50 multiple-choice questions

Question 1 (Level 1) — *Probability of a coin flip*
What is the probability of getting heads when flipping a fair coin?

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

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

(C) 1

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

Question 2 (Level 1) — *Rolling a die*
What is the probability of rolling a 4 on a fair six-sided die?

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

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

(C) $\frac{4}{6}$

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

Question 3 (Level 1) — *Impossible event*
What is the probability of rolling a 7 on a standard six-sided die?

(A) 0

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

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

(D) 1

Question 4 (Level 1) — *Certain event*
What is the probability of rolling a number less than 7 on a standard die?

(A) 1

(B) $\frac{6}{7}$

(C) $\frac{5}{6}$

(D) 0

Question 5 (Level 1) — *Complementary probability*
The probability of rain tomorrow is 0.3. What is the probability it does not rain?

(A) 0.7

(B) 0.3

(C) 0.5

(D) 1.3

Question 6 (Level 1) — *Drawing from a bag*
A bag contains 3 red and 5 blue marbles. What is the probability of drawing a red marble?

(A) $\frac{3}{8}$

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

(C) $\frac{5}{8}$

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

Question 7 (Level 1) — *Even number on a die*
What is the probability of rolling an even number on a fair die?

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

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

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

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

Question 8 (Level 1) — *Probability as a percentage*
Convert $P = \frac{1}{4}$ to a percentage.

(A) 25%

(B) 4%

(C) 50%

(D) 75%

Question 9 (Level 1) — *Sample space of a coin*
How many outcomes are in the sample space when flipping two coins?

(A) 4

(B) 2

(C) 3

(D) 8

Question 10 (Level 1) — *Spinner probability*
A spinner has 4 equal sections coloured red, blue, green, and yellow. What is the probability of landing on blue?

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

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

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

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

Question 11 (Level 2) — *Two-coin probability*
Two fair coins are flipped. What is the probability of getting exactly one head?

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

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

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

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

Question 12 (Level 2) — *Sum of two dice*
Two dice are rolled. What is the probability the sum is 7?

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

(B) $\frac{7}{36}$

(C) $\frac{1}{12}$

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

Question 13 (Level 2) — *Tree diagram — two draws*
A bag has 2 red and 3 blue marbles. One marble is drawn and replaced, then another is drawn. What is the probability of getting two reds?

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

(B) $\frac{2}{25}$

(C) $\frac{1}{10}$

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

Question 14 (Level 2) — *OR probability — mutually exclusive*
A card is drawn from a standard deck. What is P(King or Queen)?

(A) $\frac{2}{13}$

(B) $\frac{1}{13}$

(C) $\frac{4}{52}$

(D) $\frac{8}{13}$

Question 15 (Level 2) — *Expected frequency*
A fair die is rolled 60 times. How many times would you expect to roll a 3?

(A) 10

(B) 12

(C) 6

(D) 20

Question 16 (Level 2) — *Drawing a card*
What is the probability of drawing a heart from a standard 52-card deck?

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

(B) $\frac{1}{13}$

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

(D) $\frac{1}{52}$

Question 17 (Level 2) — *At least one head*
Three coins are flipped. What is the probability of getting at least one head?

(A) $\frac{7}{8}$

(B) $\frac{3}{8}$

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

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

Question 18 (Level 2) — *Without replacement*
A bag has 4 red and 6 blue marbles. Two are drawn without replacement. What is $P(\text{first red, second blue})$?

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

(B) $\frac{24}{100}$

(C) $\frac{6}{25}$

(D) $\frac{2}{15}$

Question 19 (Level 2) — *Relative frequency*
In 200 trials, an event occurred 50 times. Estimate the probability of this event.

(A) 0.25

(B) 0.5

(C) 0.4

(D) 50

Question 20 (Level 2) — *Die — greater than 4*
What is the probability of rolling a number greater than 4 on a fair die?

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

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

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

(D) $\frac{4}{6}$

Question 21 (Level 3) — *Venn diagram — union*
In a class of 30 students, 18 play soccer (S) and 15 play basketball (B). If 8 play both, how many play soccer or basketball?

(A) 25

(B) 33

(C) 22

(D) 5

Question 22 (Level 3) — *Venn diagram — only one*
Using the data from the previous question ($|S| = 18$, $|B| = 15$, $|S \cap B| = 8$), how many play only soccer?

(A) 10

(B) 18

(C) 8

(D) 7

Question 23 (Level 3) — *Two-way table probability*
In a survey, 40 people were asked about pets. 15 own a dog, 10 own a cat, and 5 own both. What is $P(\text{dog or cat})$?

