CHAPTER 11

Probability

Exercise

1. If two dice are thrown, probability of getting an odd number on one and multiple of 3 on other is
   (a) $\frac{1}{3}$ (b) $\frac{2}{3}$
   (c) $\frac{11}{36}$ (d) $\frac{13}{36}$

2. Two balanced dice are thrown. Let A be the event that the sum of the two faces is an even integer and B be the event that the sum is not less than 10. Then the probability that one of the two events will occur is
   (a) $\frac{4}{9}$ (b) $\frac{1}{4}$
   (c) $\frac{1}{12}$ (d) $\frac{5}{9}$

3. A point is chosen at random inside a rectangle measuring 6 inches by 5 inches. What is the probability that the randomly selected point is at least one inch from the edge of the rectangle?
   (a) $\frac{2}{3}$ (b) $\frac{1}{2}$
   (c) $\frac{1}{4}$ (d) $\frac{2}{5}$

4. If P(A) = 0.8, P(B) = 0.9, P(AB) = p, which one of the following is correct ?
   (a) $0.72 \le p \le 0.8$ (b) $0.7 \le p \le 0.8$
   (c) $0.72 < p < 0.8$ (d) $0.7 < p < 0.8$

5. A card is drawn from a well shuffled pack of 52 cards. The probability of getting a queen of club or king of heart is
   (a) $\frac{1}{13}$ (b) $\frac{1}{52}$
   (c) $\frac{1}{26}$ (d) $\frac{2}{13}$

6. There are 4 addressed envelopes and 4 letters. Then the chance that all the letters are not mailed through proper envelope is
   (a) 1/24 (b) 1
   (c) 23/24 (d) 9/2

7. 15 coupons are numbered 1, 2, 3, ..., 14, 15. Seven coupons are selected at random, one at a time with replacement. The probability that 9 would be the largest number appearing on the selected coupon is
   (a) $(1/16)^6$ (b) $(8/15)^7$
   (c) $(3/5)^7$ (d) None of these

8. You are given a box with 20 cards in it. 10 of these cards have the letter I printed on them. The other ten have the letter T printed on them. If you pick up 3 cards at random and keep them in the same order, the probability of making the word IIT is
   (a) $\frac{9}{80}$ (b) $\frac{1}{8}$
   (c) $\frac{4}{27}$ (d) $\frac{5}{38}$

9. A student appears for tests, I, II and III. The student is successful if he passes either in tests I and II or tests I and III. The probabilities of the student passing in test I, II and III are p, q and 1/2 respectively. If the probability that the student is successful is $\frac{1}{2}$, then
   (a) $p = q = 1$ (b) $p = q = \frac{1}{2}$
   (c) $p = 1, q = 0$ (d) $p = 1, q = \frac{1}{2}$

10. There are 3 works. One is of 3 volumes; one is of 4 volumes and one is of only one and they are placed at random in a shelf. What is the chance that volume of

the same work is placed together ?
(a) 1/40 (b) 3/140
(c) 9/70 (d) None of these

11. 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
(a) 1/5 (b) 3/8
(c) 1/3 (d) 2/3

12. In a group of equal number of men and women 10% men and 45% women are unemployed. What is the probability that a person selected at random is employed ?
(a) $\frac{27}{40}$ (b) $\frac{11}{40}$
(c) $\frac{29}{40}$ (d) $\frac{13}{40}$

13. An urn contains 4 white and 5 black balls, a second urn contains 5 white and 4 black balls. One ball is transferred from the first to second urn, then a ball is drawn from the second urn, what is the probability that it is white ?
(a) $\frac{41}{90}$ (b) $\frac{49}{90}$
(c) $\frac{33}{90}$ (d) $\frac{37}{90}$

14. A class consists of 80 students. 25 of them are girls and 55 boys. If 10 of them are rich and the remaining poor and also 20 of them are intelligent then the probability of selecting an intelligent rich girl is
(a) 5/128 (b) 25/128
(c) 5/512 (d) None of these

15. A multiple choice examination has 5 questions. Each question has three alternative answers of which exactly one if correct. The probability that a student will get 4 or more correct answer just by guessing
(a) $\frac{17}{3^5}$ (b) $\frac{13}{3^5}$
(c) $\frac{11}{3^5}$ (d) $\frac{10}{3^5}$

16. A pair of fair dice is thrown independently three times. The probability of getting a score of exactly 9 twice is
(a) $\frac{1}{729}$ (b) $\frac{8}{9}$
(c) $\frac{8}{729}$ (d) $\frac{8}{243}$

17. A room has three lamp sockets. From a collection of 10 light bulbs of which only six are good, three bulbs are selected at random and placed in the sockets. What is the probability that there will be light in the room ?
(a) $\frac{25}{36}$ (b) $\frac{1}{30}$
(c) $\frac{5}{32}$ (d) $\frac{29}{30}$

18. If 3 distinct numbers are chosen randomly from {1, 2, ... 100}, then probability that all are divisible by both 2 and 3 is
(a) 4/25 (b) 4/35
(c) 4/33 (d) 4/1155

19. Of cigarette smoking population 70% are men and 30% are women 10% of these men and 20% of these women smoke Wills. Probability that a person seen smoking a Wills to be male is
(a) 1/5 (b) 7/13
(c) 5/13 (d) 7/10

20. A five digit number is formed by the digits 1, 2, 3, 4, 5, 6 and 8 without repetition. The probability that the number has even digit at both ends is
(a) 2/7 (b) 3/7
(c) 4/7 (d) None of these

21. What is the probability of two persons being born on the same day (ignoring date)?
(a) $\frac{1}{49}$ (b) $\frac{1}{365}$
(c) $\frac{1}{7}$ (d) $\frac{2}{7}$

22. If the letters of the word REGULATION be arranged at random, then the probability that there will be exactly four letters between R and E is
(a) 1/5 (b) 1/2
(c) 1/9 (d) 1/10

23. A bag contains 10 mangoes out of which 4 are rotten, two mangoes are taken out together. If one of them is found to be good, the probability that the other is also good is
(a) $\frac{1}{3}$ (b) $\frac{8}{15}$
(c) $\frac{5}{13}$ (d) $\frac{2}{3}$

24. A fair coin is tossed 100 times. What is the probability of getting tails an odd number of times? **[NDA-I 2016]**
(a) 1/2 (b) 3/8
(c) 1/4 (d) 1/8

25. Three dice are thrown simultaneously. What is the probability that the sum on the three faces is atleast 5?
[NDA-I 2016]
(a) $\frac{17}{18}$ (b) $\frac{53}{54}$
(c) $\frac{103}{108}$ (d) $\frac{215}{216}$

26. Two independent events A and B have P(A) = $\frac{1}{3}$ and P(B) = $\frac{3}{4}$. What is the probability that exactly one of the two events A or B occurs? **[NDA-I 2016]**
(a) 1/4 (b) 5/6
(c) 5/12 (d) 7/12

27. A coin is tossed three times. What is the probability of getting head and tail alternately? **[NDA-I 2016]**
(a) 1/8 (b) 1/4
(c) 1/2 (d) 3/4

28. A card is drawn from a well-shuffled deck of 52 cards. What is the probability that it is queen of spade? **[NDA-I 2016]**
(a) $\frac{1}{52}$ (b) $\frac{1}{13}$
(c) $\frac{1}{4}$ (d) $\frac{1}{8}$

29. If two dice are thrown, then what is the probability that the sum on the two faces is greater than or equal to 4? **[NDA-I 2016]**
(a) $\frac{13}{18}$ (b) $\frac{5}{6}$
(c) $\frac{11}{12}$ (d) $\frac{35}{36}$

