CHAPTER-13

PROBABILITY

01 MARK TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	Three friends A, B and C are playing a dice game. The numbers rolled up by them in their first three chances were noted and given by A = {1,5}, B= {2,4,5} and C= {1, 2, 5} as A reaches the cell 'SKIP YOUR NEXT TURN' in second throw. Based on the above information, answer the following question: Find P(A|B)	1
2.	In a play zone, Aastha is playing crane game. It has 12 blue balls, 8 red balls, 10 yellow balls and 5 green balls. If Aastha draws two balls one after the other without replacement, then answer the following question: What is the probability that the first ball is blue and the second ball is green?	1
3.	Ajay enrolled himself in an online practice test portal provided by his school for better practice. Out of 5 questions in a set-I, he was able to solve 4 of them and got stuck in the one which is as shown below. If A and B are independent events, P(A)=0.6 and P(B)=0.8, then find P(AUB)	1
4.	On a holiday, a father gave a puzzle from a newspaper to his son Ravi and his daughter Priya. The probability of solving this specific puzzle independently by Ravi and Priya are $\frac{1}{4}$ and $\frac{1}{5}$respectively. Based on the above information, answer the following question: Find the probability that puzzle is solved by Ravi but not by Priya.	1
5.	To teach the application of probability a maths teacher arranged a surprise game for 5 of his students namely Archit, Aadya, Mivaan, Deepak and Vrinda. He took a bowl containing tickets numbered 1 to 50 and told the students go one by one and draw two tickets simultaneously from the bowl and replace it after noting the numbers. Based on the above information, answer the following question. Teacher ask Vrinda, what is the probability that both tickets drawn by Archit shows even number? (a) 1/50 (b) 12/49 (c) 13/49 (d) 15/49	1
6.	Probability that Raman speaks truth is $\frac{3}{5}$. A die is rolled. Raman reports that an even number appears. The probability that there is an even number.  (a) $\frac{3}{5}$ (b) $\frac{2}{5}$ (c) $\frac{1}{5}$ (d) None of these	1
7.	Ramesh is playing with a dice, and he supposed that event A is getting a number greater than 6 and event B is getting a odd prime number. Further he finds that $P(A) = 0$ and $P(B) = \frac{1}{3}$, then $P\left(\frac{B}{A}\right)$ *is*  (a) 0 (b) $\frac{1}{3}$ (c) 1 (d) not defined	1

8.	A rocket has 8 engines out of which 3 are not working. If the two engines are selected without replacement and tested, the probability that both are not working. (a) 33/56 (b) 9/64 (c) 1/14 (d) 3/28 	1
9.	In a boy's college, 30% students play Cricket, 25% play Football and 10% students play both Cricket and Football. One student is selected at random. The probability that he likes Cricket if he also like Football is (a) 1/10 (b) 2/5 (c) 9/20 (d) 1/3 	1
10.	Archaeological Survey of India has found coins at one of the sites of Indus Valley civilization. While studying these coins for historical evidence faces of the one of coin is labelled as head and tail. These coins are flipped in the air and result is noted. If events A and B are defined as A= two heads come, B= last should be head. Then, A and B are (a) Independent (b) Not independent (c) mutually exclusive (d) none of these 	1
11.	A box contains 6 pens and 10 pencils. Half of the pens and half of the pencils are of blue colour. If one of the items is chosen at random, the probability that it is of blue colour or is a pen is (a) 3/16 (b) 5/16 (c) 11/16 (d) 14/16 	1
12.	Suppose that two cards are drawn at random from a deck of cards. Let X be the number of kings obtained. Then the expected value of E is (a) 37/221 (b) 5/13 (c) 1/13 (d) 2/13 	1
13.	A bag contains 10 good and 6 bad mangoes. One of the mangoes is selected. The probability that it is either good or bad  (a) $\frac{64}{64}$ (b) $\frac{49}{64}$ (c) $\frac{40}{64}$	1

	(d) $\frac{24}{64}$	
14.	A: f A and B two events, then $P(A \cap B) = P(A)P\left(\frac{B}{A}\right)$. R: Two events are said to be exhaustive if probability of the one of the events is zero. (a) A is true, R is true and R is correct explanation for A. (b) A is true, R is true and R is not correct explanation for A. (c) A is true and R is false (d) A is false and R is true.	1
15.	A: The probability of getting either a king or an ace from a pack of 52 playing cards is $\frac{2}{13}$. R: For any two events A and $B, P(A \cup B) = P(A) + P(B) - P(A \cap B)$. (a) A is true, R is true and R is correct explanation for A. (b) A is true, R is true and R is not correct explanation for A. (c) A is true and R is false (d) A is false and R is true.	1
16.	Two dice are thrown once. If it is known that the sum of the numbers on the dice was less than 6 the probability of getting a sum 3 is (a) 1/18 (b) 5/18 (c) 1/5 (d) 2/5	1
17.	In a box, there are 8 orange, 7 white, and 6 blue balls. If a ball is picked up randomly, what is the probability that it is neither orange nor blue? (a) 1/3 (b) 2/3 (c) 1/21 (d) 5/21	1
18.	An urn contains 9 balls, two of which are red, three blue and four black. Three balls are drawn at random. The probability that they are of same colour is (a) 5/84 (b) 3/9 (c) 3/7 (d) 7/17	1
19.	A box contains 15 oranges out of which 12 are good. It is inspected by examining three randomly selected oranges drawn without replacement. If all the three oranges are good, the box is approved for sale. Then the probability that the box will be approved for sale is ---- (a) $\frac{3}{455}$ (b) $\frac{12}{455}$ (c) $\frac{44}{91}$ (d) $\frac{22}{91}$	1
20.	One card is drawn from a well shuffled pack of 52 cards. If E is the event "the card drawn is a king or a queen" and F is the event "the card drawn is an ace or a queen," then P(E/F) is---- (a) $\frac{3}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{13}$ (d) $\frac{4}{13}$	1
21.	A black and a red die are rolled. Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in 5. (a) $\frac{4}{7}$ (b) $\frac{1}{5}$ (c) $\frac{1}{3}$ (d) none of these	1
22.	A husband and his wife appear for an interview for two posts. The probability of husband's selection is 1/7 and that of wife's selection is 1/5. What is the probability that only one of them is selected? (a) $\frac{2}{7}$ (b) 0 (c) $\frac{2}{3}$ (d) $\frac{1}{4}$	1
23.	A and B throw a die alternately till one of them gets 6 and wins the game. If A starts the game. Find their respective probability of winning if A starts the game. (a) $\frac{1}{2}, \frac{1}{5}$ (b) $\frac{6}{11}, \frac{5}{11}$ (c) $\frac{11}{30}, \frac{19}{30}$ (d) $\frac{11}{26}, \frac{15}{26}$	1

