Chapter - 15
Probability

Answer the questions based on the information given.

HOOK-A-DUCK is a traditional stall game. A number of identical rubber ducks are floated in a water trough. The ducks have metal rings fastened to their heads. The player captures the ducks using a pole with a hook at one end. Although the ducks appear identical, the letters S, M or L appears on the bottom of some ducks, signifying that the player who captures them receives a Small, Medium or Large prize respectively. A duck with no letter signifies no prize.

In order to play the game, a player needs to buy a token and is given three attempts per token. In each attempt, he needs to capture a duck. The captured ducks are examined to reveal whether they have any letter and the player gets the prizes accordingly. The ducks are returned to the trough only after the player finishes all the three attempts. If a player buys more than one token, the ducks are returned to the trough after every 3 attempts.

Sam is playing one such game where there are 120 ducks in the trough. The ratio of the number of ducks without any letter to the number of ducks with letters S, M and L is 10:6:3:1 respectively.

Q: 1 **Sam is playing his first attempt of the game. What is the probability that he wins a medium prize?**

1 $\frac{3}{120}$ **2** $\frac{3}{60}$ **3** $\frac{3}{20}$ **4** $\frac{3}{17}$

Q: 2 **A player captures empty ducks in his first two attempts. What is the probability that he will win a small prize in his third attempt?**

1 $\frac{36}{120}$ **2** $\frac{36}{118}$ **3** $\frac{6}{18}$ **4** $\frac{6}{14}$

Q: 3 **Meera is playing the game and she got a duck marked S in her first attempt. Which duck will be most likely captured by her in the second attempt?**

1 A duck with letter S
2 A duck with letter M
3 A duck with letter L
4 A duck with no letter

Q: 4 **A certain number of new ducks, when added to the trough, doubles the probability of winning a large prize in the first attempt.**

Which of the following could be true about the number of new ducks getting added?

(i) 20 new ducks out of which 8 marked L.
(ii) 240 new ducks out of which 2 marked L.
(iii) 120 new ducks out of which 18 marked L.

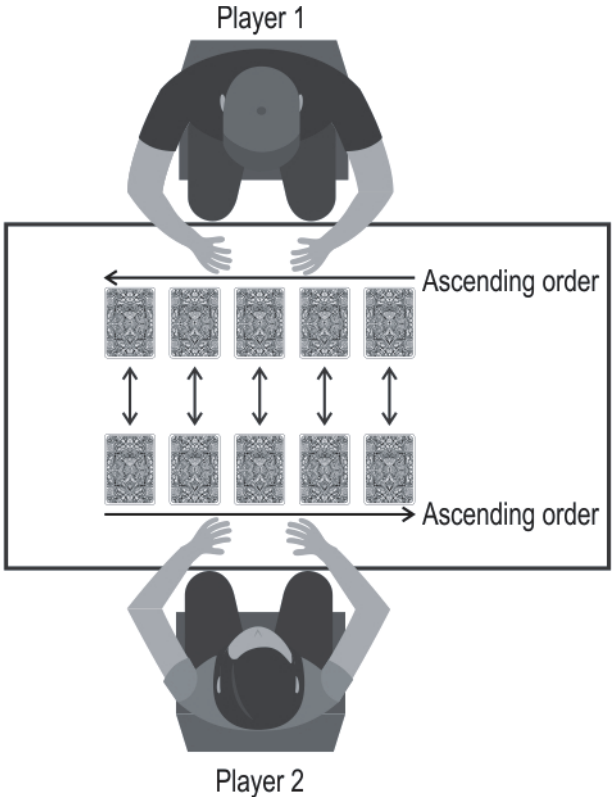
1 only (ii) **2** only (iii) **3** only (i) and (ii) **4** only (i) and (iii)

Q: 5 **Let *k* be the probability that a player wins a medium prize in his first attempt.**

If a player wins a small and a large prize in his first two attempts, then the probability that he wins a medium prize in his third attempt is _____.

1 equal to *k*
2 less than *k*
3 more than *k*
4 (cannot be determined using the given information)

Q: 6 **In a cards game, there are ten cards, 1 to 10. Two players, seated facing each other, randomly choose 5 cards each. They arrange their cards in ascending order of the number on the card as shown below.**



The difference between the corresponding cards is calculated such that the lower value is subtracted from the higher value.

