac{3}{4}$

(c) $\frac{2}{3}$ (d) $\frac{1}{4}$

55. The mean and the variance of a binomial distribution are 4 and 2 respectively. Then the probability of 2 successes is

[AIEEE 2004]

(a) $\frac{28}{256}$ (b) $\frac{219}{256}$

(c) $\frac{128}{256}$ (d) $\frac{37}{256}$

56. If X has binomial distribution with mean np and variance npq, then $\frac{P(X=k)}{P(X=k-1)}$ is

(a) $\frac{n-k}{k-1}\cdot\frac{p}{q}$ (b) $\frac{n-k+1}{k}\cdot\frac{p}{q}$

(c) $\frac{n+1}{k}\cdot\frac{q}{p}$ (d) $\frac{n-1}{k+1}\cdot\frac{q}{p}$

57. Two cards are drawn successively with replacement from a well shuffled deck of 52 cards then the mean of the number of aces is

(a) 1/13 (b) 3/13

(c) 2/13 (d) None of these

58. A sample of 4 items is drawn at a random without replacement from a lot of 10 items. Containing 3 defective. If X denotes the number of defective items in the sample then $P(0 < x < 3)$ is equal to

(a) $\frac{3}{10}$ (b) $\frac{4}{5}$

(c) $\frac{1}{2}$ (d) $\frac{1}{6}$

Critical Thinking

Objective Questions

1. If E and F are events with $P(E) \le P(F)$ and $P(E \cap F) > 0$, then

(a) Occurrence of $E \Rightarrow$ Occurrence of F

(b) Occurrence of $F \Rightarrow$ Occurrence of E

(c) Non-occurrence of $E \Rightarrow$ Non-occurrence of F

(d) None of the above implications holds

2. A coin is tossed $m+n$ times, where $m \ge n$. The probability of getting at least m consecutive heads is

(a) $\frac{n+1}{2^{m+1}}$ (b) $\frac{n+2}{2^{m+1}}$

(c) $\frac{m+2}{2^{n+1}}$ (d) None of these

3. An anti-aircraft gun take a maximum of four shots at an enemy plane moving away from it. The probability of hitting the plane at the first, second, third and fourth shot are 0.4, 0.3, 0.2 and 0.1 respectively. The probability that the gun hits the plane is **[CEE 1993; IIT Screening]**

(a) 0.25 (b) 0.21

(c) 0.16 (d) 0.6976

4. A bag contains a white and b black balls. Two players A and B alternately draw a ball from the bag replacing the ball each time after the draw till one of them draws a white ball and wins the game. A begins the game. If the probability of A winning the game is three times that of B, then the ratio a : b is

(a) 1 : 1 (b) 1 : 2

(c) 2 : 1 (d) None of these

5. If $(1+3p)/3, (1-p)/4$ and $(1-2p)/2$ are the probabilities of three mutually exclusive events, then the set of all values of p is **[IIT 1986; AMU 2002;**

(a) $\frac{1}{3} \le p \le \frac{1}{2}$ (b) $\frac{1}{3} < p < \frac{1}{2}$

(c) $\frac{1}{2} \le p \le \frac{2}{3}$ (d) $\frac{1}{2} < p < \frac{2}{3}$

6. If n positive integers are taken at random and multiplied together, the probability that the last digit of the product is 2, 4, 6 or 8, is

(a) $\frac{4^n + 2^n}{5^n}$ (b) $\frac{4^n \times 2^n}{5^n}$

(c) $\frac{4^n - 2^n}{5^n}$ (d) None of these

7. An unbiased coin is tossed. If the result is a head, a pair of unbiased dice is rolled and the number obtained by adding the numbers on the two faces is noted. If the result is a tail, a card from a well shuffled pack of eleven cards numbered 2, 3, 4,.......,12 is picked and the number on the card is noted. The probability that the noted number is either 7 or 8, is **[IIT 1994]**

(a) 0.24 (b) 0.244

(c) 0.024 (d) None of these

8. If $P(A) = 0.3$, $P(B) = 0.4$, $P(C) = 0.8$, $P(AB) = 0.08$, $P(AC) = 0.28$, $P(ABC) = 0.09$, $P(A+B+C) \ge 0.75$ and $P(BC) = x$, then **[IIT 1983]**

(a) $0.23 \le x \le 0.48$ (b) $0.32 \le x \le 0.84$

(c) $0.25 \le x \le 0.73$ (d) None of these

9. Odds 8 to 5 against a person who is 40 years old living till he is 70 and 4 to 3 against another person now 50 till he will be living 80. Probability that one of them will be alive next 30 years