24.	A die is tossed thrice .find the probability of getting an odd number at least once. (a) $\frac{1}{10}$ (b) $\frac{1}{5}$ (c) $\frac{1}{30}$ (d) none of these	1
25.	Three coins are tossed once. Find the probability of getting at most two heads (a) $\frac{3}{8}$ (b) $\frac{1}{8}$ (c) $\frac{7}{8}$ (d) $\frac{5}{8}$	1

ANSWERS:

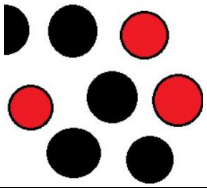
Q. NO	ANSWER	MARKS
1.	P(A)=$\frac{2}{6}$ P(B)=$\frac{3}{6}$ P(C)=$\frac{3}{6}$ $P(A \cap B)=\frac{1}{6}$ P(A|B)= $\frac{P(A\cap B)}{P(B)}$=$\frac{1}{3}$	1
2.	$P(G \cap B)=P(B).P(G\|B)=\frac{12}{35}\times\frac{5}{34}=\frac{6}{119}$	1
3.	$P(A \cap B)=P(A)P(B)=0.48$ $P(A \cup B)=P(A)+P(B)-P(A \cap B)=0.92$	1
4.	Let E_1 be the event that Ravi solved the puzzle and E_2 be the event that Priya solved the puzzle. Then, P(E_1)=1/4 and P(E_2)=1/5 P(puzzle is solved by Ravi but not by Priya)=P(E_1)P(E_2^c)=$(\frac{1}{4})\left(1-\frac{1}{5}\right)=\frac{1}{5}$	1
5.	(b) 12/49	1
6.	(a)	
7.	(d)	
8.	(d)	
9.	(b)	
10.	(b)	
11.	(c)	
12.	(d)	
13.	(a)	
14.	(c)	
15.	(a)	
16.	(c)	1
17.	(a)	1
18.	(a)	1
19.	(c)	1
20.	(b)	1
21.	(c)	1
22.	(a)	1
23.	(b)	1
24.	(c)	1
25.	(c)	1

CHAPTER-13

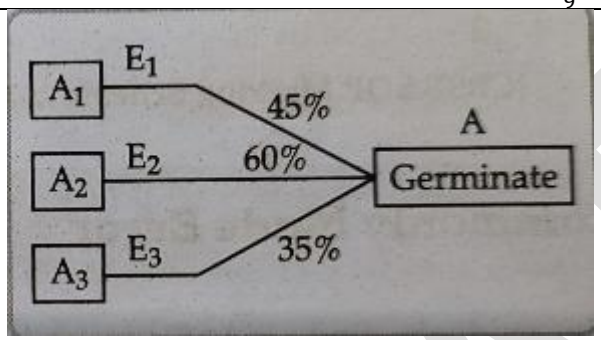
PROBABILITY

02 MARKS TYPE QUESTIONS

<table>
<tr><th>Q. NO</th><th>QUESTION</th><th>MARK</th></tr>
<tr><td>1.</td><td>In pre-board examination of class XII, commerce stream with Economics and Mathematics of a particular school, 50% of the students failed in Economics, 35% failed in Mathematics and 25% failed in both Economics and Mathematics. A student is selected at random from the class.
Based on the above information, answer the following questions:
(i) What is the probability that the selected student has failed in Economics, if it is known that he has failed in Mathematics?
(ii) What is the probability that the selected student has failed in Mathematics, if it is known that he has failed in Economics?</td><td>2</td></tr>
<tr><td>2.</td><td>Box I contains 1 white, 3 black and 2 red balls. Box II contains 2 white, 1 black and 3 red balls. Box III contains3 white, 2 black and 1 red balls. One box is chosen at random and two balls are drawn with replacement.
If E_1, E_2 and E_3 be the events that the balls drawn from box I, box II and box III respectively and E be the event that balls drawn are one white and one red, then what is the probability of occurrence of event E given that the balls drawn are from box I?</td><td>2</td></tr>
<tr><td>3.</td><td>A shopkeeper sells three types of flower seeds A1, A2, A3. They are sold is the form of a mixture, where the proportions of these seeds are 4:4:2 respectively. The germination rates of the three types of seeds are 45%, 60% and 35% respectively. Calculate the probability that a randomly chosen seed will germinate?
  </td><td>2</td></tr>
<tr><td>4.</td><td>Let a dice has property that the probability of a face with n dots showing up is proportional to n, then find the probability of face showing five dots?</td><td>2</td></tr>
<tr><td>5.</td><td>The probability distribution of a random variable X is given below:
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>P(X)</td><td>k</td><td>k/2</td><td>k/4</td><td>k/8</td></tr>
</table>
Find the value of k.</td><td>2</td></tr>
<tr><td>6.</td><td>A box contains 12 black and 24 white balls. Two balls are drawn from the box one after the other without replacement. What is the probability that both drawn balls are black?
  </td><td>2</td></tr>
<tr><td>7.</td><td>Two cards are drawn successively, without replacement from a pack of 52 well shuffled cards. What is the probability that first card is king, and the second card drawn is an ace?</td><td>2</td></tr>
</table>

