Concepts and important formulae on probability

Key concept:

***conditional probability**

***properties of conditional probability**

***Multiplication Theorem on Probablity**

***independent events**

***Theorem of Total Probablity**

***Bayes Theorem**

***Probability Distribution of a random variable**

***Mean, Variance and Standard deviation of a random variable**

***Bernoulli trials and Binomial Distribution**

The conditional probability ;

If E and F are two events associated with the same sample space of a random experiment ,the conditional probability of the event E , given the occurrence of the event F is given by

$$P(E|F) = \frac{\text{Number of elementary events favourable to } E \cap F}{\text{Number of elementary events which are favourable to } F}$$

$$= \frac{n(E \cap F)}{n(F)}$$

Dividing the numerator and the denominator by total number of elementary events of the sample space, we see that P(E|F) can also be written as

$$P(E|F) = \frac{\frac{n(E \cap F)}{n(S)}}{\frac{n(F)}{n(S)}} = \frac{P(E \cap F)}{P(F)} \quad \ldots (1)$$

1) **Properties of Probability :** Let E and F be events of a sample space S of an experiment, then we have (a) $P(\frac{S}{F})=P(\frac{F}{F})=1$ (b) $0 \leq P(E/F) \leq 1$, (c) $P(E^1/F) = 1-P(E/F)$

(d) $P((E \cup F)/G) = P(E/G) + P(F/G) - P((E \cap F)/G)$

2) **Multiplication Theorem on Probability**

$P(E \cap F) = P(E)\ P(F/E)$, $P(E) \neq 0$

$P(E \cap F) = P(F)\ P(E/F)$, $P(E) \neq 0$

3) **If E & F are independent , then**

$P(E \cap F) = P(E)\ P(F)$

$P(E/F) = P(E)$, $P(F) \neq 0$

$P(F/E) = P(F)$, $P(E) \neq 0$

4) THEOREM OF TOTAL PROBABILITY

sthe event E_1 , E_2 ,E_3,……..En has non-zero probability. Let A be any event associated with S, then

$P(A) = P(E_1)\,P(A/E_1) + P(E_2)\,P(A/E_2) + \ldots\ldots + P(E_n)\,P(A/E_n)$

5) BAYE'S THEOREM

If E_1, E_2, …………,En are the events which constitute a partition of S i.e $E_1,E_2,\ldots,E_n$ are pair wise disjoint & $E_1 \cup E_2 \cup \ldots \cup E_n = S$ & A be any event with non-zero probability, then

$$P(E_i/A) = \frac{P(Ei)P(A/Ei)}{\sum_{j=1}^{n} P(Ej)P(A/Ej)}$$

6) A random variable is a real valued fn. whose domain is the sample space of random experiment.

7) The probability distribution of a random variable X is the system of nos.

8)

X :	x_1	x_2	……………..	x_n
P(X) :	p_1	p_2	……………	p_n

Where, $p_i>0$,$\sum_{i=1}^{n} pi = 1$,i =1,2,…….,n

9) Let X be a Random variable whose possible values $x_1,x_2,\ldots,x_n$ occur with probabilities $p_1,p_2,\ldots,p_n$ resp. The mean of X**, denoted byμ** , is the No. $\sum_{i=1}^{n} xipi$.

The mean of Random variable X is also called the **Expectation of X**, denoted by **E(X)**.

10) Let X be a Random Variable whose possible values $x_1,x_2,\ldots,x_n$ occur with probabilities $p(x_1),p(x_2),\ldots,p(x_n)$ resp.
Let μ = E(X) be The mean of X. The variance of X,denoted by Var(X) or σ_x^2 ,is defined as
$\sigma_x^2 = Var(X) = \sum_{i=1}^{n}(xi-\mu)^2\, p(x_i)$ or
$\sigma_x^2 = E(X-\mu)^2$
The non-negative no.
$\boldsymbol{\sigma_x = \sqrt{Var(X)} = \sqrt{\sum_{i=1}^{n}(xi-\mu)^2 p(xi)}}$, is called the **standard deviation** of the Random VarialeX.