30. A certain type of missile hits the target with probability $p = 0.3$. What is the least number of missiles should be fired, so that there is atleast an 80% probability that the target is hit? **[NDA-I 2016]**
(a) 5 (b) 6
(c) 7 (d) None of these

31. For two mutually exclusive events A and B, P(A) = 0.2 and P($\overline{A} \cap B$) = 0.3. What is P (A | (A ∪ B)) equal to? **[NDA-I 2016]**
(a) $\frac{1}{2}$ (b) $\frac{2}{5}$
(c) $\frac{2}{7}$ (d) $\frac{2}{3}$

32. What is the probability of 5 Sunday in the month of December? **[NDA-I 2016]**
(a) 1/7 (b) 2/7
(c) 3/7 (d) None of these

33. A special dice with numbers 1, – 1, 2, – 2, 0 and 3 is thrown thrice. What is the probability that the sum of the numbers occurring on the upper face is zero? **[NDA-II 2016]**
(a) 1/ 72 (b) 1/8
(c) 7/72 (d) 25/216

34. There is 25% chance that it rains on any particular day. What is the probability that there is at least one rainy day within a period of 7 days? **[NDA-II 2016]**
(a) $1-\left(\frac{1}{4}\right)^7$ (b) $\left(\frac{1}{4}\right)^7$
(c) $\left(\frac{3}{4}\right)^7$ (d) $1-\left(\frac{3}{4}\right)^7$

35. A salesman has a 70% chance to sell a product to any customer. The behaviour of successive customers is independent. If two customers A and B enter, what is the probability that the salesman will sell the product to customer A or B? **[NDA-II 2016]**
(a) 0.98 (b) 0.91
(c) 0.70 (d) 0.49

36. A student appears for tests I, II and III. The student is considered successful if he passes in tests I, II or I, III or all the three. The probabilities of the student passing in tests I, II and III are m, n and 1/2 respectively. If the probability of the student to be successful is 1/2, then which one of the following is correct? **[NDA-II 2016]**
(a) $m(1 + n) = 1$ (b) $n(1 + m) = 1$
(c) $m = 1$ (d) $mn = 1$

37. Three candidates solve a question. Odds in favour of the correct answer are 5 : 2, 4 : 3 and 3 : 4 respectively for the three candidates. What is the probability that at least two of them solve the question correctly? **[NDA-II 2016]**
(a) 209/343 (b) 134/343
(c) 149/343 (d) 60/343

38. A medicine is known to be 75% effective to cure a patient. If the medicine is given to 5 patients, what is the probability that at least one patient is cured by this medicine? **[NDA-II 2016]**
(a) $\frac{1}{1024}$ (b) $\frac{243}{1024}$
(c) $\frac{1023}{1024}$ (d) $\frac{781}{1024}$

39. For two events A and B, it is given that P (A) = $\frac{3}{5}$, P (B) = $\frac{3}{10}$ and P (A/B) = $\frac{2}{3}$. If $\overline{A}$ and $\overline{B}$ are the complementary events of A and B, then what is P($\overline{A}/\overline{B}$) equal to? **[NDA-II 2016]**
(a) $\frac{3}{7}$ (b) $\frac{3}{4}$
(c) $\frac{1}{3}$ (d) $\frac{4}{7}$

40. A machine had three parts, A, B and C, whose chances of being defective are 0.02, 0.10 and 0.05 respectively. The machine stops working if any one of the parts becomes defective. What is the probability that the machine will not stop working? **[NDA-II 2016]**
(a) 0.06 (b) 0.16
(c) 0.84 (d) 0.94

41. Three independent events, A_1, A_2 and A_3 occur with probabilities $P(A_i) = \frac{1}{1+i}$, $i = 1, 2, 3$. What is the probability that at least one of the three events occurs? **[NDA-II 2016]**

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

(c) $\frac{3}{4}$ (d) $\frac{1}{24}$

42. In a series of 3 one-day cricket matches between teams A and B of a college, the probability of team A winning or drawing are 1/3 and 1/6 respectively. If a win, loss or draw gives 2, 0 and 1 point respectively, then what is the probability that team A will score 5 points in the series? **[NDA-II 2016]**

(a) $\frac{17}{18}$ (b) $\frac{11}{12}$

(c) $\frac{1}{12}$ (d) $\frac{1}{18}$

43. Let the random variable X follow B (6, p). If 16 P (X = 4) = P (X = 2), then what is the value of p? **[NDA-II 2016]**

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

(c) $\frac{1}{5}$ (d) $\frac{1}{6}$

44. A committee of two persons is constituted from two men and two women. What is the probability that the committee will have only women? **[NDA-I 2017]**

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

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

45. A question is given to three students A, B and C whose chances of solving it are $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ respectively. What is the probability that the question will be solved? **[NDA-I 2017]**

(a) $\frac{1}{24}$ (b) $\frac{1}{4}$

(c) $\frac{3}{4}$ (d) $\frac{23}{24}$

46. For two dependent events A and B, it is given that P(A) = 0.2 and P(B) = 0.5. If $A \subseteq B$. Then the values of conditional probabilities P(A | B) and P(B | A) are respectively. **[NDA-I 2017]**

(a) $\frac{2}{5}, \frac{3}{5}$

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

(c) $1, \frac{2}{5}$

(d) Information is insufficient

47. A point is chosen at random inside a circle. What is the probability that the point is closer to the centre of the circle than to its boundary? **[NDA-I 2017]**

(a) $\frac{1}{5}$ (b) $\frac{1}{4}$

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

48. A card is drawn from a well-shuffled ordinary deck of 52 cards. What is the probability that it is an ace? **[NDA-I 2017]**

(a) $\frac{1}{13}$ (b) $\frac{2}{13}$

(c) $\frac{3}{13}$ (d) $\frac{1}{52}$

49. Consider the following statements :

1. Two events are mutually exclusive if the occurrence of one event prevents the occurrence of the other.
2. The probability of the union of two mutually exclusive events is the sum of their individual probabilities.

Which of the above statement is/are correct? **[NDA-I 2017]**

(a) Only 1 (b) Only 2

(c) Both 1 and 2 (d) Neither 1 nor 2

50. If two fair dice are thrown, then what is the probability that the sum is neither 8 nor 9? **[NDA-I 2017]**

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

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

51. Let A and B are two mutually exclusive events with $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{4}$. What is the value of $P(\bar{A} \cap \bar{B})$? **[NDA-I 2017]**

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

(c) $\frac{1}{3}$ (d) $\frac{5}{12}$

52. A committee of two persons is selected from two men and two women. The probability that the committee will have exactly one woman is **[NDA-II 2017]**

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

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

53. Let a die be loaded in such a way that even faces are twice likely to occur as the odd faces. What is the probability that a prime number will show up when the die is tossed? **[NDA-II 2017]**

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

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

54. Let the sample space consist of non-negative integers up to 50, X denote the numbers which are multiples of 3 and Y denote the odd numbers. Which of the following is/are correct?