In a random game, what is the probability that the sum of the differences is 24?

1 0
2 $\frac{1}{5}$
3 $\frac{1}{2}$
4 (cannot be calculated without knowing the cards chosen by each player.)

Q: 7 **At a party, there is one last pizza slice and two people who want it. To decide who gets the last slice, two fair six-sided dice are rolled. If the largest number in the roll is:**

- **1, 3 or 6, Ananya would get the last slice, and**
- **2, 4 or 5, Pranit would get it.**

In a random roll of dice, who has a higher chance of getting the last pizza slice?

(Note: If the number on both the dice is the same, then consider that number as the larger number.)

1 Ananya
2 Pranit
3 Both have an equal chance
4 (cannot be answered without knowing the exact numbers in a roll.)

Q: 8 **A number was selected at random from 1 to 100 (inclusive of both numbers) and it was found to be a multiple of 10.**

What is the probability that the selected number is a multiple of 5?

1 $\frac{1}{10}$ **2** $\frac{1}{5}$ **3** $\frac{1}{2}$ **4** 1

Answer the questions based on the information given below.
Four friends - Ayush, Minal, Rohan and Shreya - are playing a board game called Food Master. Shown below are their current positions on the board during the first round.

The rules of the game are:
- In each chance, two 6-sided fair dice numbered 1-6 are rolled by the player.
- The number of steps a player moves forward by is the sum of the numbers on the two dice.
- Each player gets a restaurant card for their first visit to any of the 16 restaurants.
- After 10 rounds, the player with the most number of restaurant cards wins.

Q: 9 **What are the chances that Rohan lands on 'FREE PARKING' in his next turn?**

1 $\frac{7}{36}$ **2** $\frac{1}{6}$ **3** $\frac{1}{12}$ **4** $\frac{1}{36}$

Q: 10 **What is the probability of Minal landing on 'ROLL AGAIN' in her next turn?**

1 0 **2** $\frac{1}{36}$ **3** $\frac{1}{6}$ **4** 1

Q: 11 **Among Minal and Shreya, who has a higher chance of landing on the Goan restaurant in their next turn? Show your steps.** **[2]**

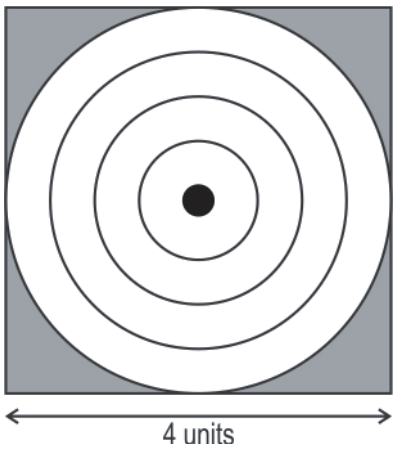
Q: 12 **In a medical centre, 780 randomly selected people were observed to find if there is a relationship between age and the likelihood of getting a heart attack. The following results were observed.** **[2]**

	Younger than or equal to 55	Older than 55	Total
Number of persons who have had a heart attack	29	75	104
Number of persons who have never had a heart attack	401	275	676
Total	430	350	780

(i) Based on this table, what is the probability that a randomly chosen person from the same sample is younger than or equal to 55 years and has had a heart attack?

(ii) Looking at the data in the table, Giri says "*if a person is randomly chosen, then the probability that the person have had a heart attack is about 12.5%*".
Is the statement true or false? Justify your reason.

Q: 13 **Shown below is a square dart board with circular rings inside.** **[2]**



(Note: The figure is not to scale.)

Find the probability that a dart thrown at random lands on the shaded area. Show your steps.