11) $Var(X) = E(X^2) - [E(X)]^2$

12) Trials of a random experiment are called **Bernoulli trials**, if they satisfy the following conditions.
i) There should be a finite no. of trials.
ii) The trial should be independent.
iii) Each trial has exactly two outcomes: success or failure

iv) The probability of success remains the same in each trial.
For Binomial distribution B(n,p), $P(X=x) = {}^nC_x q^{n-x} p^x$, x= 0,1,2,……….,n & (q = 1-p
Mean =np, and Varience =npq

Standard deviation $=\sqrt{npq}$

IMPORTANT BOARD QUESTIONS

Q.1 An Insurance Company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers . The probability of an accident involving a scooter, a car and a truck is 0.01, 0 .03 and 0.15 respectively. If a driver meets an accident, what is the chance that the person is a scooter driver? What is importance of insurance in everybody's life.

Q.2. A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn and are found to be both diamonds. Find the probability of the lost card being a diamond. Does it better not to tell any person regarding loss of the card while playing ?

Q.3 A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six. Write at least one drawback of telling lie.

Q.4 A factory has two machines A and B. Past record shows that machine A produced 60% of the items of output and machine B produced 40% of the items. Further, 2% of the items produced by machine A and 1% produced by machine B were defective. All the items are put into one stockpile and then one item is chosen at random from this and is found to be defective. What is the probability that it was produced by machine B?

Q.4. An urn contains 5 red and 5 black balls. A ball is drawn at random, its colour is noted and is returned to the urn. Moreover, 2 additional balls of the colour drawn are put in the urn and then a ball is drawn at random. What is the probability that the second ball is red?

Q.5. A laboratory blood test is 99% effective in detecting a certain disease when it is in fact, present. However, the test also yields a false positive result for 0.5% of the healthy person tested (that is, if a healthy person is tested, then, with probability 0.005, the test will imply he has the disease). If 0.1 percent of the population actually has the disease, what is the probability that a person has the disease given that his test result is positive?

Q.6 On a multiple choice examination with three possible answers (out of which only one is correct) for each of the five questions, What is the probability that a candidate would get four of or more correct answers just by guessing? (2009)

Q.7. Find the probability of throwing at most 2 sixes in 6 throws of a single throw a die.

Q.8 An experiment succeeds thrice as often as it fails. Find the probability that the next five trails, there will be at least 3 successes. (2014)

Q.9 How many times must a fair coin be tossed so that the probability of getting atleast one head is more than 80%? (2015)

10. A random variable has following probability distribution:

X	0	1	2	3	4	5	6	7
P(X)	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

Determine: (i) k (ii) $P(X < 3)$ (iii) $P(X > 6)$ (iv) $P(0 < X < 3)$

Q.11. Two cards are drawn simultaneously (without replacement) from a well- shuffled pack of 52 cards. Find the mean and variance of the number of red cards. (2012)

Q.12.Two numbers are selected at random without replacement from first 6 positive integers,Let X denote the largest of the two numbers obtained. Find the probability distribution of X also find the expectation of X.

ANSWERS

Q.1. Let A be the event that the insured person meets with an accident and E_1, E_2 and E_3 are the events that the person is a scooter, car and truck driver respectively. Then we have to find $P(E_1/A)$.

Total number of insured persons = 2000+4000+6000 = 12000.

$P(E_1) = 2000/12000 = 1/6$; $P(E_2) = 4000/12000 = 1/3$; $P(E_3) = 6000/12000 = ½$

Also $P(A/E_1) = 0.01$; $P(A/E_2) = 0.03$ and $P(A/E_3) = 0.15$ 3marks

Hence by Bye's theorem we have

$$P(E_1/A) = \frac{P(A/E_1)P(E_1)}{P(A/E_1)P(E_1) + P(A/E_2)P(E_2) + P(A/E_3)P(E_3)}$$

$$= \frac{0.01 \times 1/6}{0.01 \times 1/6 + 0.03 \times 1/3 + 0.15 \times 1/2} = 1/52.$$