1. $P(X) = \frac{8}{25}$ 2. $P(Y) = \frac{1}{2}$

Select the correct answer using the code given below. **[NDA-II 2017]**

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

55. For two events A and B, let $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{2}{3}$ and $P(A \cap B) = \frac{1}{6}$. What is $P(\bar{A} \cap B)$ equal to? **[NDA-II 2017]**

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

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

56. Let A and B be two events with $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{6}$ and $P(A \cap B) = \frac{1}{12}$. What is $P(B \mid \bar{A})$ equal to? **[NDA-II 2017]**

(a) $\frac{1}{5}$ (b) $\frac{1}{7}$

(c) $\frac{1}{8}$ (d) $\frac{1}{10}$

57. In a binomial distribution, the mean is $\frac{2}{3}$ and the variance is $\frac{5}{9}$. What is the probability that X = 2 ? **[NDA-II 2017]**

(a) $\frac{5}{36}$ (b) $\frac{25}{36}$

(c) $\frac{25}{216}$ (d) $\frac{25}{54}$

58. The probability that a ship safely reaches a port is $\frac{1}{3}$. The probability that out of 5 ships, at least 4 ships would arrive safely is **[NDA-II 2017]**

(a) $\frac{1}{243}$ (b) $\frac{10}{243}$

(c) $\frac{11}{243}$ (d) $\frac{13}{243}$

59. What is the probability that at least two persons out of a group of three persons were born in the same month (disregard year)? **[NDA-II 2017]**

(a) $\frac{33}{144}$ (b) $\frac{17}{72}$

(c) $\frac{1}{144}$ (d) $\frac{2}{9}$

60. If $P(B) = \frac{3}{4}$, $P(A \cap B \cap \bar{C}) = \frac{1}{3}$ and $P(\bar{A} \cap B \cap \bar{C}) = \frac{1}{3}$, then what is $P(B \cap C)$ equal to? **[NDA-II 2017]**

(a) $\frac{1}{12}$ (b) $\frac{3}{4}$

(c) $\frac{1}{15}$ (d) $\frac{1}{9}$

61. In a multiple-choice test, an examinee either knows the correct answer with probability p, or guesses with probability $1 - p$. The probability of answering a question correctly is $\frac{1}{m}$, if he or she merely guesses. If the examinee answers a question correctly, the probability that he or she really knows the answer is **[NDA-II 2017]**

(a) $\frac{mp}{1+mp}$ (b) $\frac{mp}{1+(m-1)p}$

(c) $\frac{(m-1)p}{1+(m-1)p}$ (d) $\frac{(m-1)p}{1+mp}$

62. Five sticks of length 1, 3, 5, 7 and 9 feet are given. Three of these sticks are selected at random. What is the probability that the selected sticks can form a triangle? **[NDA-II 2017]**

(a) 0.5 (b) 0.4
(c) 0.3 (d) 0

63. In a Binomial distributuion, the mean is three times its variance. What is the probability of exactly 3 successes out of 5 trials ? **[NDA-I 2018]**

(a) $\frac{80}{243}$ (b) $\frac{40}{243}$

(c) $\frac{20}{243}$ (d) $\frac{10}{243}$

64. Consider the following statements :

1. $P(\bar{A} \cup B) = P(\bar{A}) + P(B) - P(\bar{A} \cap B)$
2. $P(A \cap \bar{B}) = P(B) - P(A \cap B)$
3. $P(A \cap B) = P(B)\, P(A \mid B)$

Which of the above statements are correct ? **[NDA-I 2018]**

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

65. The probabilites that a student will solve Question A and Question B are 0.4 and 0.5 respectively. What is the probability that he solves at least one of the two questions ? **[NDA-I 2018]**
(a) 0.6 (b) 0.7
(c) 0.8 (d) 0.9

66. Two fair dice are rolled. What is the probability of getting a sum of 7 ? **[NDA-I 2018]**
(a) $\frac{1}{36}$ (b) $\frac{1}{6}$
(c) $\frac{7}{12}$ (d) $\frac{5}{12}$

67. If A and B are two events such that 2P(A) = 3P(B), where 0 < P(A) < P(B) < 1, then which one of the following is correct ? **[NDA-I 2018]**
(a) $P(A | B) < P(B | A) < P(A \cap B)$
(b) $P(A \cap B) < P(B | A) < P(A | B)$
(c) $P(B | A) < P(A | B) < P(A \cap B)$
(d) $P(A \cap B) < P(A | B) < P(B | A)$

68. A box has ten chits numbered 0, 1, 2, 3, ..., 9. First, one chit is drawn at random and kept aside. From the remaining, a second chit is drawn at random. What is the probability that the second chit drawn is 9 ? **[NDA-I 2018]**
(a) $\frac{1}{10}$ (b) $\frac{1}{9}$
(c) $\frac{1}{90}$ (d) None of these

69. One bag contains 3 white and 2 black balls, another bag contains 5 white and 3 black balls. If a bag is chosen at random and a ball is drawn from it, what is the chance that is white ? **[NDA-I 2018]**
(a) $\frac{3}{8}$ (b) $\frac{49}{80}$
(c) $\frac{8}{13}$ (d) $\frac{1}{2}$

70. Consider the following in respect of events A and B :
1. P(A occurs but not B) = P(A) – P(B) if $B \subset A$
2. P(A alone or B alone occurs) = P(A) + P(B) – $P(A \cap B)$
3. $P(A \cup B) = P(A) + P(B)$ if A and B are mutually exclusive

Which of the above is/are correct ? **[NDA-I 2018]**
(a) 1 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1 and 2 only

71. A committee of three has to be chosen from a group of 4 men and 5 women. If the selection is made at random, what is the probability that exactly two members are men ? **[NDA-I 2018]**
(a) $\frac{5}{14}$ (b) $\frac{1}{21}$
(c) $\frac{3}{14}$ (d) $\frac{8}{21}$

72. In a bolt factory, machines X, Y, Z manufacture bolts that are respectively 25%, 35% and 40% of the factory's total output. The machines X, Y, Z respectively produce 2%, 4% and 5% defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine X ? **[NDA-II 2018]**
(a) $\frac{5}{39}$ (b) $\frac{14}{39}$
(c) $\frac{20}{39}$ (d) $\frac{34}{39}$

73. 8 coins are tossed simultaneously. The probability of getting at least 6 heads is **[NDA-II 2018]**
(a) $\frac{7}{64}$ (b) $\frac{57}{64}$
(c) $\frac{37}{256}$ (d) $\frac{229}{256}$

74. Three groups of children contain 3 girls and 1 boy; 2 girls and 2 boys; 1 girl and 3 boys. One child is selected at random from each group. The probability that the three selected consists of 1 girl and 2 boys is **[NDA-II 2018]**
(a) $\frac{13}{32}$ (b) $\frac{9}{32}$
(c) $\frac{8}{32}$ (d) $\frac{1}{32}$

75. If the probability of simultaneous occurrence of two events A and B is p and the probability that exactly one of A, B occurs is q, then which of the following is/are correct?
1. $P(\bar{A}) + P(\bar{B}) = 2 - 2p - q$
2. $P(\bar{A} \cap \bar{B}) = 1 - p - q$

Select the correct answer using the code given below : **[NDA-II 2018]**
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

76. Two integers x and y are chosen with replacement from the set {0, 1, 2, .. 10}. The probability that $|x - y| > 5$ is **[NDA-II 2018]**
(a) $\frac{6}{11}$ (b) $\frac{35}{121}$
(c) $\frac{30}{121}$ (d) $\frac{25}{121}$

77. If two dice are thrown and at least one of the dice shows 5, then the probability that the sum is 10 or more is **[NDA-II 2018]**
(a) $\frac{1}{6}$ (b) $\frac{4}{11}$

(c) $\frac{3}{11}$ (d) $\frac{2}{11}$

78. Let A, B and C be three mutually exclusive and exhaustive events associated with a random experiment. If P(B) = 1.5 P(A) and P(C) = 0.5 P(B), then P(A) is equal to **[NDA-II 2018]**

(a) $\frac{3}{4}$ (b) $\frac{4}{13}$

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

79. From a deck of cards, cards are taken out with replacement. What is the probability that the fourteenth card taken out is an ace ? **[NDA-I 2019]**