		
8.	Bag one contains 3 red and 4 black balls second another Bag II contains 5 red and 6 black balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from second Bag. 	2
9.	A group consists of an equal number of girls and boys. Out of this group 20% of boys and 30% of the girls are unemployed. If a person is selected at random from this group, then find the probability of the selected person being employed. 	2
10.	Abraham speaks truth in 80% cases and Bhavesh speaks truth in 90% cases. In What percentage of cases are they likely to agree with each other in stating the same fact? 	2
11.	If P(A) =0.4, P(B)=0.8 and P(B/A) = 0.6 then find P(A ∪ B).	2
12.	Probability of solving specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively if both are trying to solve the problem independently then find the probability of that (i) The problem is solved (ii) Exactly one of them solves the problem	2
13.	A speaks truth in 80% cases and B speaks truth in 90% cases. In what percentage of cases are they likely to agree with each other in stating the same fact?	2
14.	Assume that each born child is equally likely to be a boy or a girl. If a family has two children, what is the conditional probability that both are girls given that (i) the youngest is a girl? (ii) at least one is a girl?	2
15.	An unbiased coin is tossed 4 times. Find the probability of getting at least one head.	2

ANSWERS:

Q. NO	ANSWER	MARKS
1.	Let,E and M denote the events that student has failed in Economics and Mathematics respectively. $P(E) = \frac{50}{100}$ $P(M) = \frac{35}{100}$ $P(E \cap M) = \frac{25}{100}$ (i) $P(E\|M) = \frac{P(E \cap M)}{P(M)} = \frac{5}{7}$ (ii) $P(M \mid E) = \frac{P(M \cap E)}{P(E)} = \frac{1}{2}$	2
2.	$P(E_1) = P(E_2) = P(E_3) = \frac{1}{3}$ Probability of drawing red and white ball if box I is selected = $P(E\|E_1) = P(red) \times P(white) + P(white) \times P(red) = \frac{1}{9}$	2
3.	 $P(E_1) = \frac{4}{10}$ $P(E_2) = \frac{4}{10}$ $P(E_3) = \frac{2}{10}$ $P\left(\frac{A}{E_1}\right) = \frac{45}{100}$ $P\left(\frac{A}{E_2}\right) = \frac{60}{100}$ $P\left(\frac{A}{E_3}\right) = \frac{35}{100}$ $P(A) = P(E_1)P\left(\frac{A}{E_1}\right) + P(E_2)P\left(\frac{A}{E_2}\right) + P(E_3)P\left(\frac{A}{E_3}\right) = \frac{49}{100}$	2
4.	Let P(n)=Proportional to n where n=1,2,3,4,5,6 ⇒ P(n)=nk P(1)+P(2)+P(3)+P(4)+P(5)+P(6)=1 ⇒k+2k+3k+4k+5k+6k=1 $\Rightarrow k = \frac{1}{21}$ P(5)=5k=$\frac{5}{21}$	2
5.	We know, $\sum p_i = 1$ Or, $k + \frac{k}{2} + \frac{k}{4} + \frac{k}{8} = 1$ Or, $k = \frac{8}{15}$	2
6.	Let E and F denote respectively the events that first and second ball drawn are black. We have to find $P(EF)$. Now $P(E) = \frac{12}{36}$ and $P(F\|E) = \frac{11}{35}$ By multiplication rule of probability, we have $P(E \cap F) = P(E)\,P\left(\frac{F}{E}\right)$ $= \frac{12}{36} \times \frac{11}{35}$	

	$= \frac{11}{105}$	
7.	Let K denote the event that the card drawn is king and A be the event that the card drawn is an ace. Clearly, we have to find P (KA) Now $P(K) = \frac{4}{52}$ and $P(A\|K) = \frac{4}{51}$ By multiplication rule of probability, we have $P(KA) = P(K)\, P\left(\frac{A}{K}\right)$ $= \frac{4}{52} \times \frac{4}{51}$ $= \frac{4}{663}$	
8.	Let E_1 be the event of choosing the first bag I, E_2 the event of choosing the second bag and A be the event of drawing a red ball. Then $P(E_1) = P(E_2) = \frac{1}{2}$ Note that $P\left(\frac{A}{E_1}\right) = \frac{3}{7}$ and $P\left(\frac{A}{E_2}\right) = \frac{5}{11}$ Now the required probability is $P\left(\frac{E_2}{A}\right)$. By using Bayes' theorem, we have By using Bayes' theorem, we have $P\left(\frac{E_2}{A}\right) = \frac{P(E_2)P(\frac{A}{E_2})}{P(E_1)P\left(\frac{A}{E_1}\right) + P(E_2)P(\frac{A}{E_2})}$ $= \frac{\frac{1}{2} \times \frac{5}{11}}{\frac{1}{2} \times \frac{3}{7} + \frac{1}{2} \times \frac{5}{11}}$ $= \frac{35}{58}$	
9.	$P(\text{girls}) = \frac{1}{2}$ $P(\text{boys}) = \frac{1}{2}$ $P\left(\frac{\text{unemployed}}{\text{boys}}\right) = \frac{20}{100} = \frac{2}{10}$ $P\left(\frac{\text{unemployed}}{\text{girls}}\right) = \frac{30}{100} = \frac{3}{10}$ $P(\text{unemployed}) = P(\text{boys})P\left(\frac{\text{unemployed}}{\text{boys}}\right) + P(\text{girls})\, P\left(\frac{\text{unemployed}}{\text{girls}}\right)$ $= \frac{1}{2} \times \frac{2}{10} + \frac{1}{2} \times \frac{3}{10} = \frac{5}{20} = \frac{1}{4}$ Therefore $P(employed) = 1 - \frac{1}{4} = \frac{3}{4}$	