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

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

(C) $\frac{25}{40}$

(D) $\frac{3}{8}$

Question 24 (Level 3) — *Independent events*
Events A and B are independent with $P(A) = 0.4$ and $P(B) = 0.5$. Find $P(A \cap B)$.

(A) 0.2

(B) 0.9

(C) 0.7

(D) 0.1

Question 25 (Level 3) — *Tree diagram — sequential*
A bag has 3 red and 2 green balls. Two balls are drawn without replacement. What is $P(\text{both green})$?

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

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

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

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

Question 26 (Level 3) — *Addition rule — not mutually exclusive*
A card is drawn from a standard deck. Find P(red or King).

(A) $\frac{7}{13}$

(B) $\frac{15}{26}$

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

(D) $\frac{30}{52}$

Question 27 (Level 3) — *Arrangements*
How many ways can 3 people sit in a row of 3 chairs?

(A) 6

(B) 9

(C) 3

(D) 27

Question 28 (Level 3) — *Probability with replacement*
A letter is chosen at random from the word STATISTICS. What is P(S)?

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

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

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

(D) $\frac{3}{7}$

Question 29 (Level 3) — *Conditional probability — basic*
A die is rolled. Given that the number is even, what is the probability it is greater than 3?

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

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

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

(D) $\frac{2}{6}$

Question 30 (Level 3) — *Complement with multiple events*
The probability that a student passes maths is 0.8 and passes English is 0.7. If the events are independent, find P(passes at least one).

(A) 0.94

(B) 0.56

(C) 1.5

(D) 0.76

Question 31 (Level 4) — *Conditional probability formula*
If $P(A) = 0.6$, $P(B) = 0.5$, and $P(A \cap B) = 0.3$, find $P(A|B)$.

(A) 0.6

(B) 0.5

(C) 0.3

(D) 0.8

Question 32 (Level 4) — *Independence test*
If $P(A) = 0.4$, $P(B) = 0.5$, and $P(A \cap B) = 0.2$, are A and B independent?

(A) Yes, because $P(A \cap B) = P(A) \times P(B)$

(B) No, because $P(A) \neq P(B)$

(C) No, because $P(A \cap B) \neq 0$

(D) Cannot be determined

Question 33 (Level 4) — *Combinations*
How many ways can a committee of 3 be chosen from 7 people?

(A) 35

(B) 210

(C) 21

(D) 42

Question 34 (Level 4) — *Binomial probability — single trial*
The probability of hitting a target is 0.3. In 5 shots, what is $P(\text{exactly 2 hits})$?

(A) 0.3087

(B) 0.36

(C) 0.1323

(D) 0.6

Question 35 (Level 4) — *Venn diagram — three-set inclusion-exclusion setup*
In a group of 50 students: 25 like maths (M), 20 like science (S), $P(M \cap S) = \frac{1}{5}$. Find $P(M \cup S)$.

(A) 0.7

(B) 0.9

(C) 0.5

(D) $\frac{35}{50}$

Question 36 (Level 4) — *Permutations*
How many 4-letter arrangements can be formed from the letters A, B, C, D, E (no repeats)?

(A) 120

(B) 625

(C) 24

(D) 60

Question 37 (Level 4) — *Probability using combinations*
A hand of 5 cards is dealt from a standard 52-card deck. What is the probability that all 5 are hearts?

(A) $\frac{1287}{2598960}$

(B) $\left(\frac{1}{4}\right)^5$

(C) $\frac{13}{52}$

(D) $\frac{1}{52^5}$

Question 38 (Level 4) — *Law of total probability*
Box A has 3 red, 7 blue balls. Box B has 6 red, 4 blue. A box is chosen at random, then a ball is drawn. What is $P(\text{red})$?

(A) $\frac{9}{20}$

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

(C) $\frac{3}{10}$

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

Question 39 (Level 4) — *At least one success — binomial*
A coin is biased with $P(H) = 0.6$. It is flipped 4 times. Find P(at least one H).

(A) 0.9744

(B) 0.6

(C) 0.936

(D) 0.8704

Question 40 (Level 4) — *Multiplication principle*
A lock has 4 digits, each from 0–9. How many possible codes are there?

(A) 10000

(B) 40

(C) 5040

(D) 1000

Question 41 (Level 5) — *Bayes' theorem*
A test for a disease is 95% accurate (positive when sick, negative when healthy). The disease affects 1% of the population. If a person tests positive, what is P(sick|positive)?