(a) $\frac{1}{51}$ (b) $\frac{4}{51}$

(c) $\frac{1}{52}$ (d) $\frac{1}{13}$

80. If A and B are two events such that P(A) = 0.5, P(B) = 0.6 and $P(A \cap B) = 0.4$, then what is $P(\overline{A \cup B})$ equal to? **[NDA-I 2019]**

(a) 0.9 (b) 0.7

(c) 0.5 (d) 0.3

ANSWERS

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

Explanations

1. (c) Total ways = 36
Favourable ways of odd numbers on die = 3
Favourable ways of multiple of three = 2
These ways can be on reverse ways also
So, favourable ways = 2 × 3 × 2 = 12
But, one point, 3 is common. Hence, total favourable ways = 12 – 1 = 11
Then, required probability = 11/ 36

2. (d) Let A be the event of obtaining an even sum and B the event of obtaining a sum not less than 10.
Then, we have to find $P(A \cup B)$
Total sample space = 6 × 6 = 36
A = {(1, 1), (1, 3), (1, 5), (2, 2), (2, 4), (2, 6) (3, 1), (3, 3), (3, 5), (4, 2), (4, 4), (4, 6), (5, 1), (5, 3), (5, 5), (6, 2), (6, 4), (6, 6)}

$$P(A) = \frac{n(A)}{n(S)} = \frac{18}{36}$$

B = {(4, 6), (5, 5), (5, 6), (6, 4), (6, 5), (6, 6)}

$$P(B) = \frac{n(B)}{n(S)} = \frac{6}{36}$$

and $A \cap B$ = {(4, 6), (5, 5), (6, 4), (6, 6)}

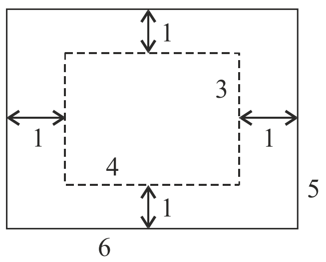
$$P(A \cap B) = \frac{n(A \cap B)}{n(S)} = \frac{4}{36}$$

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

$$= \frac{18}{36} + \frac{6}{36} - \frac{4}{36} = \frac{5}{9}$$

3. (d) Total area of rectangle having measurement 6 inches by 5 inches = 6 × 5 = 30 sq inches
Area of rectangle having measurement 4 inches by 3 inches = 4 × 3 = 12 sq inches

So, required probability = $\frac{12}{30} = \frac{2}{5}$



4. (b) $\because$ $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$\Rightarrow 0.8 + 0.9 - p \le 1$ $\{\because P(A \cup B) \le 1\}$
$\Rightarrow 1.7 - p \le 1 \Rightarrow 0.7 \le p$
Since, $P(A) < P(B)$
$\therefore$ $P(A \cap B) \le P(A) \Rightarrow p \le 0.8$
Hence, $0.7 \le p \le 0.8$

5. (c) $n(S) = {}^{52}C_1 = 52$
There is one queen of club and one king of heart.
$\Rightarrow n(E) = 1 + 1 = 2$
So, required probability $P(E) = \frac{2}{52} = \frac{1}{26}$

6. (c) Total ways of sending the letters = 4! = 24
Ways of sending all the letters through proper envelopes = 1
So, probability of sending all the letters through proper envelopes = $\frac{1}{24}$
Hence, required probability = $1 - \frac{1}{24} = \frac{33}{24}$

7. (c) $n(S) = {}^{15}C_1 \times {}^{15}C_1 \times {}^{15}C_1 \times \ldots$ up to $7 = (15)^7$
$n(E) = {}^{9}C_1 \times {}^{9}C_1 \times {}^{9}C_1 \times \ldots$ up to $7 = (9)^7$
So, $p = \frac{n(E)}{n(S)} = \left(\frac{9}{15}\right)^7 = \left(\frac{3}{5}\right)^7$

8. (d) Probability of making the word IIT,
$$= \frac{10}{20} \times \frac{9}{19} \times \frac{10}{18} = \frac{5}{38}$$

9. (c) Let A, B, C denote the events of passing test I, II and III respectively.
Now, given student is successful if he passes either in I and II, i.e., event A or in I and III, i.e., event B.
So, according to question,
$$\frac{1}{2} = P[(A \cap B) \cup (A \cap C)]$$
$$\frac{1}{2} = P(A \cap B) + P(A \cap C) - P\{(A \cap B) \cap (A \cap C)\}$$
$$= P(A) \times P(B) + P(A) \times P(C) - P(A)P(B)P(C)$$
$\{\because$ All are independent events$\}$
$$\frac{1}{2} = pq + p.\frac{1}{2} - pq.\frac{1}{2}$$
$$\Rightarrow \frac{1}{2} = \frac{1}{2}p(q+1) \text{ or } p(q+1) = 1$$
which is satisfied by $p = 1$ and $q = 0$.

10. (b) $n(S) = (3 + 4 + 1)! = 8!$
$n(E) = \{3! \times 4! \times 1!\} \times 3!$
$$p = \frac{3! \times 4! \times 1! \times 3!}{8!} = \frac{3}{140}$$

11. (b) Let A be the event of having person with brown hair and B be the event of having person with brown eyes.
Then, $P(A) = \frac{40}{100} = \frac{2}{5}; P(B) = \frac{25}{100} = \frac{1}{4}$
$P(A \cap B) = \frac{15}{100} = \frac{3}{20}$
Required probability
$$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{3/20}{2/5} = \frac{3}{8}$$

12. (c) $P(\bar{M}) = \frac{10}{100} = \frac{1}{10}; P(M) = \frac{9}{10}$
$P(\bar{W}) = \frac{45}{100} = \frac{9}{20}; P(W) = \frac{11}{20}$
$\because$ Group contains equal numbers of men and women.
So, probability of selecting an employed person
$$= \frac{1}{2}P(M) + \frac{1}{2}P(W) = \frac{1}{2}\left\{\frac{9}{10} + \frac{11}{20}\right\} = \frac{29}{40}$$

13. (b) There are two possibilities of transferring a ball it may be white or black. Probability of transferring a white ball = $\frac{4}{9}$
Probability of transferring a black ball = $\frac{5}{9}$
When white ball is transferred then there are 6 white and 4 black balls in second urn.
So, probability of drawing a white ball from second win = $\frac{6}{10}$
When black ball is transferred then there are 5 white and 5 black balls in second urn.
So, probability of drawing a white ball from second win = $\frac{5}{10}$
Thus, both possibilities are mutually exclusive.
So, required probability $= \frac{4}{9} \times \frac{6}{10} + \frac{5}{9} \times \frac{5}{10} = \frac{49}{50}$

14. (c) $P(G) = \frac{25}{80}; P(R) = \frac{10}{80}; P(I) = \frac{20}{80}$
These events are independent.
So, probability of selecting an intelligent rich girl
$= P(I \cap R \cap G) = P(I) \,.\, P(R) \,.\, P(G)$
$$= \frac{20}{80} . \frac{10}{80} . \frac{25}{80} = \frac{5}{512}$$

15. (c) Each equation has three alternatives.
So, $p = 1/3$ and $q = 2/3$
$P(X \ge 4) = P(X = 4) + P(X = 5)$
$$= {}^5C_4 \left(\frac{1}{3}\right)^4 \left(\frac{2}{3}\right)^1 + {}^5C_5 \left(\frac{1}{3}\right)^5 \left(\frac{2}{3}\right)^0$$
$$= 5.\frac{2}{3^5} + \frac{1}{3^5} = \frac{11}{3^5}$$

16. (d) Probability of getting a sum of nine in a single throw

$$= \frac{4}{6\times 6} = \frac{1}{9}$$

So, probability of getting a score of exactly 9 twice

$$= {}^3C_2\left(\frac{1}{9}\right)^2\left(\frac{8}{9}\right) = \frac{8}{243}$$

17. (d) $p = \dfrac{{}^6C_1 \times {}^4C_2 + {}^6C_2 \times {}^4C_1 + {}^6C_3}{{}^{10}C_3} = \dfrac{29}{30}$

18. (d) $n(S) = {}^{100}C_3$

Total numbers divisible by 2 and 3 = 16

So, $n(E) = {}^{16}C_3$

$$p = \frac{n(E)}{n(S)} = \frac{{}^{16}C_3}{{}^{100}C_3} = \frac{16\times 15\times 14}{100\times 99\times 98} = \frac{4}{1155}$$

19. (b) Let there are 70 men and 30 women. 10% men smoke, i.e., 7 men and 20% women smoke, i.e., 6 women.