10.	$P(A) = \frac{80}{100} = \frac{4}{5}, P(B) = \frac{90}{100} = \frac{9}{10}$ P(agree)= P(both speaking truth or both speaking lie) $= P(AB \text{ or } \bar{A}\bar{B})$ $= \frac{4}{5} \times \frac{9}{10} + \frac{1}{5} \times \frac{1}{10}$ $= \frac{37}{50} = \frac{74}{100} = 74\%$	
11.	P(B/A) = $\frac{P(A \cap B)}{P(A)}$ P (A ∩ B) = $0.6 \times 0.4 = 0.24$ ∴ P(A ∪ B) = P(A) + P(B) – P (A∩B) = 0.4 + 0.8 − 0.24 = 1.2 – 0.24 = 0.96	1 1
12.	(i) P $(\bar{A})$P(B) + P(A) P $(\bar{B})$ + P(A). P(B) $= \frac{1}{2} \text{ x } \frac{1}{3} + \frac{1}{2} \text{ x } \frac{2}{3} + \frac{1}{2} \text{ x } \frac{1}{3}$ $= \frac{2}{3}$ (ii) P $(\bar{A})$ P(B) + P(A). P$(\bar{B})$ $= \frac{1}{2} \text{ x } \frac{1}{3} + \frac{1}{2} \text{ x } \frac{2}{3}$ $= \frac{1}{2}$	1 1
13.	Given $P(A) = \frac{80}{100} = \frac{4}{5}$ and $P(B) = \frac{90}{100} = \frac{9}{10}$ P(Agree) = P(both speaking truth or both telling lie) = P(AB or $\bar{A}\bar{B}$) = P(A). P(B) or P $(\bar{A})$ P$(\bar{B})$ $= \frac{4}{5} \times \frac{9}{10} + \frac{1}{5} \times \frac{1}{10}$ $= \frac{37}{50} = \frac{74}{100} = 74$ %.	1 1
14.	Sample space S = {BB, BG, GB,GG} (i) Let A and B be two events such that A = Both are girls ={GG} B = The youngest is a girl = {BG, GG} P$(\frac{A}{B}) = \frac{P(A \cap B)}{P(B)} = \frac{\frac{1}{4}}{\frac{2}{4}} = \frac{1}{2}$ (ii) Let C be the event such that C = at least one is a girl ={BG, GB, GG} Now , P$(\frac{A}{C}) = \frac{P(A \cap C}{P(C)} = \frac{\frac{1}{4}}{\frac{3}{4}} = \frac{1}{3}$	 1 1
15.	When an unbiased coin is tossed once, then	

	$P(H) = P(T) = \frac{1}{2}$	1
	Probability of getting at least one head $= 1 - P(\text{ no head})$ $= 1 - P(\text{all tails})$ $= 1 - \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$ $= 1 - \frac{1}{16} = \frac{15}{16}$	1

CHAPTER-13

PROBABILITY

03 MARKS TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	In a bilateral cricket series between India and South Africa, the probability that India wins the first match is 0.6. If India wins any match, then the probability that it wins the next match is 0.4, otherwise the probability is 0.3. Also, it is given that there is no tie in any match.  Based on the above information answer the following questions: (i) What is the probability that India won the second match, if India has already loose the first match? (ii) What is the probability that India losing the third match, if India has already loose the first two matches? (iii) Find the probability that India is loosing the first two matches.	3
2.	A factory has three machines A, B and C to manufacture bolts. Machine A manufacture 30%, machine B manufacture 20% and machine C manufacture 50% of the bolts respectively. Out of their respective outputs 5%, 2% and 4% are defective. A bolt is drawn at random from total production and it is found to be defective.  Based on the above information, answer the following questions: What is the probability that defective bolt drawn is manufactured by machine A?	3
3.	A coin is biased so that the head is three times as likely to occur as tail. If the coin is tossed twice, find the probability distribution of number of tails. Hence find the mean of the number of tails.	3
4.	A bag contains $(2n + 1)$ coins. It is known that $(n - 1)$ of these coins have a head on both sides, whereas the rest of the coins are fair. A coin is picked up at random from the bag and is tossed. If the probability that the toss results in a head is $\frac{31}{42}$, determine the value of n. 	3
5.	The probability that Abraham hits the target is $\frac{1}{3}$ and the probability that Bhavesh hits it, is $\frac{2}{5}$. If both try to hit the target independently, find the probability that target is hit.	3

		
6.	An electric shop has two types of LED bulbs of equal quantity. The probability of an LED bulb lasting more than 6 months given that it is of type 1 is 0.7 and is given that it is of type 2 is 0.4. Then find the probability that on LED bulb chosen uniformly at random lasts more than 6 months. 	3
7.	A die marked 1,2,3 in red and 4,5,6 in green is tossed. Let A be the event "numbers even" and B be the event" numbers are marked red". Find whether the event A and B are independent or not.	3
8.	Suppose that 5 men out of 100 and 25 women out of 1000 are good orators assuming that there are equal nos. of men and women, find the probability of choosing a good orator.	3
9.	Suppose a girl throws a die. If she gets a 5 or 6, she tosses a coin 3 times and notes the number of heads. If she gets 1, 2,3 or 4 she tosses a coin once and notes whether a head or tail is obtained. If she obtained exactly one head, what is the probability that she threw 1, 2, 3 or 4 with the die?	3

ANSWERS:

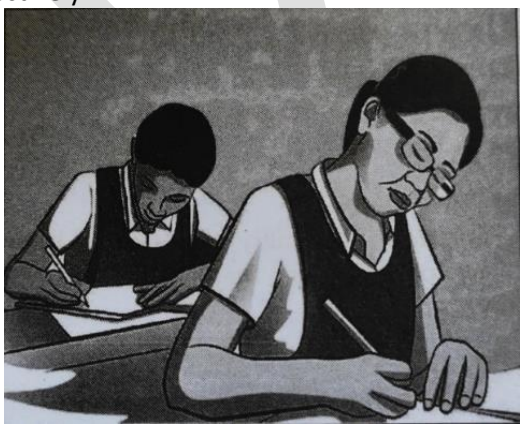
<table>
<tr><th>Q. NO</th><th>ANSWER</th><th>MARKS</th></tr>
<tr><td>1.</td><td>(i)It is given that if India loose any match, then the probability that it wins the next match is 0.3.
Required probability= 0.3
(ii) It is given that if India loose any match, then the probability that it wins the next match is 0.3.
Required probability= 1-0.3=0.7
(iii)Required probability= P(India loosing first match).P(India loosing second match when India has already lost first match) = 0.4×0.7 = 0.28</td><td>3</td></tr>
<tr><td>2.</td><td>Let E_1, E_2, E_3 be the events of drawing a bolt produced by machine A,B and C.
Then $P(E_1) = \frac{3}{10}, \quad P(E_2) = \frac{1}{5}, \quad P(E_3) = \frac{1}{2}$
Let, E be the event of drawing a defective bolt.
Probability that defective bolt drawn is manufactured by machine A =
$P(E_1|E) = \frac{P(E|E_1) \times P(E_1)}{P(E_1)P\left(\frac{E}{E_1}\right) + P(E_2)P\left(\frac{E}{E_2}\right) + P(E_3)P\left(\frac{E}{E_3}\right)} = \frac{\frac{1}{20} \times \frac{3}{10}}{\frac{3}{10} \times \frac{1}{20} + \frac{1}{5} \times \frac{1}{50} + \frac{1}{2} \times \frac{1}{25}}$
$= \frac{5}{13}$</td><td>3</td></tr>
<tr><td>3.</td><td>$P(Head) = \frac{3}{4}, P(Tail) = \frac{1}{4}$
Let, X = Number of tails.
Probability distribution is given by
<table><tr><td>X</td><td>0</td><td>1</td><td>2</td></tr><tr><td>P(X)</td><td>$\frac{9}{16}$</td><td>$\frac{6}{16}$</td><td>$\frac{1}{16}$</td></tr></table>Mean = ∑ X.P(X) = $\frac{6}{16} + \frac{2}{16} = \frac{1}{2}$</td><td>3</td></tr>
<tr><td>4.</td><td>No of coins with head on both sides $= (n-1)$
No of fair coins $= (n+2)$
Let E_1 = picking a coin with head on both sides and E_2 =Picking a fair coin.
A =Getting a head on tossing the coin
Now by total probability theorem
$P(A) = P(E_1)P\left(\frac{A}{E_1}\right) + P(E_2)P\left(\frac{A}{E_2}\right)$
$= \frac{n-1}{2n+1} \times 1 + \frac{(n+2)}{2n+1} \times \frac{1}{2} = \frac{3n}{2(2n+1)}$
ATQ
$\frac{3n}{2(2n+1)} = \frac{31}{42} \Rightarrow n = 31$</td><td></td></tr>
<tr><td>5.</td><td>$P(A) = P$(A hits target)$= \frac{1}{3}$
$P(B) = P$(B hits target)$= \frac{2}{5}$
Now, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$= \frac{1}{3} + \frac{2}{5} - \frac{1}{3} \times \frac{1}{5} = \frac{3}{5}$</td><td></td></tr>
<tr><td>6.</td><td>$P(\text{LED of type 1}) = \frac{1}{2} = 0.5$</td><td></td></tr>
</table>

	$P(\text{LED of type 2}) = \frac{1}{2} = 0.5$ Also note that $P\left(\frac{\text{LED lasting more than 6 months}}{\text{LED of type 1}}\right) = P\left(\frac{A}{T_1}\right) = 0.7$ $P\left(\frac{\text{LED lasting more than 6 months}}{\text{LED of type 2}}\right) = P\left(\frac{A}{T_2}\right) = 0.4$ $P(H) = P(T_1)P\left(\frac{H}{T_1}\right) + P(T_2)P\left(\frac{H}{T_2}\right)$ $= 0.5 \times 0.7 + 0.5 \times 0.4$ $= 0.35 + 0.22$ $= 0.55$	
7.	$A = \{2,4,6\}$ $B = \{1,2,3\}$ $P(A) = \frac{3}{6} = \frac{1}{2}$ $P(B) = \frac{1}{2}$ $P(A) \times P(B) = \frac{1}{4}$ $n(A \cap B) = \{2\}$ $P(A \cap B) = \frac{1}{6}$ $\therefore P(A \cap B) \neq P(A) \times P(B)$. $\therefore$ Given two events are not independent	1 1 1
8.	Let, A = good orator E_1 =no. of men good orator E_2 = no. of women good orator $\therefore P(E_1) = P(E_2) = \frac{1}{2}$, $P\left(\frac{A}{E_1}\right) = \frac{5}{100}$, $P\left(\frac{A}{E_2}\right) = \frac{25}{1000}$ $\therefore P\left(\frac{E_1}{A}\right) = \frac{P(E_1) \times P\left(\frac{A}{E_1}\right)}{P(E_1) \times P\left(\frac{A}{E_1}\right) + P(E_2) \times P\left(\frac{A}{E_2}\right)} = \frac{2}{3}$	1 1 1
9.	Let E_1 : the die shows 1, 2, 3 or 4 E_2 : the die shows 5 or 6 and A: the girl obtained exactly one head $P(E_1) = \frac{4}{6} = \frac{2}{3}$ and $P(E_2) = \frac{2}{6} = \frac{1}{3}$ $P\left(\frac{A}{E_1}\right) = \frac{1}{2}$ $P\left(\frac{A}{E_2}\right) = \frac{3}{8}$ From Baye's theorem $\therefore P\left(\frac{E_1}{A}\right) = \frac{P(E_1) \times P\left(\frac{A}{E_1}\right)}{P(E_1) \times P\left(\frac{A}{E_1}\right) + P(E_2) \times P\left(\frac{A}{E_2}\right)} = \frac{8}{11}$	1 1 1