(a) $\frac{59}{91}$ (b) $\frac{44}{91}$

(c) $\frac{51}{91}$ (d) $\frac{32}{91}$

10. A rifle man is firing at a distant target and has only 10% chance of hitting it. The minimum number of rounds he must fire in order to have 50% chance of hitting it at least once is

(a) 7 (b) 8

(c) 9 (d) 6

11. If the integers m and n are chosen at random between 1 and 100, then the probability that a number of the form $7^m + 7^n$ is divisible by 5 equals **[IIT 1999]**

(a) $\frac{1}{4}$ (b) $\frac{1}{7}$

(c) $\frac{1}{8}$ (d) $\frac{1}{49}$

12. There are four machines and it is known that exactly two of them are faulty. They are tested, one by one, is a random order till both the faulty machines are identified. Then the probability that only two tests are needed is **[IIT 1998]**

(a) $\frac{1}{3}$ (b) $\frac{1}{6}$

(c) $\frac{1}{2}$ (d) $\frac{1}{4}$

13. Two persons A and B take turns in throwing a pair of dice. The first person to through 9 from both dice will be avoided the prize. If A throws first then the probability that B wins the game is

(a) $\frac{9}{17}$ (b) $\frac{8}{17}$

(c) $\frac{8}{9}$ (d) $\frac{1}{9}$

14. In four schools B_1, B_2, B_3, B_4 the percentage of girls students is 12, 20, 13, 17 respectively. From a school selected at random, one student is picked up at random and it is found that the student is a girl. The probability that the school selected is B_2, is **[Pb. CET 2004]**

(a) $\frac{6}{31}$ (b) $\frac{10}{31}$

(c) $\frac{13}{62}$ (d) $\frac{17}{62}$

15. Probability that a student will succeed in IIT entrance test is 0.2 and that he will succeed in Roorkee entrance test is 0.5. If the probability that he will be successful at both the places is 0.3, then the probability that he does not succeed at both the places is

(a) 0.4 (b) 0.3

(c) 0.2 (d) 0.6

16. Six boys and six girls sit in a row. What is the probability that the boys and girls sit alternatively**[II**

(a) $\frac{1}{462}$ (b) $\frac{1}{924}$

(c) $\frac{1}{2}$ (d) None of these

17. Cards are drawn one by one at random from a well shuffled full pack of 52 cards until two aces are obtained for the first time. If N is the number of cards required to be drawn, then $P_r\{N=n\}$, where $2 \le n \le 50$, is **[CEE 1993; IIT 1983]**

(a) $\frac{(n-1)(52-n)(51-n)}{50\times49\times17\times13}$ (b) $\frac{2(n-1)(52-n)(51-n)}{50\times49\times17\times13}$

(c) $\frac{3(n-1)(52-n)(51-n)}{50\times49\times17\times13}$ (d) $\frac{4(n-1)(52-n)(51-n)}{50\times49\times17\times13}$

18. Let X be a set containing n elements. If two subsets A and B of X are picked at random, the probability that A and B have the same number of elements, is

(a) $\frac{{}^{2n}C_n}{2^{2n}}$ (b) $\frac{1}{{}^{2n}C_n}$

(c) $\frac{1.3.5......(2n-1)}{2^n}$ (d) $\frac{3^n}{4^n}$

19. If three dice are thrown simultaneously, then the probability of getting a score of 7 is**[Kurukshetra CE**

(a) $\frac{5}{216}$ (b) $\frac{1}{6}$

(c) $\frac{5}{72}$ (d) None of these

20. Seven white balls and three black balls are randomly placed in a row. The probability that no two black balls are placed adjacently equals

(a) $\frac{1}{2}$ (b) $\frac{7}{15}$

(c) $\frac{2}{15}$ (d) $\frac{1}{3}$

21. One of the two events must occur. If the chance of one is 2/3 of the other, then odds in favour of the other are

(a) 2 : 3 (b) 1 : 3

(c) 3 : 1 (d) 3 : 2

22. If A and B are two events such that $P(A\cup B)=P(A\cap B)$, then the true relation is

(a) $P(A)+P(B)=0$

(b) $P(A)+P(B)=P(A)P\left(\frac{B}{A}\right)$

(c) $P(A)+P(B)=2P(A)P\left(\frac{B}{A}\right)$

(d) None of these

23. The probability of happening an event A is 0.5 and that of B is 0.3. If A and B are mutually exclusive events, then the probability of happening neither A nor B is