Q.2 let E_1, E_2, E_3, E_4 and A be the events defined as follows;

E_1=the missing card is a diamond

E_2=the missing card is not diamond

A= two drawn card are of diamond

Now $P(E_1)=13/52= ¼$

$P(E_2) = \frac{3}{4}$

$P(A/E_1)$= probability of drawing of second heart cards when one diamond card is missing

$= \frac{C(12,2)}{C(51,2)} = \frac{12}{51}.\frac{11}{50}$

Similarly $P(A/E_2) = \frac{C(13,2)}{C(51,2)} = \frac{13}{51}.\frac{12}{50}$

$$P\left(\frac{E_1}{A}\right) = \frac{P(E_1).P(\frac{A}{E_1})}{P(E_1).P\left(\frac{A}{E_1}\right) + P(E_2).P(\frac{A}{E_2})}$$

$$= \frac{\frac{1}{4}.\frac{12}{51}.\frac{11}{50}}{\frac{1}{4}.\frac{12}{51}.\frac{11}{50} + \frac{3}{4}.\frac{13}{51}.\frac{12}{50}} = \frac{1.12.11}{1.12.11 + 3.13.12} = \frac{11}{11 + 39} = \frac{11}{50}$$

No, When we are playing any game it should be played honestly.

Q.3

The event that six occurs and S2 be the event that six does not occur.

Then P(S1) = Probability that *six* occurs = $\frac{1}{6}$

P(S2) = Probability that *six* does not occur = $\frac{5}{6}$

P(E|S1) = Probability that the man reports that *six* occurs when *six* has actually occurred on the die

= Probability that the man speaks the truth = $\frac{3}{4}$

P(E|S2) = Probability that the man reports that *six* occurs when *six* has not actually occurred on the die

= Probability that the man does not speak the truth = $1-\frac{3}{4}=\frac{1}{4}$

Thus, by Bayes' theorem, we get

P(S1|E) = Probability that the report of the man that *six* has occurred is

actually a *six*

$$= \frac{P(S_1)P(E|S_1)}{P(S_1)P(E|S_1)+P(S_2)P(E|S_2)}$$

Hence, the required probability is = $\frac{3}{8}$

Value based answer

Q.4 . . E_1= Items from Machine A and E_2 = Items from Machine B

E=Choosing a defective item

$P(E_1)$ =3/5 $P(E_2)$=2/5

$P(E/E_1) = \frac{1}{50}$ $P(E/E_2) = \frac{1}{100}$

$$P(E_2/E) = \frac{P(E/E_2)P(E_2)}{P(E/E_1)P(E_1)+P(E/E_2)P(E_2)}$$ 1mark

$$= \frac{\frac{1}{100}\times\frac{2}{5}}{\frac{2}{5}\times\frac{1}{100}+\frac{3}{5}\times\frac{1}{50}}$$

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

Q.4. The urn contains 5 red and 5 black balls.

Let a red ball be drawn in the first attempt.

∴ P (drawing a red ball) $= \frac{5}{10} = \frac{1}{2}$

If two red balls are added to the urn, then the urn contains 7 red and 5 black balls.

P (drawing a red ball) $= \frac{7}{12}$

Let a black ball be drawn in the first attempt.

∴ P (drawing a black ball in the first attempt) $= \frac{5}{10} = \frac{1}{2}$

If two black balls are added to the urn, then the urn contains 5 red and 7 black balls.

P (drawing a red ball) $= \frac{5}{12}$

Therefore, probability of drawing second ball as red is

$$\frac{1}{2}\times\frac{7}{12}+\frac{1}{2}\times\frac{5}{12} = \frac{1}{2}\left(\frac{7}{12}+\frac{5}{12}\right) = \frac{1}{2}\times 1 = \frac{1}{2}$$

Q.5 Let E_1 and E_2 be the respective events that a person has a disease and a person has no disease.

Since E_1 and E_2 are events complimentary to each other,

∴ $P(E_1) + P(E_2) = 1$

$\Rightarrow P(E_2) = 1 - P(E_1) = 1 - 0.001 = 0.999$

Let A be the event that the blood test result is positive.