CHAPTER-13

PROBABILITY

04 MARKS TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	Read the following text and answer the following question on the basis of the same: A coach is training 3 players. He observes that the player A can hit a target 4 times in 5 shots, player B can hit 3 times in 4 shots and the player C can hit 2 times in 3 shots.  (i) Let the target is hit by A,B,C. Then the probability that A, B and C all will hit is (a) $\frac{4}{5}$ (b) $\frac{3}{5}$ (c) $\frac{2}{5}$ (d) $\frac{1}{5}$ (ii) What is the probability that B,C will hit and A will lose? (a) $\frac{1}{10}$ (b) $\frac{3}{10}$ (c) $\frac{7}{10}$ (d) $\frac{4}{10}$ (iii) What is the probability that any two of A,B and C will hit? (a) $\frac{1}{30}$ (b) $\frac{11}{30}$ (c) $\frac{17}{30}$ (d) $\frac{13}{30}$ (iv) What is the probability that none of them will hit the target? (a) $\frac{1}{30}$ (b) $\frac{1}{60}$ (c) $\frac{1}{15}$ (d) $\frac{2}{15}$	4
2.	Read the following text and answer the following questions on the basis of the same. In answering a question on a multiple choice test for class XII, a student either knows the answer or guesses. Let $\frac{3}{5}$ be the probability that he knows the answer and $\frac{2}{5}$ be the probability that he guesses. Assume that a student who guesses at the answer will be correct with probability $\frac{1}{3}$. Let, E_1, E_2, E be the events that the student knows the answer, guesses the answer and answers correctly respectively.  (i) Value of $P(E\|E_1)$ is (a) $\frac{1}{3}$ (b) 1 (c) $\frac{2}{3}$ (d) $\frac{4}{5}$ (ii) $\sum_{k=1}^{k=2} P(E_k)P(E\|E_k)$ equals	4

	(a) $\frac{11}{15}$ (b) $\frac{4}{15}$ (c) $\frac{1}{5}$ (d) 1 (iii) Value of $\sum_{k=1}^{k=2} P(E_k)$ is (a) $\frac{1}{3}$ (b) $\frac{1}{5}$ (c) 1 (d) $\frac{3}{5}$ (iv) What is the probability that the student knows the answer given that he answered it correctly? (a) $\frac{2}{11}$ (b) $\frac{5}{3}$ (c) $\frac{9}{11}$ (d) $\frac{13}{3}$	
3.	Read the following passage and answer the questions given below:  The reliability of a COVID PCR test is specified as follows: Of people having COVID, 90% of the test detects the disease but 10% goes undetected. Of people free of COVID, 99% of the test is judged COVID negative but 1% are diagnosed as showing COVID positive. From a large population of which only 0.1% have COVID, one person is selected at random, given the COVID PCR test, and the pathologists reports him/her as COVID positive. (a) What is the probability of the 'person to be tested as COVID positive' given that 'he is actually having COVID'? (b) What is the probability of the 'person to be tested as COVID positive' given that 'he is actually not having COVID'? (c) What is the probability that the person is actually not having COVID'?	4
4.	Read the following passage and answer the questions given below:  There are two antiaircraft guns, named A and B. The probabilities that the shell fired from them hitting an airplane are 0.3 and 0.2 respectively. Both of them fired one shell at an airplane at the same time. (a) What is the probability that the shells fired from, exactly one of them hit the plane? (b) If it is known that the shell fired from exactly one of them hit the plane, then what is the probability that it was fired from B?	4
5.	Anand, Samanyu and Shah of shortcut classes were given a problem in mathematics whose respective probability of solving it are $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$. They were asked to solve it independently.	

Using the information given above, answer the following :

(i) The probability that Anand alone solves it is

(A) $\frac{1}{4}$ (B) $\frac{3}{4}$ (C) $\frac{11}{24}$ (D) $\frac{17}{24}$

(ii) The probability that the problem is solved is

(A) $\frac{1}{4}$ (B) $\frac{3}{4}$ (C) $\frac{17}{24}$ (D) $\frac{11}{24}$

(iii)The probability that exactly one of them solves the problem is

(A) $\frac{1}{4}$ (B) $\frac{3}{4}$ (C) $\frac{17}{24}$ (D) $\frac{11}{24}$

(iv) The probability that exactly two of them solves the problem is

(A) $\frac{1}{4}$ (B) $\frac{3}{4}$ (C) $\frac{17}{24}$ (D) $\frac{11}{24}$

.

6. In an office three employees Aman, Aryan and Biswajit process incoming copies of a certain form. Aman processes 50% of the forms, Aryan processes 20% and Biswajit the remaining 30% of the forms. Aman has an error rate of 0.06, Aryan has an error rate of 0.04 and Biswajit has an error rate of 0.03.

Based on the above information answer the following:

(i) The conditional probability that an error is committed in processing given that Aryan processed the form is:

(A) 0.0210
(B) 0.04
(C) 0.47
(D) 0.06

(ii) The probability that Aryan processed the form and committed an error is:

(A) 0.005
(B) 0.006
(C) 0.008
(D) 0.68

	(iii) The total probability of committing an error in processing the form is: (A) 0 (B) 0.047 (C) 0.234 (D) 1 (iv) The manager of the company wants to do a quality check. During inspection he selects a form at random from the days output of processed forms. If the form selected at random has an error, the probability that the form is not processed by Aman is: (A) 1 (B) $\frac{30}{47}$ (C) $\frac{20}{47}$ (D) $\frac{17}{47}$	

ANSWERS:

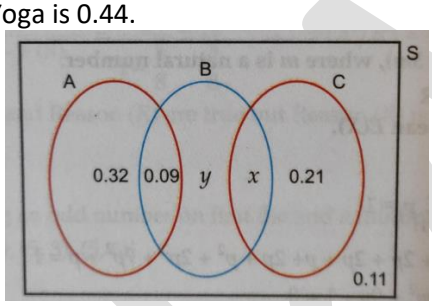
Q. NO	ANSWER	MARKS
1.	(i) C (ii) a (iii) d (iv) b	4
2.	(i) b (ii) a (iii) c (iv) c	4
3.	E= person selected has COVID F=person selected hasn't COVID G= test is judged COVID positive (a) $P\left(\frac{G}{E}\right) = \frac{90}{100} = 0.9$ (b) $P\left(\frac{G}{F}\right) = \frac{1}{100} = 0.01$ (c) Required probability = $1-0.001 = 0.999$	
4.	E = Gun A hits the plane, F = Gun B hits the plane $P(E) = 0.3$ and $P(F) = 0.2$ (a) Let G be the event that exactly one of two shells fired from guns A and B hits the plane. Then, $P(G) = P(E) + P(F) - 2P(EF)$ $= 0.3 + 0.2 - 2 \times 0.3 \times 0.2 = 0.38$ (b) Required Probability= $P\left(\frac{F}{G}\right) = \frac{PF \cap G)}{P(G)} = \frac{P(F \cap \bar{E})}{P(G)} = \frac{P(F)P(\bar{E})}{P(G)} = \frac{0.2 \times 0.7}{0.38} = \frac{7}{19}$	
5.	(i) (A) $\frac{1}{4}$ (ii) (B) $\frac{3}{4}$ (iii) (D) $\frac{11}{24}$ (iv) (A) $\frac{1}{4}$	1 1 1 1

6.	(i) (B) 0.04 (ii) (C) 0.008 (iii) (B) 0.047 (iv) (D) $\frac{17}{47}$	1 1 1 1

CHAPTER-13

PROBABILITY

05 MARKS TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	Read the following passage and answer the following questions: There are different types of Yoga which involve the usage of different poses of Yoga Asanas, Meditation and Pranayam as shown in the figure below:  The Venn diagram below represents the probabilities of three different types of Yoga A, B and C performed by the people of a society. Further, it is given that probability of a member performing type C Yoga is 0.44.  (i) Find the value of x (ii) Find the value of y (iii) Find $P(\frac{C}{B})$ (iv) Find the probability that a randomly selected person of the society does Yoga of type A or B but not C.	5
2.	Read the following text and answer the questions: For an audition of a reality singing competition, interested candidates were asked to apply under one of the two musical genres-folk or classical and under one of the two age categories-below 18 or 18 and above. The following information is known about the 2000 application received: • 960 of the total applications were the folk genre. • 192 of the folk applications were for the below 18 category. • 104 of the classical applications were for the 18 and above category. (i)What is the probability that an application selected at random is for the 18 and above category provided it is under the classical genre? (ii)An application selected at random is found to be under the below 18 category. Find the probability that it is under the folk genre.	5
3.	Ramesh is going to play a game of chess against one of four opponents in an inter school sports competition. Each opponent is equally likely to be paired against him. The table below	5

<table>
<tr><td></td><td>shows the chances of Ramesh losing, where paired against each opponent.
<table>
<tr><td>Opponent</td><td>Chance of losing</td></tr>
<tr><td>Opponent 1</td><td>12%</td></tr>
<tr><td>Opponent 2</td><td>60%</td></tr>
<tr><td>Opponent 3</td><td>x%</td></tr>
<tr><td>Opponent4</td><td>84%</td></tr>
</table>
If the probability that Ramesh loses the game that day is $\frac{1}{2}$, find the probability for Ramesh to be losing when paired against opponent 3.</td><td></td></tr>
<tr><td>4.</td><td>In a factory, machine A produces 30% of total output, machine B produces 25% and the machine C produces the remaining output. The defective items produced by machines A, B and C are 1%, 1.2%, 2% respectively. An item is picked at random from a day's output and found to be defective. Find the probability that it was produced by machine B?
 </td><td>5</td></tr>
<tr><td>5.</td><td>Probability that A speaks truth is $\frac{4}{5}$. A coin is tossed, A reports the head appears. What is the probability that actually it was head?</td><td>5</td></tr>
<tr><td>6.</td><td>A bag I contains 5 red and 4 white balls and a bag II
contains 3 red and 3 white balls. Two balls are transferred from the bag I to the bag II and then one ball is drawn from the bag II. If the ball drawn from the bag II is red, then find the probability that one red and one white ball are transferred from the bag I to the bag II.</td><td>5</td></tr>
</table>

ANSWERS:

<table>
<tr><th>Q. NO</th><th>ANSWER</th><th>MARKS</th></tr>
<tr><td>1.</td><td>(i) Given that probability of a member performing type C yoga is 0.44
$x + 0.21 = 0.44$
$x = 0.23$
(ii) $0.32 + 0.09 + y + x + 0.21 = 1 - 0.11$
$y = 0.04$
(iii) $P(C|B) = \frac{P(C \cap B)}{P(B)} = \frac{x}{0.09+y+x} = \frac{23}{36}$
(iv) Required probability=$0.32 + 0.09 + y = 0.45$</td><td>5</td></tr>
<tr><td>2.</td><td>According to the given information we construct the following table.
Given total applications=2000
<table>
<tr><td></td><td>Folk Genre</td><td>Classical Genre</td></tr>
<tr><td></td><td>960 (given)</td><td>2000-960=1040</td></tr>
<tr><td>Below 18</td><td>192 (given)</td><td>1040-104=936</td></tr>
<tr><td>18 or above 18</td><td>960-192=768</td><td>104 (given)</td></tr>
</table>
Let, E_1= Event that application for folk genre
E_2 = Event that application for classical genre
A = Event that application for below 18
B = Event that application for 18 or above 18
$P(E_2) = \frac{1040}{2000} \quad and \quad P(B \cap E_2) = \frac{104}{2000}$
(i)Required probability = $\frac{P(B \cap E_2)}{P(E_2)} = \frac{1}{10}$
(ii) Required probability = $P\left(\frac{folk}{below\ 18}\right) = P\left(\frac{E_1}{A}\right) = \frac{P(E_1 \cap A)}{P(A)}$
$P(E_1 \cap A) = \frac{192}{2000}$ and $P(A) = \frac{192+936}{2000} = \frac{1128}{2000}$
Required probability = $\frac{192}{1128} = \frac{8}{47}$</td><td>5</td></tr>
<tr><td>3.</td><td>Note that
$P(E_1) = P(E_2) = P(E_3) = P(E_4) = \frac{1}{4}$
Given $P(A) = \frac{1}{2}$
$P\left(\frac{A}{E_1}\right) = 12\% = \frac{12}{100}$
$P\left(\frac{A}{E_2}\right) = 60\% = \frac{60}{100}$
$P\left(\frac{A}{E_3}\right) = x\% = \frac{x}{100}$
$P\left(\frac{A}{E_4}\right) = 84\% = \frac{84}{100}$
Using total probability theorem, we have
$P(A) = P(E_1)P\left(\frac{A}{E_1}\right) + P(E_2)P\left(\frac{A}{E_2}\right) + P(E_3)P\left(\frac{A}{E_3}\right) + P(E_4)P\left(\frac{A}{E_4}\right)$
$\Rightarrow \frac{1}{2} = \frac{1}{4} \times \frac{12}{100} + \frac{1}{4} \times \frac{60}{100} + \frac{1}{4} \times \frac{x}{100} + \frac{1}{4} \times \frac{84}{100}$
$\Rightarrow x = 44$</td><td></td></tr>
</table>