[IIT 1980; DCE 2000]

(a) 0.6 (b) 0.2

(c) 0.21 (d) None of these

24. If A and B are two events, then the probability of the event that at most one of A, B occurs, is

(a) $P(A'\cap B)+P(A\cap B')+P(A'\cap B')$

(b) $1-P(A\cap B)$

(c) $P(A')+P(B')+P(A\cup B)-1$

(d) All of the these

25. For any two events A and B in a sample space **[IIT 1991]**

(a) $P\left(\frac{A}{B}\right)\ge\frac{P(A)+P(B)-1}{P(B)}$, $P(B)\ne0$ is always true

(b) $P(A\cap\overline{B})=P(A)-P(A\cap B)$ does not hold

(c) $P(A\cup B)=1-P(\overline{A})P(\overline{B})$, if A and B are disjoint

(d) None of these

26. Urn A contains 6 red and 4 black balls and urn B contains 4 red and 6 black balls. One ball is drawn at random from urn A and placed in urn B. Then one ball is drawn at random from urn B and placed in urn A. If one ball is now drawn at random from urn A, the probability that it is found to be red, is

(a) $\frac{32}{55}$ (b) $\frac{21}{55}$

(c) $\frac{19}{55}$ (d) None of these

27. If A and B are two events such that $P(A)=\frac{1}{2}$ and $P(B)=\frac{2}{3}$, then

(a) $P(A\cup B)\ge\frac{2}{3}$ (b) $\frac{1}{6}\le P(A\cap B)\le\frac{1}{2}$

(c) $\frac{1}{6}\le P(A'\cap B)\le\frac{1}{2}$ (d) All of the above

28. The probability that a leap year selected at random contains either 53 Sundays or 53 Mondays, is **[Roorkee 1999]**

(a) $\frac{2}{7}$ (b) $\frac{4}{7}$

(c) $\frac{3}{7}$ (d) $\frac{1}{7}$

29. The probabilities that a student passes in Mathematics, Physics and Chemistry are m, p and c respectively. On 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% chance 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) $pmc=\frac{1}{4}$

30. One bag contains 5 white and 4 black balls. Another bag contains 7 white and 9 black balls. A ball is transferred from the first bag to the second and then a ball is drawn from second. The probability that the ball is white, is **[DSSE 1987]**

(a) $\frac{8}{17}$ (b) $\frac{40}{153}$

(c) $\frac{5}{9}$ (d) $\frac{4}{9}$

31. Two numbers are selected at random from the numbers 1, 2, ... n. The probability that the difference between the first and second is not less than m (where $0<m<n$), is

(a) $\frac{(n-m)(n-m+1)}{(n-1)}$ (b) $\frac{(n-m)(n-m+1)}{2n}$

(c) $\frac{(n-m)(n-m-1)}{2n(n-1)}$ (d) $\frac{(n-m)(n-m+1)}{2n(n-1)}$

32. Three groups A, B, C are competing for positions on the Board of Directors of a company. The probabilities of their winning are 0.5, 0.3, 0.2 respectively. If the group A wins, the probability of introducing a new product is 0.7 and the corresponding probabilities for group B and C are 0.6 and 0.5 respectively. The probability that the new product will be introduced, is

(a) 0.18 (b) 0.35
(c) 0.10 (d) 0.63

33. Consider two events A and B such that $P(A)=\frac{1}{4}, P\left(\frac{B}{A}\right)=\frac{1}{2}, P\left(\frac{A}{B}\right)=\frac{1}{4}$. For each of the following statements, which is true

I. $P(A^c/B^c)=\frac{3}{4}$

II. The events A and B are mutually exclusive

III. $P(A/B)+P(A/B^c)=1$ **[AMU 2000]**

(a) I only (b) I and II
(c) I and III (d) II and III

34. A purse contains 4 copper coins and 3 silver coins, the second purse contains 6 copper coins and 2 silver coins. If a coin is drawn out of any purse, then the probability that it is a copper coin is **[BIT Ranchi 1991; MNR 1984; UPSEAT 2000]**

(a) 4/7 (b) 3/4
(c) 37/56 (d) None of these

35. An unbiased die with faces marked 1, 2, 3, 4, 5 and 6 is rolled four times. Out of four face values obtained the probability that the minimum face value is not less than 2 and the maximum face value is not greater than 5, is **[IIT 1993; DCE 2000; Roorkee 2000]**