Total smoking persons = 6 + 7 = 13

Probability that a smoking person is male $= \dfrac{7}{13}$

20. (a) $n(S) = {}^7P_5 = 2520$

$n(E) = {}^4P_2 \times {}^5P_3 = 12 \times 60 = 720$

$$p = \frac{n(E)}{n(S)} = \frac{720}{2520} = \frac{2}{7}$$

21. (c) Probability that two persons born on the same day

$$= \frac{{}^7C_1}{7\times 7} = \frac{1}{7}$$

22. (c) $n(S) = 10!$

If there are four letters between R and E then there are 5 places for R and E and they can be arranged in 2! ways. Remaining 8 letters can be arranged in 8! ways.

So, $n(E) = 5 \times 2! \times 8!$

So, $p = \dfrac{10\times 8!}{10!} = \dfrac{1}{9}$

23. (c) Total number of mangoes = 10

Number of rotten mangoes = 4

Number of good mangoes = 6

Let A_1 and A_2 denote the events that out of the two mangoes taken exactly one and exactly two are good respectively.

$$P(A_1) = \frac{{}^6C_1 . {}^4C_1}{{}^{10}C_2} = \frac{24}{45}$$

$$P(A_2) = \frac{{}^6C_2}{{}^{10}C_2} = \frac{15}{45}$$

$\therefore$ Required probability $= \dfrac{15/45}{24/45 + 15/45} = \dfrac{5}{13}$

24. (a) $n(S) = 2 \times 2 \times 2 \times \ldots$ 100 terms $= 2^{100}$

$n(E) = {}^{100}C_1 + {}^{100}C_3 + {}^{100}C_5 + \ldots {}^{100}C_{99} = 2^{99}$

So, $p = \dfrac{n(E)}{n(S)} = \dfrac{2^{99}}{2^{100}} = \dfrac{1}{2}$

25. (b) $n(S) = 6 \times 6 \times 6 = 216$

Cases having sum 4 is (1, 1, 2), (1, 2, 1), (2, 1, 1,) i.e., 3 cases.

Cases having sum 3 is (1, 1, 1) i.e., one case.

So, total cases having sum atleast 5.

i.e., $n(E) = 216 - (3 + 1) = 212$

So, $p = \dfrac{n(E)}{n(S)} = \dfrac{212}{216} = \dfrac{53}{54}$

26. (d) $P(A) = \dfrac{1}{3} \Rightarrow P(\bar{A}) = \dfrac{2}{3}$

and $P(B) = \dfrac{3}{4} \Rightarrow P(\bar{B}) = \dfrac{1}{4}$

Probability of occurring exactly one of the events.

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

$= P(A) . P(\bar{B}) + P(\bar{A}) . P(B) = \dfrac{7}{12}$

27. (b) $n(S) = 2 \times 2 \times 2 = 8$

E = {(HTH), (THT)}

$n(E) = 2$

$\therefore P = \dfrac{n(E)}{n(S)} = \dfrac{2}{8} = \dfrac{1}{4}$

28. (a) $n(S) = {}^{52}C_1 = 52$

$n(E) = {}^1C_1 = 1$

So, $p = \dfrac{1}{52}$

29. (c) $n(S) = 6 \times 6 = 36$

Cases having sum 3 = (1, 2) (2, 1) = 2 cases

Cases having sum 2 = (1, 1) = 1 case

So, total cases having sum atleast 4.

i.e., $n(E) = 36 - (2 + 1) = 33$

So, $p = \dfrac{n(E)}{n(S)} = \dfrac{33}{36} = \dfrac{11}{12}$

30. (a) $p = 0.3 \Rightarrow q = 0.7$

$P(X = r) = {}^nC_r = (0.3)^r (0.7)^{n-r}$

Target is hit when atleast 1 missile hits the target.

i.e., $P(X \geq 1) = 1 - P(X = 0)$

$= 1 - {}^nC_0 \ (0.3)^0 \ (0.7)^{n-0}$

Given, probability must be greater than 80%.

$\Rightarrow 1 - {}^nC_0 (0.3)^0 (0.7)^{n-0} \geq \dfrac{80}{100}$

$\Rightarrow 1 - \left(\dfrac{7}{10}\right)^n \geq \dfrac{80}{100}$ or $\left(\dfrac{7}{10}\right)^n \leq \dfrac{20}{100}$

$\Rightarrow n \geq 5$

31. (b) $P(A) = 0.2$, $P(\bar{A} \cap B) = 0.3$ and $P(A \cap B) = 0$

$P(\bar{A} \cap B) = 0.3 \Rightarrow P(B) = 0.3$

$$P\left(\frac{A}{A\cup B}\right)=\frac{P\{(A\cap(A\cup B)\}}{P(A\cup B)}$$

$$=\frac{P(A)}{P(A)+P(B)}=\frac{0.2}{0.2+0.3}=\frac{2}{5}$$

32. (c) In month of December there are 31 days having 4 weeks and 3 days remaining so probability of having 5 Sundays = $\frac{3}{7}$.

33. (d) $n(S) = 6 \times 6 \times 6 = 216$

Let A be the event of getting the sum of the numbers occurring on the upper face is 0.

Then, E = {(1, 0, – 1), (– 1, 0, 1), (0, 1, – 1), (0, – 1, 1), (1, – 1, 0), (– 1, 1, 0) (2, 0, – 2), (– 2, 0, 2), (0, 2, – 2), (0, – 2, 2), (2, – 2, 0), (– 2, 2, 0), (3, – 1, – 2), (3, – 2, – 1), (– 1, – 2, 3), (– 1, 3, – 2), (– 2, 3, – 1), (– 2, – 1, 3), (2, – 1, – 1), (– 1, 2, – 1), (–1, –1, 2), (–2, 1, 1), (1, –2, 1), (1, 1, –2), (0, 0, 0)}

$$\therefore p=\frac{n(E)}{n(S)}=\frac{215}{216}$$

34. (d) $p=\frac{25}{100}=\frac{1}{4}\Rightarrow q=\frac{3}{4}$

and $n = 7$

$P(X \geq 1) = 1 - P(X \geq 0)$

$$=1-{}^{7}C_{0}\left(\frac{1}{4}\right)^{0}\left(\frac{3}{4}\right)^{7-0}=1-\left(\frac{3}{4}\right)^{7}$$

35. (b) Let A and B be the events of selling the product to customer A and B.

$\therefore$ P(A) = $\frac{7}{10}$ and P(B) = $\frac{7}{10}$

$\because$ A and B are independent so

$P(A\cap B) = P(A) . P(B) = \frac{49}{100}$

Probability that product will be saled to A or B.

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

$$=\frac{7}{10}+\frac{7}{10}-\frac{49}{100}$$

$$=\frac{91}{100}=0.91$$

36. (a) Let A, B, C denotes the events of passing test I, II and III respectively.