$P(E_1) = 0.1\% = \frac{0.1}{100} = 0.001$

$P(A|E_1) = P(\text{result is positive given the person has disease}) = 99\% = 0.99$

$P(A|E_2) = P(\text{result is positive given that the person has no disease}) = 0.5\% = 0.005$

Probability that a person has a disease, given that his test result is positive, is given by

$P(E_1|A)$.

By using Bayes' theorem, we obtain

$$P(E_1|A) = \frac{P(E_1)\cdot P(A|E_1)}{P(E_1)\cdot P(A|E_1) + P(E_2)\cdot P(A|E_2)}$$
$$= \frac{0.001\times 0.99}{0.001\times 0.99 + 0.999\times 0.005}$$
$$= \frac{0.00099}{0.00099 + 0.004995}$$
$$= \frac{0.00099}{0.005985}$$
$$= \frac{990}{5985}$$
$$= \frac{110}{665}$$
$$= \frac{22}{133}$$

Q.6.

No. of questions = $n = 5$

Option given in each question = 3

p = probability of answering correct by guessing= $\frac{1}{3}$

q = probability of answering wrong by guessing = $1 - p = 1 - \frac{1}{3} = \frac{2}{3}$

This problem can be solved by binomial distribution. $P(r) = {}^{n}C_{r}\left(\frac{2}{3}\right)^{n-r}\left(\frac{1}{3}\right)^{r}$

Where r = four or more correct answers = 4 or 5

(i) $P(4) = {}^{5}C_{4}\left(\frac{2}{3}\right)\left(\frac{1}{3}\right)^{4}$ (ii) $P(5) = {}^{5}C_{5}\left(\frac{1}{3}\right)^{5}$

$\therefore P(4) + p(5) = {}^{5}C_{4}\left(\frac{2}{3}\right)\left(\frac{1}{3}\right)^{4} + {}^{5}C_{5}\left(\frac{1}{3}\right)^{5} = \frac{11}{243}$

Q.7 : The repeated throws of a die are Bernoulli trials.

Let X denotes the number of sixes in 6 throws of die.

Obviously, X has the binomial distribution with $n = 6$

and $p = 1/6$ $q = 1-1/6 = 5/6$

where p is probability of getting a six and q is probability of not getting a six

Now,

Probability of getting at most 2 sixes in 6 throws = $P(X = 0) + P(X = 1) + P(X = 2)$

$$6_{C_0} P^0 q^6 + 6_{C_1} P^1 q^5 + 6_{C_2} P^2 q^4 = \left(\frac{5}{6}\right)^6 + \frac{6!}{1!5!}\frac{1}{6}\left(\frac{5}{6}\right)^5 + \frac{6!}{2!4!}\left(\frac{1}{6}\right)^2\left(\frac{5}{6}\right)^4 =$$

$$\left(\frac{5}{6}\right)^6 + 6.\frac{1}{6}\left(\frac{5}{6}\right)^5 + \frac{6.5}{2}\left(\frac{1}{6}\right)^2\left(\frac{5}{6}\right)^4 = \frac{21875}{23328}$$

Q.8 : $p = \frac{2}{3}$,q =1- $p = 1 - \frac{2}{3} = \frac{1}{3}$; n = 6

$$P(r) = n_{C_r} q^{n-r} p^r$$

$$P(r) = 6_{C_r}\left(\frac{1}{3}\right)^{n-r}\left(\frac{2}{3}\right)^r$$

$$P(x \geq 4) = P(x = 4) + P(x = 5) + P(x = 6)$$

$$= 6_{C_4}\left(\frac{1}{3}\right)^{6-4}\left(\frac{2}{3}\right)^4 + 6_{C_5}\left(\frac{1}{3}\right)^{6-5}\left(\frac{2}{3}\right)^5 + 6_{C_6}\left(\frac{1}{3}\right)^{6-6}\left(\frac{2}{3}\right)^6 = 31.\frac{2^4}{3^6}$$

Q.9: Let p denotes probability of getting heads

Let q denotes probability of getting tails .

