16 PROBABILITY

1. Two fair dice are thrown. The probability that the sum is less than 5 is

A. $\frac{1}{12}$
B. $\frac{1}{9}$
C. $\frac{1}{6}$
D. $\frac{5}{18}$
E. $\frac{5}{36}$

2. Two fair dice are thrown. Find the probability that at least one die is 6.

A. $\frac{1}{6}$
B. $\frac{1}{12}$
C. $\frac{5}{36}$
D. $\frac{11}{36}$
E. $\frac{25}{36}$

3. Two fair dice are rolled. Find the probability that the scores on the dice are different.

A. $\frac{1}{6}$
B. $\frac{11}{36}$
C. $\frac{1}{2}$
D. $\frac{25}{36}$
E. $\frac{5}{6}$

4. Three unbiased dice are thrown. The probability that the scores are 1, 2 and 3 is

A. $\frac{1}{36}$
B. $\frac{1}{72}$
C. $\frac{1}{120}$
D. $\frac{1}{216}$
E. $\frac{1}{8}$

5. If three fair coins are tossed, what is the probability that there will be two heads?

A. $\frac{1}{8}$
B. $\frac{1}{4}$
C. $\frac{1}{3}$
D. $\frac{1}{2}$
E. $\frac{3}{8}$

6. If a fair coin is tossed 4 times, what is the probability that the first two outcomes are tails?

A. $\frac{1}{16}$
B. $\frac{1}{8}$
C. $\frac{3}{8}$
D. $\frac{1}{4}$
E. $\frac{1}{2}$

7. Assume the probability of a baby being male is 0.5. If a family has 4 children, what is the probability that there are 2 boys and 2 girls?

A. $\frac{1}{16}$
B. $\frac{1}{4}$
C. $\frac{3}{8}$
D. $\frac{1}{2}$
E. $\frac{5}{16}$

8. A card is chosen at random from a pack of 52 bridge cards. What is the probability that the card is red or a king?

A. $\frac{4}{13}$
B. $\frac{1}{2}$
C. $\frac{7}{13}$
D. $\frac{29}{52}$
E. $\frac{15}{26}$

9. An identity card is picked at random. What is the probability that the sum of the last two digits of its number is 9?

A. $\frac{1}{9}$
B. $\frac{1}{10}$
C. $\frac{1}{20}$
D. $\frac{10}{99}$
E. $\frac{9}{100}$

10. A 4-digit number is formed by arranging the digits 1, 2, 3 and 5 at random. What is the probability that the number is less than 2000?

A. $\frac{1}{10}$
B. $\frac{1}{5}$
C. $\frac{1}{4}$
D. $\frac{1}{3}$
E. $\frac{1}{2}$

11. If a two-digit number is selected at random, what is the probability that it contains the digit 7?

A. $\frac{1}{5}$
B. $\frac{2}{9}$
C. $\frac{1}{10}$
D. $\frac{19}{90}$
E. $\frac{19}{100}$

12. A bag contains 18 white balls and some black balls. The probability that a ball chosen at random is black is $\frac{2}{3}$. How many balls are in the bag?

A. 27
B. 30
C. 36
D. 45
E. 54

13. A box contains 36 cards. If a card is picked at random, the probability of being red is $\frac{2}{9}$. How many red cards should be added to make this probability $\frac{1}{3}$?

A. 4
B. 6
C. 8
D. 10
E. 12

14. If a teacher calls 3 names at random, what is the probability that the names are in alphabetical order?

A. $\frac{1}{3}$
B. $\frac{1}{6}$
C. $\frac{1}{8}$
D. $\frac{1}{9}$
E. $\frac{1}{27}$

15. A fly lands on a circular cake of diameter 20 cm. What is the probability that it is at least 6 cm from the centre of the cake?

A. $\frac{2}{5}$
B. $\frac{7}{10}$
C. $\frac{4}{25}$
D. $\frac{9}{25}$
E. $\frac{16}{25}$

16. A piece of wire is cut into two at a point selected at random. The probability that the longer part is at least 5 times as long as the shorter part is

A. $\frac{1}{3}$
B. $\frac{1}{5}$
C. $\frac{2}{5}$
D. $\frac{1}{6}$
E. $\frac{1}{2}$

17. In a bag containing 6 gold and 4 silver coins, two coins are drawn one by one without replacement. If the first coin is gold, the probability that the second coin is gold is

A. $\frac{1}{3}$
B. $\frac{2}{3}$
C. $\frac{3}{5}$
D. $\frac{1}{2}$
E. $\frac{5}{9}$

18. Two fair dice are rolled. It is known that one die shows a 2, what is the probability that the total score is less than 7?