Given, student is successful if he passes I, II or I, III or all the three.

According to question,

$$\frac{1}{2}=P\{(A\cap B)\cup(A\cap C)\}$$

$$\frac{1}{2}=P(A\cap B)+P(A\cap C)-P\{(A\cap B)\cap(A\cap C)\}$$

$$\frac{1}{2}=P(A)\,P(B)+P(A)\,P(C)-P(A)\,P(B)\,P(C)$$

{$\because$ All are independent events.}

$$\frac{1}{2}=mn+\frac{m}{2}-\frac{mn}{2}$$

{$\because$ P(A) = m, P(B) = n and P(C) = $\frac{1}{2}$ Given}

$$\Rightarrow\frac{1}{2}=\frac{mn+m}{2}$$

$\Rightarrow m(n + 1) = 1$

37. (a) Let three students be A, B and C.

Then, P(A) = $\frac{5}{7}$, P(B) = $\frac{4}{7}$ and P (C) = $\frac{3}{7}$

Probability atleast two solve the questions is

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

$$=\frac{5}{7}\times\frac{4}{7}\times\frac{4}{7}+\frac{5}{7}\times\frac{3}{7}\times\frac{3}{7}+\frac{2}{7}\times\frac{4}{7}\times\frac{3}{7}+\frac{5}{7}\times\frac{4}{7}\times\frac{3}{7}$$

$$=\frac{80}{343}+\frac{45}{343}+\frac{24}{343}+\frac{60}{343}=\frac{209}{343}$$

38. (c) $p=\frac{75}{100}=\frac{3}{4}\Rightarrow q=\frac{1}{4}$

At least one patient is cured out of 5 patients i.e., $P(X \geq 1) = 1 - P(X \geq 0)$

$$=1-{}^{5}C_{0}\left(\frac{3}{4}\right)^{0}\left(\frac{1}{4}\right)^{5-0}$$

$$=1-1\times\frac{1}{1024}=\frac{1023}{1024}$$

39. (a) P(A) = $\frac{3}{5}$, P(B) = $\frac{3}{10}$ and $P\left(\frac{A}{B}\right)=\frac{2}{3}$

$$\Rightarrow\frac{P(A\cap B)}{P(B)}=\frac{2}{3}$$

or $P(A\cap B)=\frac{1}{5}$

So, $P(A\cup B) = P(A) + P(B) - P(A\cap B)$

$$=\frac{3}{5}+\frac{3}{10}-\frac{1}{5}=\frac{7}{10}$$

Now, $P\left(\frac{\bar{A}}{\bar{B}}\right)=\frac{P(\bar{A}\cap\bar{B})}{P(\bar{B})}=\frac{P(\overline{A\cup B})}{P(\bar{B})}$

$$=\frac{1-P(A\cup B)}{1-P(B)}=\frac{1-\frac{7}{10}}{1-\frac{3}{10}}=\frac{\frac{3}{10}}{\frac{7}{10}}=\frac{3}{7}$$

40. (c) $P(\bar{A})=\frac{2}{100}, P(\bar{B})=\frac{10}{100}$ and $P(\bar{C})=\frac{5}{100}$

Probability machine will not stop working

= Probability all parts are not defective

$= P(A \cap B \cap C)$

$= P(A) \times P(B) \times P(C)$

{$\because$ All parts are independent.}

$$= \frac{98}{100} \times \frac{90}{100} \times \frac{95}{100} = 0.08379$$

41. (c) $P(A_1) = \frac{1}{2}, P(A_2) = \frac{1}{3}, P(A_3) = \frac{1}{4}$

Probability atleast one of the events will occur.

= 1 – Probability no event will occur.

$$= 1 - P(\bar{A}_1 \cap \bar{A}_2 \cap \bar{A}_3)$$

$$= 1 - P(\bar{A}_1).P(\bar{A}_2).P(\bar{A}_3)$$

$$= 1 - \frac{1}{2} \times \frac{2}{3} \times \frac{3}{4}$$

{Given A_1, A_2 and A_3 are independent events.}

$$= \frac{3}{4}$$

42. (d) $P(\text{Win}) = \frac{1}{3}$ and $P(\text{Draw}) = \frac{1}{6}$

$$\Rightarrow P(\text{Loss}) = 1 - \left(\frac{1}{3} + \frac{1}{6}\right) = \frac{1}{2}$$

To score 5 points possible cases are as follows

(2, 2, 1) or (2, 1, 2) or (1, 2, 2)

i.e., P(W W D) + P(W D W) or P(D W W)

$$= 3 \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{6} = \frac{1}{18}$$

43. (c) $16P(X = 4) = P(X = 2)$

$16\, {}^nC_4\, p^4\, (q)^{n-4} = {}^nC_2\, (p)^2\, q^{n-2}$

$\Rightarrow 16p^2 \times {}^6C_4 = {}^6C_2\, q^2$

Here, $n = 6$ $\{{}^6C_4 = {}^nC_2\}$

$$\Rightarrow \left(\frac{p}{q}\right)^2 = \frac{1}{16}$$

$$\Rightarrow \frac{p}{1-p} = \frac{1}{4} \Rightarrow p = \frac{1}{5}$$

44. (a) $p = \frac{{}^2C_2}{{}^4C_2} = \frac{1}{6}$

45. (c) Given $P(A) = \frac{1}{2}$

$$\Rightarrow P(\bar{A}) = 1 - \frac{1}{2} = \frac{1}{2} P(B) = \frac{1}{3} \Rightarrow P(\bar{B}) = 1 - \frac{1}{3} = \frac{2}{3}$$

$$P(C) = \frac{1}{4} \Rightarrow P(\bar{C}) = 1 - \frac{1}{4} = \frac{3}{4}$$

Problem will be solved if even any one of them solve it.

So, required probability of solving the question

= 1 – question is not solved

$$1 - P(\bar{A}).P(\bar{B}).P(\bar{C})$$

$$= 1 - \frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \qquad \text{\{Independent events\}}$$

$$= 1 - \frac{1}{4} = \frac{3}{4}$$

46. (b) $P(A) = 0.2$ and $P(B) = 0.5$

$\because A \subseteq B \Rightarrow A \cap B = A$

$\Rightarrow P(A \cap B) = P(A) = 0.2$

$$P\left(\frac{A}{B}\right) = \frac{P(A \cap B)}{P(B)} = \frac{0.2}{0.5} = \frac{2}{5}$$

$$\therefore P\left(\frac{B}{A}\right) = \frac{P(A \cap B)}{P(A)} = \frac{0.2}{0.2} = 1$$

47. (b) $p = \dfrac{\text{area of circle having radius } \frac{r}{2}}{\text{area of circle having radius } r}$

$$= \frac{\pi\left(\frac{r}{2}\right)^2}{\pi r^2} = \frac{1}{4}$$

48. (a) $p = \frac{{}^4C_1}{{}^{52}C_1} = \frac{4}{52} = \frac{1}{13}$

49. (c) $\because$ A and B are mutually exclusive.

So, $A \cap B = \phi$

$\Rightarrow P(A \cap B) = 0$

So, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\Rightarrow P(A \cup B) = P(A) + P(B)$

Here, both the statements are correct.

50. (c) $n(S) = 6 \times 6 = 36$

Cases of having sum 8 or 9

(2, 6), (3, 5), (4, 4) , (5, 3), (6, 2), (4, 5), (3, 6), (6, 3), (5, 4)

i.e., 9 cases are there.