$p = \frac{1}{2}, q = 1 - \frac{1}{2} = \frac{1}{2}$

Suppose the coin is tossed n times.

Let X denotes the number of times of getting heads in n trails .

$P(X=r)={}^nC_r\, p^r q^{n-r}={}^nC_r\,(\frac{1}{2})^r(\frac{1}{2})^{n-r}={}^nC_r\,(\frac{1}{2})^n, r=0,1,2,....n$

$P(X\geq 1)>\frac{80}{100}$

$\Rightarrow P(X=1)+P(X=2)+......+P(X=n)>\frac{80}{100}$

$\Rightarrow 1-P(X=0)>\frac{80}{100}$

$\Rightarrow P(X=0)<\frac{1}{5}$

$\Rightarrow {}^nC_0\,(\frac{1}{2})^n<\frac{1}{5}$

$\Rightarrow (\frac{1}{2})^n<\frac{1}{5}$

$\Rightarrow n=3,4,5.....$

So the fair coin should be tossed for 3 or more times for getting the required probability

Q.10. Ans : $\sum_{i=1}^{n} P_i=1$

$0+k+2k+2k+3k+k^2+2k^2+7k^2+k=1$

$10k^2+9k-1=0$

$10k^2+10k-k-1=0$

$10k(k+1)-1(k+1)=0$

$(k+1)(10k-1)=0$

$k=-1$ and $k=1/10$

But k can never be negative as probability is never negative. $k=1/10$

Now,

1 $k=1/10$

2 $P(X<3)=P(X=0)+P(X=1)+P(X=2)=0+k+2k=3k=3/10$

3 $P(X>6)=P(X=7)=7k^2+k.=17/100$

$P(0<X<3)=P(X=1)+P(X=2)=k+2k=3k=3/10$

Q.11 : X can take values 0,1,2

P(X=0)= P(no card is red)= 26/52x 25/51= 25/102

P(X=1)= P(one card is red)= 26/52x26/51+26/52x26/51= =26/51

P(X=2)= P(both cards are red)= 26/52x 25/51= 25/102

Mean= 0(25/102)+1(26/51)+2(25/105)

=26/51+2x26/52x25/51

=1

$\sum P_i x_i^2=0.\frac{25}{102}+1.\frac{26}{51}+4.\frac{25}{102}$

$= \frac{26}{51} + \frac{100}{102} = \frac{202}{102}$

Variance $= \sum p_i x_i^2 - (\sum p_i x_i)^2 = \frac{202}{102} - 1 = \frac{50}{51}$

Q.12

The first six positive integers are 1, 2, 3, 4, 5, 6.

We can select the two positive numbers in 6 × 5 = 30 different ways.

Out of this, 2 numbers are selected at random and let X denote the larger of the two numbers.

Since X is the large of the two numbers, X can assume the value of 2, 3, 4, 5 or 6.

P (X =2) = P (larger number is 2) = {(1,2) and (2,1)} = 2/30

P (X = 3) = P (larger number is 3) = {(1,3), (3,1), (2,3), (3,2)} = 4/30

P (X = 4) = P (larger number is 4) = {(1,4), (4,1), (2,4), (4,2), (3,4), (4,3)} = 6/30

P (X = 5) = P (larger number is 5) = {(1,5), (51,), (2,5), (5,2), (3,5), (5,3), (4,5), (5.4)} = 8/30

P (X = 6) = P (larger number is 6) = {(1,6), (6,1), (2,6), (6,2), (3,6), (6,3), (4,6), (6,4), (5,6), (6,5)} = 10/30

Given the above probability distribution, the expected value or the mean can be calculated as follows:

Mean = ∑(Xi×P(Xi))∑(Xi×P(Xi))

= 2×2/30+3×4/30+4×6/30+5×8/30+6×10/30

(4+12+24+40+60)/30=140/30=14/3

HOTS

Q.1 A man is known to speak the truth 3 out of 5 times. He throws a die and reports that it is a number greater than 4.find the probability that it is actually a number greater than 4. (2009)