(A) ≈ 0.161

(B) 0.95

(C) 0.01

(D) ≈ 0.5

Question 42 (Level 5) — *Expected value*
A game costs \$5 to play. You roll a die: if 6, you win \$20; otherwise you win nothing. What is the expected profit?

(A) $-\frac{5}{3}$

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

(C) \$15

(D) $-\$5$

Question 43 (Level 5) — *Conditional probability — table*
In a class: $P(\text{girl}) = 0.6$, $P(\text{glasses}|\text{girl}) = 0.25$, $P(\text{glasses}|\text{boy}) = 0.5$. Find $P(\text{girl}|\text{glasses})$.

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

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

(C) 0.25

(D) 0.6

Question 44 (Level 5) — *Binomial — finding n*
A fair coin is flipped n times. If $P(\text{all heads}) < 0.01$, find the smallest n.

(A) 7

(B) 6

(C) 10

(D) 8

Question 45 (Level 5) — *Geometric probability*
A point is chosen uniformly at random in a square of side 4. What is the probability it lies within a circle of radius 2 inscribed in the square?

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{2}$

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

(D) π

Question 46 (Level 5) — *Derangements*
Three letters are placed randomly in three envelopes. What is the probability that no letter is in its correct envelope?

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

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

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

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

Question 47 (Level 5) — *Birthday problem variant*
In a group of 3 people, what is the probability that at least two share the same birthday? (Assume 365 days, ignore leap years.)

(A) ≈ 0.008

(B) $\frac{1}{365}$

(C) ≈ 0.5

(D) $\frac{3}{365}$

Question 48 (Level 5) — *Conditional independence*
$P(A) = 0.3$, $P(B|A) = 0.4$, and $P(B|A') = 0.6$. Find $P(A|B)$.

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

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

(C) 0.4

(D) 0.3

Question 49 (Level 5) — *Recursive probability*
A gambler starts with \$2 and wins \$1 with probability $\frac{1}{2}$ or loses \$1 with probability $\frac{1}{2}$ each round. What is the probability of reaching \$0 before \$4? (Gambler's ruin)

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

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

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

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

Question 50 (Level 5) — *Multinomial counting*
How many distinct arrangements are there of the letters in MISSISSIPPI?

(A) 34650

(B) 11!

(C) 39916800

(D) 69300

Solutions

Q1: (A)
$P(\text{heads}) = \frac{1}{2}$.
Q2: (A)
$P(4) = \frac{1}{6}$.
Q3: (A)
There is no 7, so $P(7) = 0$.
Q4: (A)
All outcomes satisfy this, so $P = \frac{6}{6} = 1$.
Q5: (A)
$P(\text{not rain}) = 1 - 0.3 = 0.7$.
Q6: (A)
$P(\text{red}) = \frac{3}{8}$.
Q7: (A)
$P(\text{even}) = \frac{3}{6} = \frac{1}{2}$.
Q8: (A)
$\frac{1}{4} \times 100 = 25\%$.
Q9: (A)
There are 4 outcomes: $\{HH, HT, TH, TT\}$.
Q10: (A)
$P(\text{blue}) = \frac{1}{4}$.
Q11: (A)
Favourable: $\{HT, TH\}$. $P = \frac{2}{4} = \frac{1}{2}$.
Q12: (A)
Pairs: $(1,6), (2,5), (3,4), (4,3), (5,2), (6,1)$ — that is 6. $P = \frac{6}{36} = \frac{1}{6}$.
Q13: (A)
$P(RR) = \frac{2}{5} \times \frac{2}{5} = \frac{4}{25}$.
Q14: (A)
$P = \frac{4}{52} + \frac{4}{52} = \frac{8}{52} = \frac{2}{13}$.
Q15: (A)
$60 \times \frac{1}{6} = 10$.
Q16: (A)
$P(\text{heart}) = \frac{13}{52} = \frac{1}{4}$.
Q17: (A)
$P(\text{no heads}) = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$. So $P = 1 - \frac{1}{8} = \frac{7}{8}$.
Q18: (A)
$P = \frac{4}{10} \times \frac{6}{9} = \frac{24}{90} = \frac{4}{15}$.
Q19: (A)
$P \approx \frac{50}{200} = \frac{1}{4} = 0.25$.