So, $n(E) = 36 - 9 = 27$

$$\therefore p = \frac{n(E)}{n(S)} = \frac{27}{36} = \frac{3}{4}$$

51. (d) $P(A) = \frac{1}{3}, P(B) = \frac{1}{4}$

$\because$ A and B are mutually exclusive.

So, $P(A \cap B) = 0$

$\Rightarrow P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$$= \frac{1}{3} + \frac{1}{4} = \frac{7}{12}$$

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

$$= 1 - \frac{7}{12} = \frac{5}{12}$$

52. (b) $p = \dfrac{{}^2C_1 \times {}^2C_1}{{}^4C_2} = \dfrac{2\times 2}{6} = \dfrac{2}{3}$

53. (b) A dice has 6 faces.
Let there are 2 odd faces, then there will be 4 even faces.

$P(\text{odd face}) = \dfrac{2}{6} = \dfrac{1}{3}$

and $P(\text{even face}) = \dfrac{4}{6} = \dfrac{2}{3}$

$\because$ 2 is a prime number.

So, probability $= \dfrac{2}{3}$

54. (d) $S = \{0, 1, 2, 3, \ldots 50\}$
$\Rightarrow n(S) = 51$
$X = \{0, 3, 6, 9, \ldots 48\}$
$\Rightarrow n(X) = 17$
$Y = \{1, 3, 5, \ldots. 49\}$
$\Rightarrow n(Y) = 25$

$P(X) = \dfrac{17}{51} = \dfrac{1}{3}$ and $P(Y) = \dfrac{25}{51}$

So, none of the statement is true.

55. (a) $P(A) = \dfrac{1}{2}, P(A\cup B) = \dfrac{2}{3}, P(A\cap B) = \dfrac{1}{6}$

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

$\Rightarrow \dfrac{2}{3} = \dfrac{1}{2} + P(B) - \dfrac{1}{6}$

$\Rightarrow P(B) = \dfrac{1}{3}$

Now, $P(\bar{A} \cap B) = P(B) - P(A\cap B)$

$= \dfrac{1}{3} - \dfrac{1}{6} = \dfrac{1}{6}$

56. (c) $P(A) = \dfrac{1}{3}, P(B) = \dfrac{1}{6}, P(A\cap B) = \dfrac{1}{12}$

$\therefore\ P\left(\dfrac{B}{\bar{A}}\right) = \dfrac{P(B\cap\bar{A})}{P(\bar{A})}$

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

$= \dfrac{\frac{1}{6} - \frac{1}{12}}{1 - \frac{1}{3}} = \dfrac{\frac{1}{12}}{\frac{2}{3}} = \dfrac{1}{8}$

57. (c) $np = \dfrac{2}{3}$ and $npq = \dfrac{5}{9}$

$\Rightarrow q = \dfrac{5}{6}, p = \dfrac{1}{6}$ and $n = 4$

$P(X = 2) = {}^4C_2 \left(\dfrac{1}{6}\right)^2 \left(\dfrac{5}{6}\right)^2$

$= 6 \times \dfrac{25}{36\times 36} = \dfrac{25}{216}$

58. (c) $p = \dfrac{1}{3}$ and $q = \dfrac{2}{3}$

Probability at least 4 ships out of 5 arrive safely.
$= P(X = 4) + P(X = 5)$

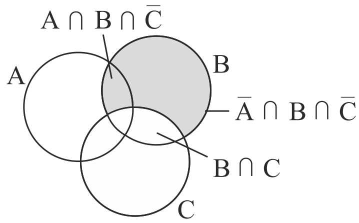
$= {}^5C_4 \left(\dfrac{1}{3}\right)^4 \left(\dfrac{2}{3}\right)^1 + {}^5C_5 \left(\dfrac{1}{3}\right)^5$

$= 5 \times \dfrac{2}{3^5} + \dfrac{1}{3^5} = \dfrac{11}{243}$

59. (c) $p = \dfrac{12\times 1\times 1}{12\times 12\times 12} = \dfrac{1}{144}$

60. (a) $P(B) = \dfrac{3}{4}, P(A\cap B\cap\bar{C}) = \dfrac{1}{3},$

$P(\bar{A}\cap B\cap\bar{C}) = \dfrac{1}{3}$



Now,
$P(B) = P(A\cap B\cap \bar{C}) + (\bar{A}\cap B\cap\bar{C}) + P(B\cap C)$

$\Rightarrow \dfrac{3}{4} = \dfrac{1}{3} + \dfrac{1}{3} + P(B\cap C)$

$\Rightarrow P(B\cap C) = \dfrac{3}{4} - \dfrac{2}{3} = \dfrac{1}{12}$

61. (c) Let A be the event of knowing answer.
$P(A) = p$ and $P(\bar{A}) = 1 - p$
Let B be the event of giving correct answer by guessing.

Then, $P(B) = \dfrac{1}{m}$

and $P(\bar{B}) = 1 - \dfrac{1}{m} = \dfrac{m-1}{m}$

$\therefore$ Required probability

$= \dfrac{P(\bar{B})\,P(A)}{P(B) + P(\bar{B})\,P(A)}$

$= \dfrac{\left(\frac{m-1}{m}\right)p}{\frac{1}{m} + \left(\frac{m-1}{m}\right)p} = \dfrac{(m-1)p}{1 + (m-1)p}$

62. (c) $n(S) = {}^5C_3 = 10$
Cases that these three numbers can form a triangle are (3, 5, 7), (3, 7, 9) and (5, 7, 9).
So, $n(E) = 3$
$$\therefore p = \frac{n(E)}{n(S)} = \frac{3}{10} = 0.3$$

63. (a) Mean $= np$ and and variacne $= npq$
$\because$ Mean = 3 Variance
$\Rightarrow np = 3npq$
$$\Rightarrow q = \frac{1}{3}$$
$$\Rightarrow p = 1 - q = \frac{2}{3}$$
Probability of exactly 3 success out of 5 trials.
$$P(X = 3) = {}^5C_3 \left(\frac{2}{3}\right)^3 \left(\frac{1}{3}\right)^{5-3}$$
$$= 10 \times \frac{8}{27} \times \frac{1}{9} = \frac{80}{243}$$

64. (a) $\because P(\bar{A} \cup B) = P(\bar{A}) + P(B) - P(\bar{A} \cap B)$
$P(A \cap \bar{B}) = P(A) - P(A \cap B)$ and
$$P(A \cap B) = P(B).P\left(\frac{A}{B}\right)$$
Hence, statements I and II are correct.

65. (b) Given, $P(A) = 0.4$ and $P(B) = 0.5$
$\Rightarrow P(\bar{A}) = 0.6$ and $P(\bar{B}) = 0.5$
Both are independent events. So, probability that he solves at least one of the two questions
$$= 1 - P(\bar{A} \cap \bar{B}) = 1 - \{0.6 \times 0.5\}$$
$= 1 - 0.3 = 0.7$

66. (b) $n(S) = 6 \times 6 = 36$
Let E be the event of getting a sum of 7. Then,
E = {(1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1)}
$\Rightarrow n(E) = 6$
$$\text{So, required probability} = \frac{n(E)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

67. (b) Given, $2P(A) = 3P(B)$
$$\Rightarrow \frac{2P(A)}{P(A \cap B)} = \frac{3P(B)}{P(A \cap B)}$$
$$\Rightarrow \frac{1}{2}\frac{P(A \cap B)}{P(A)} = \frac{1}{3}\frac{P(A \cap B)}{P(B)}$$
$$\Rightarrow \frac{1}{2}P\left(\frac{B}{A}\right) = \frac{1}{3}P\left(\frac{A}{B}\right)$$
$$\Rightarrow P\left(\frac{B}{A}\right) = \frac{2}{3}P\left(\frac{A}{B}\right)$$
$$\Rightarrow P\left(\frac{B}{A}\right) < P\left(\frac{A}{B}\right) \text{ and}$$
$$P\left(\frac{B}{A}\right) \text{ or } P\left(\frac{A}{B}\right) > P(A \cap B)$$
$$\Rightarrow P(A \cap B) < P\left(\frac{B}{A}\right) < P\left(\frac{A}{B}\right)$$