Q.2Coloured balls distributed in three bags as shown in the following table:

Bag	Colour of the ball		
	Black	White	Red
I	1	2	3
II	2	4	1
III	4	5	3

A bag is selected at random and then two balls are randomly drawn from the selected bag. They happen to be black and red. What is the probability that they came from bag I? (2009)

Q.3 Given three identical boxes I,II and III each containing two coins. In box I, both coins are gold coins, in box II both are silver coins and in box III, there is one gold coin and one silver coin. A person chooses a box at random and takes out a coin. If the coin is of gold, what is the probability that the other coin in the box is also of gold? (2011)

Q.4 A bag contains four balls. Two balls are drawn at random, and are found to be white. What is the probability that all ball are white? (2010)

Q.5 Suppose a girl throws a die. If she gets 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 note 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? (2012)

Q.6 In a set of 10 coins, two coins are with heads on both the sides. A coin is selected at random from this set and tossed five times. If all the five times, the result was heads, find the probability that the selected coin had heads on both the sides. (2015)

ANSWERS

Q.1: Let E1 =getting no. more than 4 ; E2 = getting no. not more than 4

P(E1) =1/3 ;P(E2) =2/3

Let A be the event person is speaking truth

P(A/E1)=3/5 ; P(A/E2)=2/5

SO the probability for getting a no. more than 4 is

$$P(E1/A)=\frac{P(E1)P(A/E1)}{P(E1)P\left(\frac{A}{E1}\right)+P(E2)P(A/E2)}= 3/7$$

Q.2: As bags are selected at random $P(\text{bag } I) = 1/3 = P(\text{bag } II) = P(\text{bag } III)$

Let E be the event that 2 balls are 1 black and 1 red.

$$P\left(\frac{E}{bag\ I}\right) = \frac{{}^{1}C_1 \times {}^{3}C_1}{{}^{6}C_2} = \frac{1}{5} \qquad P\left(\frac{E}{bag\ II}\right) = \frac{{}^{2}C_1 \times {}^{1}C_1}{{}^{7}C_2} = \frac{2}{21}$$

$$P\left(\frac{E}{bag\ III}\right) = \frac{{}^{4}C_1 \times {}^{3}C_1}{{}^{12}C_2} = \frac{2}{11}$$

We have to determine

$$P\left(\frac{bag\ I}{E}\right)=\frac{P(bag\ I)P\left(\frac{E}{bag\ I}\right)}{P(bag\ I)P\left(\frac{E}{bag\ I}\right)+P(bag\ II)P\left(\frac{E}{bag\ II}\right)+P(bag\ III)P\left(\frac{E}{bag\ III}\right)}$$

$$=\frac{\frac{1}{3}x\frac{1}{5}}{\frac{1}{3}x\frac{1}{5}+\frac{1}{3}x\frac{1}{21}+\frac{1}{3}x\frac{2}{11}}=\frac{231}{551}$$

Q.3: Let $E1$, $E2$, $E3$ be events such that

$E1$ = Selection of Box I ; $E2$= Selection of Box II ; $E3$ = Selection of Box III

Let A be event such that

A = the coin drawn is of gold

Now, $P(E_1) = P(E_2) = P(E_3) = 1/3$

$P\left(\frac{A}{E1}\right)$= P(a gold coin from box I)=1 , $P\left(\frac{A}{E2}\right)$= P(a gold coin from box II) = 0,

$P\left(\frac{A}{E3}\right)$= (a gold coin from box III) =1/2

the probability that the other coin in the box is also of gold =

$$P\left(\frac{E1}{A}\right)=\frac{P(E1)P(A/E1)}{P(E1)P\left(\frac{A}{E1}\right)+P(E2)P\left(\frac{A}{E2}\right)+P(E3)P\left(\frac{A}{E3}\right)}$$

$$=\frac{\frac{1}{3}.1}{\frac{1}{3}.1+\frac{1}{3}.0+\frac{1}{3}.\frac{1}{2}}=\frac{2}{3}$$