(a) 16/81 (b) 1/81
(c) 80/81 (d) 65/81

36. India plays two matches each with West Indies and Australia. In any match the probabilities of India getting point 0, 1 and 2 are 0.45, 0.05 and 0.50 respectively. Assuming that the outcomes are independents, the probability of India getting at least 7 points is **[IIT 1992; Orissa JEE 2004]**

(a) 0.8750 (b) 0.0875
(c) 0.0625 (d) 0.0250

37. In binomial probability distribution, mean is 3 and standard deviation is $\frac{3}{2}$. Then the probability distribution is **[AISSE 1979; Pb. CET 2003]**

(a) $\left(\frac{3}{4}+\frac{1}{4}\right)^{12}$ (b) $\left(\frac{1}{4}+\frac{3}{4}\right)^{12}$

(c) $\left(\frac{1}{4}+\frac{3}{4}\right)^{9}$ (d) $\left(\frac{3}{4}+\frac{1}{4}\right)^{9}$

38. A dice is thrown $(2n+1)$ times. The probability of getting 1, 3 or 4 at most n times, is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$

(c) $\frac{1}{4}$ (d) None of these

39. A box contains 24 identical balls, of which 12 are white and 12 are black. The balls are drawn at random from the box one at a time with replacement. The probability that a white ball is drawn for the 4th time on the 7th draw is **[IIT Screening 1994]**

(a) $\frac{5}{64}$ (b) $\frac{27}{32}$

(c) $\frac{5}{32}$ (d) $\frac{1}{2}$

40. The chance of an event happening is the square of the chance of a second event but the odds against the first are the cube of the odds against the second. The chances of the events are

(a) $\frac{1}{9},\frac{1}{3}$ (b) $\frac{1}{16},\frac{1}{4}$

(c) $\frac{1}{4},\frac{1}{2}$ (d) None of these

Answers

Definition of various terms

1	d	2	b	3	d	4	c	5	b
6	a	7	a						

Definition of probability

1	a	2	c	3	a	4	d	5	c
6	a	7	c	8	b	9	a	10	c
11	c	12	c	13	b	14	b	15	c
16	b	17	b	18	a	19	a	20	c
21	a	22	d	23	b	24	b	25	b
26	b	27	b	28	c	29	b	30	d
31	c	32	b	33	c	34	b	35	c
36	b	37	b	38	c	39	a	40	b
41	d	42	c	43	a	44	c	45	d
46	b	47	a	48	c	49	d	50	b
51	c	52	b	53	a	54	b	55	d
56	b	57	b	58	b	59	b	60	a
61	b	62	c	63	a	64	d	65	d
66	d	67	a	68	c	69	a	70	b
71	b	72	c	73	b	74	b	75	a
76	b	77	a	78	b	79	a	80	d
81	a	82	a	83	c	84	d	85	b
86	b	87	b	88	c	89	c	90	c
91	b	92	a	93	c	94	b	95	c
96	c	97	a	98	b	99	b	100	d
101	c	102	d	103	d	104	b	105	c
106	d	107	b	108	a	109	b	110	c
111	a	112	c	113	a	114	c	115	b
116	b	117	d	118	d	119	d	120	a
121	c	122	c	123	d	124	d	125	b
126	c	127	c	128	a	129	b	130	d
131	b	132	a	133	b	134	d	135	a
136	b	137	b	138	b	139	b	140	c
141	b	142	a	143	c	144	d	145	c
146	c	147	a	148	d	149	a	150	d
151	b	152	d	153	a				

Use of permutations and combinatons in probability

1	c	2	c	3	c	4	b	5	c
6	a	7	c	8	a	9	b	10	a
11	a	12	d	13	a	14	c	15	c
16	b	17	d	18	a	19	b	20	b
21	c	22	b	23	c	24	a	25	c
26	c	27	a	28	a	29	a	30	b
31	c	32	b	33	a	34	c	35	b
36	b	37	c	38	a	39	c	40	a
41	d	42	d	43	b	44	c	45	b
46	b	47	a	48	d	49	b	50	d
51	d	52	a	53	a	54	a	55	d
56	d	57	c	58	b	59	a	60	a
61	d	62	c	63	c	64	d	65	b
66	d	67	b	68	c	69	a	70	a
71	a	72	a	73	a	74	c	75	c
76	b	77	d	78	b	79	a	80	d
81	b								