A. $\frac{2}{3}$
B. $\frac{5}{6}$
C. $\frac{4}{11}$
D. $\frac{5}{11}$
E. $\frac{7}{11}$

19. A pencil box contains 3 blue and 2 red ballpens. If two are taken at random, the chance that they are both blue is

A. $\frac{1}{10}$
B. $\frac{3}{10}$
C. $\frac{9}{20}$
D. $\frac{6}{25}$
E. $\frac{9}{25}$

20. An urn contains 3 blue balls and 2 yellow balls. Three balls are drawn in succession with replacement. The probability that the balls drawn are of the same colour is

A. $\frac{1}{10}$
B. $\frac{3}{5}$
C. $\frac{7}{25}$
D. $\frac{8}{125}$
E. $\frac{27}{125}$

21. In a club, the probability that Alan will be chosen as the chairman is a and that Bob will be chosen is b. What is the probability that they will not be the chairman?

A. $1 - a - b$
B. $1 - ab$
C. $(1 - a)(1 - b)$
D. $1 - a - b - ab$
E. $2 - a - b$

22. If the probability that a baby is male is 0.4, what is the probability that in a family of 3 children, there will be at least one boy?

A. 0.144
B. 0.216
C. 0.432
D. 0.784
E. 0.936

23. If 2 persons are selected at random, what is the probability that they were born on Friday?

A. $\frac{1}{7}$
B. $\frac{2}{7}$
C. $\frac{1}{49}$
D. $\frac{2}{49}$
E. $\frac{13}{49}$

24. The probabilities that Lam and Tam will attend a meeting are 0.6 and 0.7 respectively. The probability that neither of them will attend the meeting is

A. 0.12
B. 0.18
C. 0.28
D. 0.42
E. 0.58

25. A pack of 10 shirts contains 2 large size ones. If two shirts are bought at random, what is the probability that they are of large size?

A. $\frac{1}{90}$
B. $\frac{1}{50}$
C. $\frac{1}{45}$
D. $\frac{2}{45}$
E. $\frac{1}{25}$

26. There are 9 balls numbered 1 to 9 in a bag. What is the probability that the product of the numbers on two balls drawn at random is even?

A. $\frac{1}{2}$
B. $\frac{1}{6}$
C. $\frac{5}{9}$
D. $\frac{5}{18}$
E. $\frac{13}{18}$

27. There are 6 couples in a party. If a man and a woman is selected at random, what is the probability that a specified couple will be chosen?

A. $\frac{1}{6}$
B. $\frac{1}{12}$
C. $\frac{1}{18}$
D. $\frac{1}{24}$
E. $\frac{1}{36}$

28. An examination consists of 3 parts. The probability that a student will pass in each part is 0.7. What is the probability that the student will pass in at least 2 parts?

A. 0.441
B. 0.49
C. 0.784
D. 0.91
E. 0.973

29. If 3 letters are taken randomly from the word 'PROPORTION', what is the probability that they can form the word 'POT'?

A. $\frac{1}{20}$
B. $\frac{1}{40}$
C. $\frac{1}{120}$
D. $\frac{3}{500}$
E. $\frac{9}{500}$

30. If one letter is taken from each of the words 'BREAD' and 'BUTTER' at random, what is the probability that the two letters are the same?

A. $\frac{1}{5}$
B. $\frac{1}{10}$
C. $\frac{1}{15}$
D. $\frac{2}{15}$
E. $\frac{1}{30}$

31. There are two rotten ones in a dozen of eggs. If 2 eggs are taken at random, what is the probability of one good and one rotten?

A. $\frac{5}{33}$
B. $\frac{10}{33}$
C. $\frac{5}{36}$
D. $\frac{10}{36}$
E. $\frac{16}{45}$

32. In a bunch of 15 keys, only 1 key can open a box. What is the chance that the box can be opened at the 10th trial by choosing keys at random one by one without repetition?

A. $\frac{1}{6}$
B. $\frac{2}{3}$
C. $\frac{1}{15}$
D. $\frac{2}{15}$
E. $\frac{4}{15}$

33. A boy continues to roll a fair die until a 6 turns up. What is the probability that he will stop after rolling 3 times?