Q.4: Let us define the following events ,

E: drawn balls are white

A: 2 white balls in bag

B: 3 white balls in bag

C: 4 white balls in bag

Then $P(A) = P(B) = P(C) = \frac{1}{3}$

$$P\left(\frac{E}{A}\right)=\frac{{}^2c_2}{{}^4c_2}=\frac{1}{6},\ P\left(\frac{E}{B}\right)=\frac{{}^3c_2}{{}^4c_2}=\frac{3}{6},\ P\left(\frac{E}{C}\right)=\frac{{}^4c_2}{{}^4c_2}=1$$

By applying Bayes theorem

$$P\left(\frac{C}{E}\right)=\frac{P(C)P\left(\frac{E}{C}\right)}{P(A)P\left(\frac{E}{A}\right)+P(B)P\left(\frac{E}{B}\right)+P(C)P\left(\frac{E}{C}\right)}$$

$$=\frac{\frac{1}{3}.1}{\frac{1}{3}.\frac{1}{6}+\frac{1}{3}.\frac{3}{6}+\frac{1}{3}.1}=\frac{3}{5}$$

Q.5 : Let E1= outcome 5 or 6 and E2= outcome of 1,2,3,4 then

P(E1)=2/6=1/3 ; P(E2)=4/6=2/3

Let A be the event of getting one head

P(A|E1)=3/8

P(A|E2)= ½ ;then By using Bayes Theorem

$$P(E2|A)=\frac{P(E2).P(A|E2)}{P(E1).P(A|E1)+P(E2).P(A|E2)}$$

=8/11

Q.6

Let E_1, E_2 and A be the events defined as follows

E_1 = selecting a coin having head on both the sides

E_2 = selecting a coin not having head on both the sides

A= getting all heads when a coin is tossed 5 time

$$P(E_1)=\frac{{}^2C_1}{{}^{10}C_1}=\frac{2}{10}$$

There are eight coins not having heads on both the sides

$$P(E_2)=\frac{{}^8C_1}{{}^{10}C_1}=\frac{8}{10}$$

$$P(A/E_1)=(1)^5=1$$

$$P(A/E_2)=\frac{1}{(2)^5}=\frac{1}{32}$$

By bayes theorem, we have

$$P(E_1/A)=\frac{P(E_1)P(A/E_1)}{P(E_1)P(A/E_1)+P(E_2)P(A/E_2)}$$

$$=\frac{\frac{2}{10}\times 1}{\frac{2}{10}\times 1+\frac{8}{10}\times\frac{1}{32}}=\frac{8}{9}$$

HOT AND VALUE BASED QUESTION FOR SELF EVALUATION-

Q.1If each element of a second order determinant is either 0 or 1.What is the probability that value of determinant is positve?Also write down the importance of positive thinking in yours daily life.

Ans=3/16

Q.2 P speaks truth 70 percent of the cases and Q in 80 percent of the cases .In what percentage of cases they likely to agree in stating the same fact? Do you think when they agree , means both are speaking truth?

Ans: 31/50, no both can tell a lie

Q.3Find the mean , the variance and the standard deviation of the number of doublets in three throws of a pair of dice?

Ans: mean =1/2, variance=5/12 and standard deviation=$\frac{\sqrt{5}}{12}$

Q.4 .In a group of 50 scouts in a camp, 30 are well trained in first aid techiniques while the remaining are well trained in hospitality but not in first aid two scouts are selected at random from the group find the probability distribution of number of selected scouts who are well trained in first aid .Find the mean of the distribution also. Write one more value which is expected from a well trained scout

Ans: Probability distribution

X	0	1	2
P(X)	38/245	120/245	87/245

Mean=294/245

Q.5 In a village there are 100 people out of them 70 people are non vegetarian. Two people are selected randomly. Find the probability distribution of vegetarian people. Which type of people is better? Give yours opinion keeping in mind the importance of life of animal in Eco –system.

Ans=

X	0	1	2
P(X)	483/990	420/990	87/990