Odds in favour and odds against, Addition theorem on probability

1	c	2	d	3	c	4	c	5	b
6	b	7	b	8	c	9	a	10	a
11	a	12	b	13	c	14	d	15	d
16	b	17	b	18	a	19	a	20	b
21	d	22	c	23	c	24	a	25	a
26	d	27	a	28	b	29	b	30	c
31	a	32	b	33	a	34	a	35	b
36	d	37	c	38	a	39	a	40	c
41	b	42	d	43	c	44	a	45	d
46	c	47	c	48	a	49	c	50	c
51	c	52	b	53	c	54	a	55	b
56	c	57	d	58	d	59	b	60	c
61	b	62	a	63	b	64	a	65	d
66	c	67	c	68	a	69	d	70	b

Conditional probability, Baye's theorem

1	b	2	c	3	c	4	b	5	a
6	a	7	a	8	b	9	c	10	d
11	a	12	c	13	c	14	a	15	d
16	d	17	c	18	c	19	b	20	cd
21	a	22	b	23	a	24	b	25	a
26	a	27	ad	28	d	29	c	30	a
31	b	32	a	33	d	34	c	35	c

Binomial distribution

1	d	2	d	3	b	4	b	5	b

6	d	7	a	8	a	9	a	10	b
11	d	12	d	13	d	14	d	15	b
16	a	17	c	18	d	19	b	20	b
21	c	22	c	23	a	24	d	25	a
26	c	27	c	28	a	29	d	30	a
31	a	32	b	33	b	34	a	35	a
36	c	37	a	38	c	39	a	40	d
41	c	42	c	43	b	44	d	45	a
46	c	47	b	48	a	49	a	50	b
51	a	52	a	53	c	54	d	55	a
56	b	57	c	58	b				

Critical Thinking Questions

1	d	2	b	3	d	4	c	5	a
6	c	7	b	8	d	9	b	10	a
11	a	12	b	13	b	14	b	15	d
16	a	17	a	18	a	19	c	20	b
21	d	22	c	23	b	24	d	25	a
26	a	27	d	28	c	29	bc	30	d
31	d	32	d	33	a	34	c	35	a
36	b	37	a	38	a	39	c	40	a

Answers and Solutions

Definition of various terms

1. (d) They are basically independent.

2. (b) $P(A_1 \cup A_2) = 1 - [1 - P(A_1)][1 - P(A_2)]$

$$= P(A_1) + P(A_2) - P(A_1).P(A_2).$$

3. (d) They are mutually independent.

4. (c) It is obvious.

5. (b) Since $A \cap \overline{B}$ and $A \cap B$ are mutually exclusive events such that $A = (A \cap \overline{B}) \cup (A \cap B)$

$$P(A) = P(A \cap \overline{B}) + P(A \cap B)$$

$$\Rightarrow P(A \cap \overline{B}) = P(A) - P(A \cap B) = P(A) - P(A)P(B)$$

($\because$ A, B are independent)

$$\Rightarrow P(A \cap \overline{B}) = P(A)(1 - P(B)) = P(A)P(\overline{B})$$

$\therefore$ A and $\overline{B}$ are also independent.

6. (a) $B \cup C$ is independent to A, so S_1 is true

$B \cap C$ is also independent to A, so S_2 is true.

7. (a) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$$\frac{5}{6} = \frac{2}{3} + \frac{1}{2} - P(A \cap B) \Rightarrow P(A \cap B) = 0$$

Events A and B are mutually exclusive.

Definition of probability

1. (a) Required probability $= \left(\frac{4}{52}\right)^2 = \frac{1}{169}$.

2. (c) Required probability is

$P(\text{getting } 8) + P(9) + P(10) + P(11) + P(12)$

$$= \frac{5}{36} + \frac{4}{36} + \frac{3}{36} + \frac{2}{36} + \frac{1}{36} = \frac{15}{36} = \frac{5}{12}.$$

3. (a) Required probability $= \frac{4}{7}$.

4. (d) The chance of head $= \frac{1}{2}$ and not of head $= \frac{1}{2}$

Since A has first throw, he can win in the first, third, …

$\therefore$ Probability of A's winning

$$= \frac{1}{2} + \left(\frac{1}{2}\right)^2 . \frac{1}{2} + \left(\frac{1}{2}\right)^4 . \frac{1}{2} + \ldots\ldots..$$

$$= \frac{1}{2} + \left(\frac{1}{2}\right)^3 + \left(\frac{1}{2}\right)^5 + \ldots\ldots.. = \frac{2}{3}.$$

5. (c) Required probability $= \frac{4}{36} = \frac{1}{9}$.

6. (a) Required probability $= \frac{4}{52} = \frac{1}{13}$.