A. $\frac{25}{72}$
B. $\frac{25}{216}$
C. $\frac{1}{216}$
D. $\frac{1}{36}$
E. $\frac{1}{6}$

34. There are 2 boys and 3 girls in room A and 3 boys and 1 girl in room B. A child is sent from room A to room B, then a child in room B is called. What is the probability that the child called is a boy?

A. $\frac{3}{5}$
B. $\frac{4}{5}$
C. $\frac{8}{25}$
D. $\frac{9}{25}$
E. $\frac{17}{25}$

35. The chances that hunters A and B can shoot their targets are $\frac{1}{3}$ and $\frac{2}{3}$ respectively. If they fire to a bird at the same time, what is the probability that the bird is hit?

A. 1
B. $\frac{7}{9}$
C. $\frac{5}{9}$
D. $\frac{4}{9}$
E. $\frac{2}{3}$

36. $\frac{1}{3}$ of a F.5 class got credits in mathematics. If 3 students are selected at random, what is the probability that at least one of them got a credit?

A. $\frac{19}{27}$
B. $\frac{8}{27}$
C. $\frac{1}{3}$
D. $\frac{2}{3}$
E. 1

37. Winnie has 10 English and 5 Chinese stamps. Peter has 12 English and 8 Chinese stamps. If they exchange one of their stamps at random, what is the probability that their numbers of stamps of the two countries remain the same?

A. $\frac{2}{5}$
B. $\frac{4}{5}$
C. $\frac{1}{12}$
D. $\frac{11}{15}$
E. $\frac{8}{15}$

38. There are 8 boxes of which 2 contain sweets. If a boy opens the boxes at random, what is the probability that he can find the sweets within 2 trials?

A. $\frac{1}{4}$
B. $\frac{3}{7}$
C. $\frac{3}{14}$
D. $\frac{1}{28}$
E. $\frac{13}{28}$

39. $\frac{1}{4}$ of pupils go to school on foot. If 4 pupils are selected at random, the probability that at least one of them goes to school by other ways is

A. $\frac{1}{256}$
B. $\frac{81}{256}$
C. $\frac{175}{256}$
D. $\frac{3}{4}$
E. $\frac{255}{256}$

40. There are 10 chips marked with 1 to 10 in a bag. Two chips are taken in succession with replacement. What is the probability that the number on the first chip is greater than that on the second one?

A. 0.4
B. 0.45
C. 0.5
D. 0.55
E. 0.6

41. A mathematics test consists of 10 multiple choice questions. Each question has 5 options, only 1 of which is correct. If a boy attempts the test by guessing, what is the probability that he will get at least 1 correct?

A. $\frac{1}{5^{10}}$
B. $\frac{1}{5}(\frac{4}{5})^9$
C. $1-(\frac{4}{5})^{10}$
D. 1
E. 2

42. The probability that a person is left-handed is p. If n persons are interviewed, find the probability that there is at least one left-handed.

A. p^n
B. $(1-p)^n$
C. $1-p^n$
D. $1-(1-p)^n$
E. $np(1-p)^{n-1}$

43. If 3 coins are thrown into 4 boxes at random, what is the probability that they will be in the same box?

A. $\frac{1}{4}$
B. $\frac{1}{16}$
C. $\frac{1}{64}$
D. $\frac{1}{81}$
E. $\frac{4}{81}$

44. The probability that 3 independent components of a car will break within a year are 0.1, 0.15 and 0.2 respectively. What is the probability that the car will need repair within the year?

A. 0.388
B. 0.45
C. 0.55
D. 0.612
E. 0.997

45. A man can go to his office by road X or road Y. The chance of having traffic congestion in road X is $\frac{1}{4}$ and that in road Y is $\frac{1}{6}$. If he is twice as likely to go by road X as road Y, the chance that he will come across congestion in a morning is

A. $\frac{2}{9}$
B. $\frac{1}{3}$
C. $\frac{2}{3}$
D. $\frac{5}{12}$
E. $\frac{7}{36}$

46. The ratio of numbers of boys and girls in a school is 3 : 2. 20% of the boys and 10% of the girls are members of the geography club. The probability that a pupil selected at random will be a member of the club is

A. 0.12
B. 0.14
C. 0.15
D. 0.16
E. 0.18

47. The probability that John will pass in physics and chemistry are p and $\frac{3}{4}$ respectively. If the probability that he will pass in at least one of the subjects is $\frac{9}{10}$, find p.