Q20: (A)
$P = \dfrac{2}{6} = \dfrac{1}{3}$.
Q21: (A)
$|S \cup B| = 18 + 15 - 8 = 25$.
Q22: (A)
Only soccer $= 18 - 8 = 10$.
Q23: (A)
$P = \dfrac{15 + 10 - 5}{40} = \dfrac{20}{40} = \dfrac{1}{2}$.
Q24: (A)
$P(A \cap B) = 0.4 \times 0.5 = 0.2$.
Q25: (A)
$P = \dfrac{2}{5} \times \dfrac{1}{4} = \dfrac{2}{20} = \dfrac{1}{10}$.
Q26: (A)
$P = \dfrac{26}{52} + \dfrac{4}{52} - \dfrac{2}{52} = \dfrac{28}{52} = \dfrac{7}{13}$.
Q27: (A)
$3! = 3 \times 2 \times 1 = 6$.
Q28: (A)
There are 3 S's out of 10 letters. $P(S) = \dfrac{3}{10}$.
Q29: (A)
Even and > 3: $\{4, 6\}$. $P = \dfrac{2}{3}$.
Q30: (A)
$P(\text{fails both}) = 0.2 \times 0.3 = 0.06$. $P = 1 - 0.06 = 0.94$.
Q31: (A)
$P(A|B) = \dfrac{0.3}{0.5} = 0.6$.
Q32: (A)
$P(A) \times P(B) = 0.4 \times 0.5 = 0.2 = P(A \cap B)$. Yes, they are independent.
Q33: (A)
$\binom{7}{3} = \dfrac{7 \times 6 \times 5}{3 \times 2 \times 1} = 35$.
Q34: (A)
$P = 10 \times 0.09 \times 0.343 = 10 \times 0.03087 = 0.3087$.
Q35: (A)
$P(M \cup S) = \dfrac{25}{50} + \dfrac{20}{50} - \dfrac{1}{5} = 0.5 + 0.4 - 0.2 = 0.7$.
Q36: (A)
$5 \times 4 \times 3 \times 2 = 120$.
Q37: (A)
$P = \dfrac{\binom{13}{5}}{\binom{52}{5}} = \dfrac{1287}{2598960} \approx 0.000495$.
Q38: (A)
$P(R) = \dfrac{1}{2} \cdot \dfrac{3}{10} + \dfrac{1}{2} \cdot \dfrac{6}{10} = \dfrac{3}{20} + \dfrac{6}{20} = \dfrac{9}{20}$.
Q39: (A)
$P(0) = (0.4)^4 = 0.0256$. $P(\geq 1) = 1 - 0.0256 = 0.9744$.
Q40: (A)
$10^4 = 10000$.

Q41: (A)
$P(+) = 0.95 \times 0.01 + 0.05 \times 0.99 = 0.0095 + 0.0495 = 0.059$. $P(S|+) = \dfrac{0.0095}{0.059} \approx 0.161$.
Q42: (A)
$E = \dfrac{1}{6}(20) - 5 = \dfrac{20}{6} - 5 = \dfrac{10}{3} - 5 = -\dfrac{5}{3} \approx -\$1.67$.
Q43: (A)
$P(G) = 0.6 \times 0.25 + 0.4 \times 0.5 = 0.15 + 0.2 = 0.35$. $P(\text{girl}|\text{glasses}) = \dfrac{0.15}{0.35} = \dfrac{3}{7}$.
Q44: (A)
$2^n > 100$. $2^6 = 64 < 100$, $2^7 = 128 > 100$. So $n = 7$.
Q45: (A)
$P = \dfrac{\pi(2)^2}{4^2} = \dfrac{4\pi}{16} = \dfrac{\pi}{4}$.
Q46: (A)
Derangements of 3 items: $D_3 = 2$. $P = \dfrac{2}{6} = \dfrac{1}{3}$.
Q47: (A)
$P(\text{all different}) = \dfrac{365}{365} \times \dfrac{364}{365} \times \dfrac{363}{365} \approx 0.9918$. $P \approx 1 - 0.9918 = 0.0082$.
Q48: (A)
$P(B) = 0.4(0.3) + 0.6(0.7) = 0.12 + 0.42 = 0.54$. $P(A|B) = \dfrac{0.12}{0.54} = \dfrac{2}{9}$.
Q49: (A)
With $k = 2$, $N = 4$: $P(\text{ruin}) = \dfrac{4-2}{4} = \dfrac{1}{2}$.
Q50: (A)
$\dfrac{11!}{1! \cdot 4! \cdot 4! \cdot 2!} = \dfrac{39916800}{1 \cdot 24 \cdot 24 \cdot 2} = \dfrac{39916800}{1152} = 34650$.