Q: 14 **A 4-sided fair die is numbered 1 - 4. Nikhil and Pratik are playing with such a die each. They roll their dice once at the same time. A player wins only if they get a number larger than the other player.** **[2]**

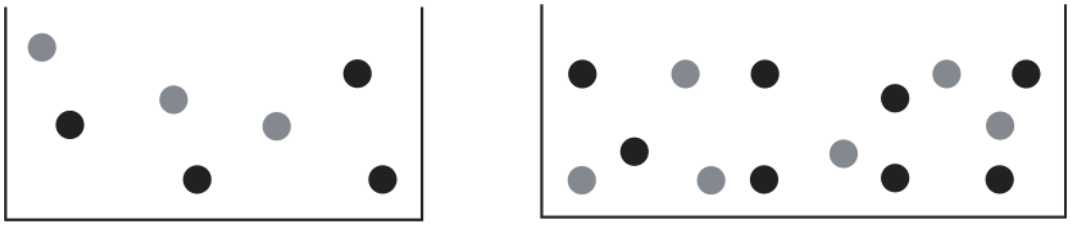
What is the probability of Pratik winning the game? Show your work.

Q: 15 **On a particular day, Vidhi and Unnati couldn't decide on who would get to drive the car. They had one coin each and flipped their coins exactly three times. The following was agreed upon:** **[3]**

- **If Vidhi gets two heads in a row, she would drive the car.**
- **If Unnati gets a head immediately followed by a tail, she would drive the car.**

Who has more probability to drive the car that day? List all outcomes and show your steps.

Q: 16 **Shown below are two baskets with grey and black balls.** **[2]**



Basket 1 Basket 2

Abhishek is playing a game with his friend where he has to close his eyes and pick a black ball from one of the baskets in one trial.

He said "I will try with basket 2 as it has a higher number of black balls than basket 1 and hence the probability of picking a black ball from basket 2 is higher."
Is Abhishek's statement correct? Justify your answer.

Q: 17 **Rohan has a bag of multiple balls either pink, green or yellow in colour. He randomly picks up one ball.** **[1]**

His friend, Farid predicted, "The probability of Rohan picking a pink ball is definitely $\frac{1}{3}$ as there are 3 colours".

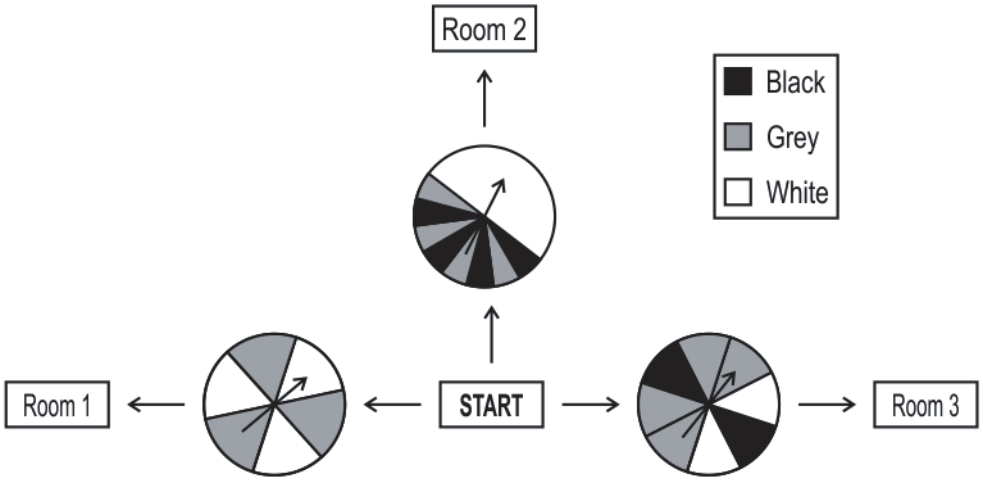
Is Farid's statement true or false. Give a valid reason or a counter example.

Q: 18 **Shivesh was tossing a fair coin. Shown below are the outcomes of his first 5 tosses.** **[1]**

Tail Tail Tail Tail Tail

Is the probability of Shivesh getting a head in his sixth toss higher than the probability of getting a tail? Give a valid reason.