A. $\frac{1}{5}$
B. $\frac{2}{5}$
C. $\frac{3}{5}$
D. $\frac{3}{20}$
E. $\frac{13}{20}$

48. 1 out of 10 tins of milk powder contains a prize slip. How many tins should be bought in order that the probability of getting at least 1 prize slip exceeds 90%?

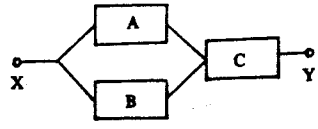
A. 10
B. 11
C. 20
D. 21
E. 22

49. A and B throw a fair die alternatively with A throwing first. If the first who gets a 1 wins, what is the probability that A will win?

A. $\frac{1}{6}$
B. $\frac{6}{11}$
C. $\frac{9}{16}$
D. $\frac{11}{36}$
E. $\frac{41}{216}$

50. In the figure, one can go from X to Y either through roads A and C or B and C. The chances of having congestion at A, B and C are 0.2, 0.3 and 0.4 respectively. What is the probability that there will be congestion when one goes from X to Y by choosing roads at random?

A. 0.1
B. 0.336
C. 0.45
D. 0.55
E. 0.9



16. Probability

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

1. The favourable outcomes are:
(1, 1), (1, 2), (1, 3), (2, 1), (2, 2), (3, 1)
$\therefore$ P(sum < 5) $= \frac{6}{36} = \frac{1}{6}$

2. The favourable outcomes are:
(1, 6), (2, 6), ..., (6, 6), (6, 5), ..., (6, 2), (6, 1)
$\therefore$ P(at least one is 6) $= \frac{11}{36}$

3. P(both are the same) $= \frac{6}{36} = \frac{1}{6}$
$\therefore$ P(both are different) $= 1 - \frac{1}{6} = \frac{5}{6}$

4. The favourable outcomes are:
(1, 2, 3), (1, 3, 2), (3, 1, 2), (3, 2, 1), (2, 3, 1), (2, 1, 3)
$\therefore$ The required probability $= \frac{6}{216} = \frac{1}{36}$

5. The favourable outcomes are:
HHT, HTH, THH.
$\therefore$ P(2 heads) $= \frac{3}{8}$

6. $\therefore$ P(first two are tails) $= \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

7. The favourable outcomes are:
BBGG, BGGB, GGBB, GBBG, GBGB, BGBG.
$\therefore$ P(2 boys and 2 girls) $= \frac{6}{16} = \frac{3}{8}$

8. There are 26 red cards and 2 black kings.
$\therefore$ The required probability $= \frac{28}{52} = \frac{7}{13}$

9. The sample space is from 00 to 99. The favourable outcomes are 09, 18, 27, 36, 45, 54, 63, 72, 81, 90.
$\therefore$ The required probability $= \frac{10}{100} = \frac{1}{10}$

10. The required probability
= P(the first digit is 1) $= \frac{1}{4}$

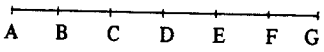
11. P(both digits are not 7) $= \frac{8}{9} \times \frac{9}{10} = \frac{4}{5}$
$\therefore$ The required probability $= 1 - \frac{4}{5} = \frac{1}{5}$

12. P(white) $= 1 - \frac{2}{3} = \frac{1}{3}$
$\therefore$ No. of balls $= 18 \div \frac{1}{3} = 54$

13. No. of red cards in the bag $= 36 \times \frac{2}{9} = 8$.
Suppose x red cards are added.
$\frac{8+x}{36+x} = \frac{1}{3}$, $24 + 3x = 36 + x$,
$2x = 12$, $\therefore$ $x = 6$

14. The required probability $= \frac{1}{3} \times \frac{1}{2} \times 1 = \frac{1}{6}$

15. Area of the cake surface $= \pi \cdot 10^2 = 100\pi$
The area of favourable region $= 100\pi - 6^2\pi$
$= 64\pi$
$\therefore$ The required probability $= \frac{64\pi}{100\pi} = \frac{16}{25}$

16.