	$P\left(\frac{A}{E_3}\right) = 44\%$	
4.	Consider the following events E_1 = item picked is produced by machine A E_2 = item picked is produced by machine B E_3 = item picked is produced by machine C A = producing a defective output Given, $P(E_1) = 30\% = \frac{30}{100} = 0.3$ $P(E_2) = 25\% = \frac{25}{100} = 0.25$ $P(E_3) = 45\% = \frac{45}{100} = 0.45$ And $P\left(\frac{A}{E_1}\right) = 1\% = \frac{1}{100} = 0.01$ $P\left(\frac{A}{E_2}\right) = 1.2\% = \frac{1.2}{100} = 0.12$ $P\left(\frac{A}{E_3}\right) = 2\% = \frac{2}{100} = 0.02$ Required Probability is $P\left(\frac{E_2}{A}\right)$ $P\left(\frac{E_2}{A}\right) = \frac{P(E_2)P\left(\frac{A}{E_2}\right)}{P(E_1)P\left(\frac{A}{E_1}\right) + P(E_2)P\left(\frac{A}{E_2}\right) + P(E_3)P\left(\frac{A}{E_3}\right)}$ $= \frac{0.25 \times 0.012}{0.3 \times 0.01 + 0.25 \times 0.012 + 0.45 \times 0.02} = \frac{300}{1500}$ $= \frac{1}{5}$	
5.	E_1: A speaks truth E_2: A speaks false Let X be the event that a head appears. P $(E_1) = \frac{4}{5}$ P $(E_2$:) = 1− P$(E_1) = 1 - \frac{4}{5} = \frac{1}{5}$ If a coin is tossed, then it may result in either head (H) or tail (T). The probability of getting a head is $\frac{1}{2}$ whether A speaks truth or not. P (X/E_1) = P$(X/E_2) = \frac{1}{2}$ The probability that there is actually a head is given by P $(E_1|X)$. $P\left(\frac{E_1}{X}\right) = \frac{P(E_1) \times P\left(\frac{X}{E1}\right)}{P(E_1) \times P\left(\frac{X}{E1}\right) + P(E_2) \times P\left(\frac{X}{E_2}\right)}$ $= \frac{\frac{4}{5} \times \frac{1}{2}}{\frac{4}{5} \times \frac{1}{2} + \frac{1}{5} \times \frac{1}{2}}$	1 1 1 1

	$= \frac{4}{5}$	1
6.	$Let\ E_1, E_2, E_3$ and A are event such that $E_1 =$ Both transferred balls from bag I to bag II are red $E_2 =$ Both transferred balls from bag I to bag II are white $E_3 =$ Out of two transferred balls one is red and other is white $A =$ Drawing a red ball from bag II	
	$\mathrm{P}(E_1) = \frac{5C_2}{9C_2} = \frac{5 \times 4}{9 \times 8} = \frac{20}{72} = \frac{5}{18}$	$\frac{1}{2}$
	$\mathrm{P}(E_2) = \frac{4C_2}{9C_2} = \frac{4 \times 3}{9 \times 8} = \frac{12}{72} = \frac{3}{18}$	$\frac{1}{2}$
	$\mathrm{P}(E_3) = \frac{5C_1 \times 4C_1}{9C_2} = \frac{5 \times 4 \times 2}{9 \times 8} = \frac{40}{72} = \frac{10}{18}$	$\frac{1}{2}$
	$\mathrm{P}\left(\frac{A}{E_1}\right) = \frac{5}{8}, \mathrm{P}\left(\frac{A}{E_2}\right) = \frac{3}{8}, \mathrm{P}\left(\frac{A}{E_3}\right) = \frac{4}{8}$	1
	$\mathrm{P}\left(\frac{\mathrm{E}_3}{\mathrm{A}}\right) = \frac{\mathrm{P}(\mathrm{E}_3) \times \mathrm{P}\left(\frac{A}{E_3}\right)}{\mathrm{P}(\mathrm{E}_1) \times \mathrm{P}\left(\frac{\mathrm{A}}{\mathrm{E1}}\right) + \mathrm{P}(\mathrm{E}_2) \times \mathrm{P}\left(\frac{\mathrm{A}}{\mathrm{E}_2}\right) + \mathrm{P}(\mathrm{E}_3) \times \mathrm{P}\left(\frac{A}{E_3}\right)}$	1
	$= \frac{\frac{10}{18} \times \frac{4}{8}}{\frac{5}{18} \times \frac{5}{8} + \frac{3}{18} \times \frac{3}{8} + \frac{10}{18} \times \frac{4}{8}} = \frac{20}{37}$	$1\frac{1}{2}$

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