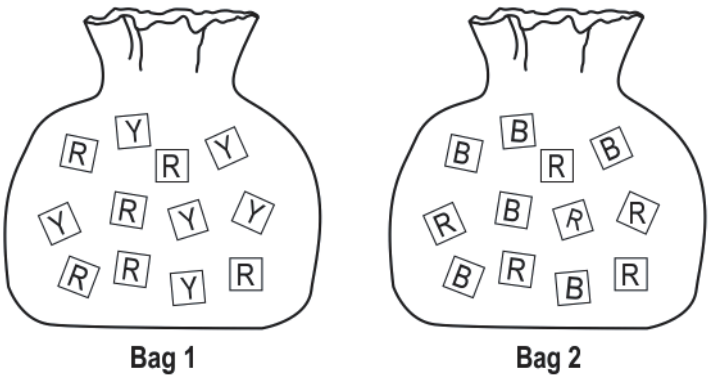
Q: 19 **Shown below is a game with 3 spinners attached to 3 rooms. Each player is given a treasure which has to be kept in one of the rooms. All the spinners are rotated and if any spinner lands on the grey region, that room is opened. If the player kept his treasure in that room, he loses the treasure. If he kept it in any other room, he wins the treasure.** **[3]**



Zaira kept her treasure in the room which is least likely to be opened.

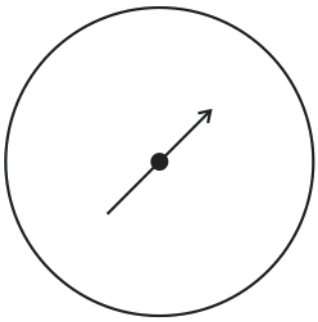
In which room did she keep her treasure? Show your work.

Q: 20 **At a fair, there is a game such that it has two bags. Bag 1 has an equal number of red(R) and yellow(Y) cubes and bag 2 has an equal number of red(R) and blue(B) cubes. Rohit has to pick a cube from each of the bags. If he picks up at least 1 red cube, he gets a prize.** **[1]**

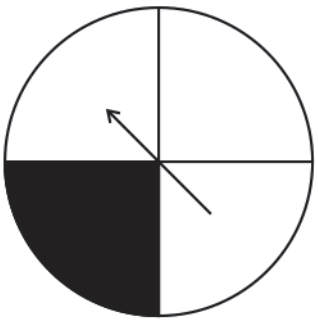


Find the probability of Rohit getting a prize. List all outcomes and show your work.

Q: 21 **Shown below are two spinners.** **[1]**



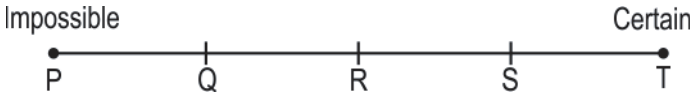
Spinner 1



Spinner 2

Select the points on the probability scale below that represents:
i) the probability of spinner 1 landing on a black region.

ii) the probability of spinner 2 landing on white region.



Q: 22 **On a given day, an airplane is carrying 78 meals, of which 39 are vegetarian and the rest are non-vegetarian.** **[1]**

If the air hostess started distributing the meals and picked the first meal from the lot, what is the probability that it has a surprise gift?

Q: 23 **Jenin has four 50-rupee notes, seven 100-rupee notes and two 2000-rupee notes in her purse. She doesn't have any other denomination of currency with her. She goes for shopping and buys a skirt for Rs 799. She takes out a note from her purse at random.** **[2]**

i) Find the probability that the note will be sufficient to pay for the dress.
ii) Find the probability that she will be able to give exactly Rs 799 to the shopkeeper.

Show your work.

Q: 24 **Farah and Sheena are playing a game with number tokens. Each of them has four number tokens, 2, 3, 4 and 5. A token is randomly picked by each of them from their stack simultaneously. If the sum of the numbers picked by each of them is a prime number, Farah wins the game and if it is a composite number, then Sheena wins the game.** **[3]**

Find the probability of each of them winning the game and state who has a higher probability of winning the game. Show your work.

Teacher should award marks if students have done the following:

Q.No	Correct Answers
1	3
2	2
3	4
4	4
5	3
6	1
7	2
8	4
9	2
10	1

Q.No	Teacher should award marks if students have done the following:	Marks
11	Finds the probability of Minal landing on the Goan restaurant as $\frac{5}{36}$.	1
	Finds the probability of Shreya landing on the Goan restaurant as $\frac{4}{36}$. Hence, concludes that Minal has a higher chance of landing on the Goan restaurant.	1
12	(i) Calculates the probability as $\frac{29}{780}$ or any equivalent number.	1
	(ii) Explains that the statement is true and gives the justification that the probability that a random person have had a heart attack is $\frac{104}{780}$ which is approximately $\frac{1}{8}$ or 12.5%.	1
13	Finds the area of the square dartboard as $4^2 = 16$ sq units.	0.5
	Finds the area of the outer circular ring with radius 2 units as $\pi(2)^2 = 4\pi$ sq units.	0.5
	Finds the probability that a dart thrown at random lands on the shaded area as $\frac{16-4\pi}{16} = \frac{4-\pi}{4}$.	1
14	Identifies the total number of outcomes as 16 and the probable outcomes to win the game as 6.	1
	Finds the probability of Pratik winning the game as $\frac{6}{16}$ or $\frac{3}{8}$.	1
15	Writes all the outcomes as {(HHH), (HHT), (HTH), (THH), (TTH), (THT), (HTT), (TTT)} and identifies the total number of outcomes as 8.	0.5
	Writes the favourable outcomes for Vidhi as {(HHH), (HHT), (THH)} and identifies the favourable outcomes for Vidhi to win as 3.	0.5
	Finds the probability of Vidhi flipping two heads in a row as $\frac{3}{8}$.	0.5
	Writes the favourable outcomes for Unnati as {(HHT), (HTH), (THT), (HTT)} and identifies the favourable outcomes for Unnati to win as 4.	0.5
	Finds the probability of Unnati flipping a head immediately followed by a tail as $\frac{4}{8}$.	0.5

Q.No	Teacher should award marks if students have done the following:	Marks
	Uses steps 3 and 5 to conclude that if they flipped their coins exactly three times, Unnati is more likely to drive the car that day.	0.5
16	Writes that Abhishek's statement is not correct.	0.5
	Justifies the answer. For example, writes that the probability of randomly picking a black ball from basket 1 is $\frac{4}{7}$ and the probability of randomly picking a black ball from basket 2 is $\frac{8}{14}$. Hence, the probability of picking a black ball from basket 1 is same as basket 2.	1.5
17	Writes that Farid's statement is false.	0.5
	Gives a counterexample. For example, if a bag has 1 pink ball, 2 green balls and 2 yellow balls, the probability of randomly picking a pink ball is $\frac{1}{5}$.	0.5
18	Writes no and gives a reason. For example, when tossing a fair coin, the probability of getting a head is equal to the probability of getting a tail.	1
19	Finds the probability of opening room 1 as $\frac{3}{6}$ or $\frac{1}{2}$.	0.5
	Finds the probability of opening room 2 as $\frac{4}{16}$ or $\frac{1}{4}$.	1
	Finds the probability of opening room 3 as $\frac{4}{8}$ or $\frac{1}{2}$.	0.5
	Compares the above probabilities and concludes that Zaira kept her treasure in room 2.	1
20	Writes all the outcomes as {(RR), (RB), (YR), (YB)} and the probable outcome to get a prize as {(RR), (RB), (YR)} .	0.5
	Uses the above step to find the probability of Rohit getting a prize as $\frac{3}{4}$.	0.5
21	i) Selects the point representing the probability of spinner 1 landing on a black region as point P.	0.5

Q.No	Teacher should award marks if students have done the following:	Marks
	ii) Selects the point representing the probability of spinner 2 landing on a white region as point S.	0.5
22	Finds the number of favourable outcomes as 1 and the number of total outcomes as 78.	0.5
	Finds the probability that the picked meal has a surprise gift as $\frac{1}{78}$.	0.5
23	i) Identifies total number of outcomes as 4 + 7 + 2 = 13 and favourable number of outcomes as 2.	0.5
	Finds the probability that the note will be sufficient to pay for the dress as $\frac{2}{13}$. (Award full marks if the probability is found directly without mentioning the above step.)	0.5
	ii) Writes that the probability that Jenin will be able to give exactly Rs 799 to the shopkeeper is 0.	1
24	Writes that the total number of outcomes is 16.	0.5
	Writes that the number of favourable outcomes for Farah to win the game is 6.	0.5
	Finds the probability that Farah wins the game as $\frac{6}{16} = \frac{3}{8}$.	0.5
	Finds the probability that Sheena wins the game as $1 - \frac{3}{8} = \frac{5}{8}$.	1
	Uses steps 3 and 4 to conclude that Sheena has a higher probability of winning the game.	0.5