68. (a) $n(S) = {}^{10}C_1 \times {}^9C_1 = 10 \times 9 = 90$
$n(E) = {}^9C_1 \times {}^1C_1 = 9$
$$\text{So, } P = \frac{n(E)}{n(S)} = \frac{9}{90} = \frac{1}{10}$$

69. (b)

3 white and 2 black balls	5 white and 3 black balls
1st bag	IInd bag

A ball is drawn from bag. It can be chosen from either of the two bags and it has to be white.
So, required probability
$$= \frac{1}{2}\left[\frac{{}^3C_1}{{}^5C_1} + \frac{{}^5C_1}{{}^8C_1}\right] = \frac{1}{2}\left[\frac{3}{5} + \frac{5}{8}\right]$$
$$= \frac{1}{2}\left[\frac{24+25}{40}\right] = \frac{49}{80}$$

70. (b) I. P(A occurs but not B) $= P(A \cap \bar{B})$
$= P(A) - P(A \cap B)$
If $B \subset A$, then $P(A \cap \bar{B}) = P(A) - P(B)$
II. P(A alone or B alone occurs)
$= P(\bar{A} \cap B) + P(A \cap \bar{B})$
III. If A and B are mutually exclusive, then
$A \cap B = \phi$
$\Rightarrow P(A \cap B) = 0$
So, $P(A \cup B) = P(A) + P(B)$

71. (a) $$p = \frac{{}^4C_2 \times {}^5C_1}{{}^9C_3} = \frac{6 \times 5}{84} = \frac{5}{14}$$

72. (a) Given, factory's total output of machines X, Y and Z are 25%, 35% and 40% respectively.
$$\Rightarrow P(X) = \frac{25}{100}, P(Y) = \frac{35}{100}, P(Z) = \frac{40}{100}$$
Probability of producing defective bulbs by three machines is given.
$$P\left(\frac{D}{X}\right) = \frac{20}{100}, P\left(\frac{D}{Y}\right) = \frac{4}{100}, P\left(\frac{D}{Z}\right) = \frac{5}{100}$$
Probability of a defective product being manufactured by X
$$= \frac{P(X).P\left(\frac{D}{X}\right)}{P(X).P\left(\frac{D}{X}\right) + P(Y)P\left(\frac{D}{Y}\right) + P(Z).P\left(\frac{D}{Z}\right)}$$

$$= \frac{\frac{25}{100}\times\frac{2}{100}}{\frac{25}{100}\times\frac{2}{100}+\frac{35}{100}\times\frac{4}{100}+\frac{40}{100}\times\frac{5}{100}}$$

$$= \frac{5}{39}$$

73. (c) $n = 8, p = \frac{1}{2}, q = \frac{1}{2}$

$P(X \geq 6) = P(X = 6) + P(X = 7) + P(X = 8)$

$$= {}^8C_6\left(\frac{1}{2}\right)^6\left(\frac{1}{2}\right)^2 + {}^8C_7\left(\frac{1}{2}\right)^7\left(\frac{1}{2}\right) + {}^8C_8\left(\frac{1}{2}\right)^8$$

$$= \left(\frac{1}{2}\right)^8 \{{}^8C_6 + {}^8C_7 + {}^8C_8\}$$

$$= \frac{1}{256}(28+8+1) = \frac{37}{256}$$

74. (a) There are 3 girls and 1 boy in I group, 2 girls and 2 boys in II group, 1 girl and 3 boys in III group.
Probability of selecting 1 girl and 2 boys
= IG IIB IIIB or IB IIG IIIB or IB IIB IIIG

$$= \frac{{}^3C_1}{{}^4C_1}\times\frac{{}^2C_1}{{}^4C_1}\times\frac{{}^3C_1}{{}^4C_1}+\frac{{}^1C_1}{{}^4C_1}\times\frac{{}^2C_1}{{}^4C_1}\times\frac{{}^3C_1}{{}^4C_1}+\frac{{}^1C_1}{{}^4C_1}\times\frac{{}^2C_1}{{}^4C_1}\times\frac{{}^1C_1}{{}^4C_2}$$

$$= \frac{18}{64}+\frac{6}{64}+\frac{2}{64} = \frac{26}{64} = \frac{13}{32}$$

75. (c) $P(A \cap B) = p$

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

Now, $P(A \cup B) = P(A \cap \bar{B}) + P(\bar{A} \cap B) + P(A \cap B)$

$\Rightarrow P(A \cup B) = p + q$

Now, $P(\bar{A}) + P(\bar{B}) = 1 - P(A) + 1 - P(B)$

$= 2 - \{P(A) + P(B)\} = 2 - \{P(A \cup B) + P(A \cap B)\}$

$= 2 - \{p + q + p\} = 2 - 2p - q$

and $P(\bar{A} \cap \bar{B}) = P(\overline{A \cup B})$

$= 1 - P(A \cup B) = 1 - (p + q) = 1 - p - q$

Hence, both statements are correct.

76. (c) There are total 11 integers and two integers are chosen with replacement.

So, $n(S) = {}^{11}C_1 \times {}^{11}C_1 = 121$

Event E is selecting two integers x and y such that $|x - y| > 5$ Then,

E = {(10, 0), (10, 1), (10, 2), (10, 3), (10, 4), (9, 0), (9, 1), (9, 2), (9, 3), (8, 0), (8, 1), (8, 2), (7, 0), (7, 1), (6, 0), (0, 6), (1, 7), (0, 7), (2, 8), (1, 8), (0, 8), (3, 9), (2, 9), (1, 9), (0, 9), (4, 10), (3, 10), (2, 10), (1, 10), (0, 10)}

$\Rightarrow n(E) = 30$

So, required probability $= \frac{30}{121}$

77. (c) For two dice when atleast one dice shows 5, sample space

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

$\Rightarrow n(S) = 11$

Event E is that the sum of the number on the both dice.

$\Rightarrow$ E = {(5, 5), (5, 6), (6, 5), (6, 6)}

$\Rightarrow n(E) = 3$

So, required probability $= \frac{3}{11}$

78. (b) Given, $P(B) = 1.5P(A) = \frac{3}{2}P(A)$

and $P(C) = \frac{5}{10}P(B)$

$$= \frac{5}{10}\times\frac{3}{2}P(A) = \frac{3}{4}P(A)$$

$\because$ A, B and C are mutually exclusive and exhaustive events.

So, $P(A) + P(B) + P(C) = 1$

$$\Rightarrow P(A) + \frac{3}{2}P(A) + \frac{3}{4}P(A)$$

$$\Rightarrow \left(1+\frac{3}{2}+\frac{3}{4}\right)P(A) = 1$$

$$\Rightarrow \frac{13}{4}P(A) = 1$$

$$\Rightarrow P(A) = \frac{4}{13}$$

79. (d) $\because$ Cards are taken out with replacement, i.e., there will be no effect of previous cards on fourteenth card and it has to be ace. So, required probability

$$= \frac{{}^4C_1}{{}^{52}C_1} = \frac{4}{52} = \frac{1}{13}$$

80. (d) $P(\overline{A \cup B}) = 1 - P(A \cup B)$

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

$= 1 - \{0.5 + 0.6 - 0.4\}$

$= 1 - 0.7 = 0.3$