The point should be within AB or FG.
$\therefore$ The required probability $= \frac{2}{6} = \frac{1}{3}$

17. After drawing one gold coin, there are 5 gold and 4 silver coins in the bag.
P(2nd coin is gold) $= \frac{5}{9}$

18. There are 11 outcomes with a die showing a 2, out of which 7 cases with a total score less than 7.
$\therefore$ The required probability $= \frac{7}{11}$

19. P(both blue) $= \frac{3}{5} \times \frac{2}{4} = \frac{3}{10}$

20. P(same colour) = P(3 blue) + P(3 yellow)
$= (\frac{3}{5})^3 + (\frac{2}{5})^3 = \frac{7}{25}$

21. The events are mutually exclusive.
$\therefore$ The required probability $= 1 - a - b$

22. P(at least one boy) = 1 – P(all girls)
$= 1 - (0.6)^3 = 0.784$

23. P(both were born on Friday) $= \frac{1}{7} \times \frac{1}{7} = \frac{1}{49}$

24. P(both are absent) $= (1 - 0.6) \times (1 - 0.7)$
$= 0.12$

25. P(both are large size) $= \frac{2}{10} \times \frac{1}{9} = \frac{1}{45}$

26. The required probability = 1 – P(both are odd)
$= 1 - \frac{5}{9} \times \frac{4}{8} = \frac{13}{18}$

27. The required probability $= \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$

28. The required probability
= P(all pass) + P(2 pass and 1 fail)
$= (0.7)^3 + 3(0.7)^2(0.3) = 0.784$

29. The required probability
= P(taking P, O, T in any order)
$= 6 \times \frac{2}{10} \times \frac{3}{9} \times \frac{1}{8} = \frac{1}{20}$

30. There are 3 letters in common.
$\therefore$ The required probability $= 3 \times \frac{1}{5} \times \frac{1}{6} = \frac{1}{10}$

31. P(one good and one bad) $= 2 \times \frac{10}{12} \times \frac{2}{11} = \frac{10}{33}$

32. The required probability
$= \frac{14}{15} \times \frac{13}{14} \times \frac{12}{13} \times \ldots \times \frac{6}{7} \times \frac{1}{6} = \frac{1}{15}$

33. The required probability
= P(the first two throws are not 6 and the third is a a 6)
$= \frac{5}{6} \times \frac{5}{6} \times \frac{1}{6} = \frac{25}{216}$

34. The required probability
= P(a boy is sent to room B and a boy is called)
+ P(no boy is sent to room B and a boy is called)
$= \frac{2}{5} \times \frac{4}{5} + \frac{3}{5} \times \frac{3}{5} = \frac{17}{25}$

35. P(hit) = 1 – P(both miss)
$= 1 - \frac{2}{3} \times \frac{1}{3} = \frac{7}{9}$

36. P(at least 1 credit)
= 1 – P(no one gets credit)
$= 1 - (\frac{2}{3})^3 = \frac{19}{27}$

37. The required probability
= P(both exchange English stamps) + P(both exchange Chinese stamps).
$= \frac{10}{15} \times \frac{12}{20} + \frac{5}{15} \times \frac{8}{20} = \frac{8}{15}$

38. The required probability
= 1 – P(he can't find)
$= 1 - \frac{6}{8} \times \frac{5}{7} = \frac{13}{28}$

39. P(by other ways) = 1 – P(all on foot)
$= 1 - (\frac{1}{4})^4 = \frac{255}{256}$

40. P(both chips are equal) $= \frac{1}{10}$
$\therefore$ The required probability $= \frac{1}{2}(1 - \frac{1}{10}) = 0.45$

41. P(at least 1 correct) = 1 – P(all wrong)
$= 1 - (\frac{4}{5})^{10}$

42. P(at least one left-handed)
= 1 – p(all are right-handed) $= 1 - (1 - p)^n$

43. P(same box) $= 4 \times (\frac{1}{4})^3 = \frac{1}{16}$

44. The required probability
$= 1 - 0.9 \times 0.85 \times 0.8 = 0.388$

45. The required probability
= P(choosing road X and having congestion)
+ P(choosing road Y and having congestion)
$= \frac{2}{3} \times \frac{1}{4} + \frac{1}{3} \times \frac{1}{6} = \frac{2}{9}$

46. The required probability
$= \frac{3}{5} \times 20\% + \frac{2}{5} \times 10\% = 0.16$

47. 1 – P(both fail) $= \frac{9}{10}$
$\therefore$ $1 - \frac{1}{4}(1 - p) = \frac{9}{10}$, $p = \frac{3}{5}$

48. $1 - (\frac{9}{10})^n > 90\%$, $0.1 > (0.9)^n$
$\therefore$ $\log 0.1 > n \log 0.9$, $n > \frac{\log 0.1}{\log 0.9}$
$n > 21.85$ $\therefore$ $n = 22$