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Sessional As.

Subject : Probability on statistics

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Q NO 1:-

Answer:- 1:-

E (1,1), (1,2), (1,3), (1,4), (1,5), (1,6), (1,7), (1,8)

(2,1), (2,2), (2,3), (2,4), (2,5), (2,6), (2,7), (2,8)

(3,1), (3,2), (3,3), (3,4), (3,5), (3,6), (3,7), (3,8)

(4,1), (4,2), (4,3), (4,4), (4,5), (4,6), (4,7), (4,8)

(5,1), (5,2), (5,3), (5,4), (5,5), (5,6), (5,7), (5,8)

(6,1), (6,2), (6,3), (6,4), (6,5), (6,6), (6,7), (6,8)

(7,1), (7,2), (7,3), (7,4), (7,5), (7,6) (7,7) (7,8)

(8,1), (8,2), (8,3), (8,4), (8,5), (8,6), (8,7), (8,8) }

Set:

A = { The Sum is 7 }

B:

B = { The sum is even }

C = { The Sum is greater than 8 }

D = { The two disc had two same outcome }

Now

A = { (1,6), (2,5), (3,4), (5,2), (6,1), (4,3) }

B = { (1,1), (1,3), (1,5), (1,7), (2,2), (2,4), (2,6), (2,8)

(3,1), (3,3), (3,5), (3,7), (4,2), (4,4), (4,6)

(4,8), (5,1), (5,3), (5,5), (5,7), (6,2)

(6,4), (6,6), (6,8), (7,1), (7,3), (7,5)

(7,7), (8,2), (8,4), (8,6), (8,8) }

C = { (1,8), (2,7), (2,8), (3,6), (3,7), (3,8)

(4,5), (4,6), (4,7), (4,8), (5,4), (5,5)

(5,6), (5,7), (5,8), (6,3), (6,4), (6,5)

(6,6), (6,7), (6,8), (7,2), (7,3), (7,4)

(7,5), (7,6), (7,7), (7,8), (8,1), (8,2),

(8,3), (8,4), (8,5), (8,6), (8,7), (8,8)}

D = {(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)

(7,7), (8,8)}

$A \cap B = \{\}$ OR $\emptyset$

$A \cap C = \{\}$

$A \cap D = \{\}$

$P(A) = 6/64$, $P(B) = 32/64$

$P(C) = 36/64$, $P(D) = 8/64$

$P(A \cap B) = 0$, $P(A \cap C) = 0$ $P(A \cap D) = 0$

Hence,

$P(A/B) = \frac{P(A \cap B)}{P(B)} = 0 \times 32/6$

$P(A/C) = 0$

$P(A/D) = \frac{P(A \cap D)}{P(D)} = 0 \times 8/64$

$P(A/D) = 0$

(Q 3):

A and B play a game in which A's proability of winning is 2/3 in a series of 8 games, What is the proabality than A will win.

1. Exactly 4 games
2. At least 4 games
3. from 3 to 6 games

Given that =

$$p = \frac{2}{3} \quad n = 8$$

$$q = 1 - p$$

$$= 1 - \frac{2}{3}$$

$$q = \frac{1}{3}$$

Let "x" denotes the number of given when by A then

(i) $P(x = 4)$

$$= \binom{8}{4} \left(\frac{2}{3}\right)^4 \left(\frac{1}{3}\right)^4$$

$$= \frac{1120}{6561}$$

$$= 0.1707$$

(ii) $P(x \geq 4)$

$$1 - P(x < 4)$$

$$= 1 - \sum_{x=0}^{3} \binom{8}{x} \left(\frac{2}{3}\right)^x \left(\frac{1}{3}\right)^{8-x}$$

$$= 1 - \left[\left(\frac{1}{3}\right)^8 + 8\left(\frac{2}{3}\right)\left(\frac{1}{3}\right)^7 + 28\left(\frac{2}{3}\right)^2\left(\frac{1}{3}\right)^6 + \right.$$

P-T-O

$$56\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right)^5\Big]$$

$$= 1 - \frac{1}{6561}\left[1+16+112+448\right]$$

$$= 1 - \frac{577}{6561}$$

$$= \frac{6561-577}{6561}$$

$$= \frac{5984}{6561}$$

$$= \boxed{0.9121}$$

~~iii~~ (iii) $P(3 \le x \le 6)$

$$\sum_{x=3}^{6}\binom{8}{x}\left(\frac{2}{3}\right)^x\left(\frac{1}{3}\right)^{8-x}$$

$$= \binom{8}{3}\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right)^5 + \binom{8}{4}\left(\frac{2}{3}\right)^4\left(\frac{1}{3}\right)^4 + \binom{8}{5}\left(\frac{2}{3}\right)^5\left(\frac{1}{3}\right)^3 +$$

$$\binom{8}{6}\left(\frac{2}{3}\right)^6\left(\frac{1}{3}\right)^2$$

$$= \frac{8}{(3)^8}\left[56+140+224+224\right]$$

$$= \frac{8\times 644}{6561} = \frac{5152}{6561} = \boxed{0.7852}$$

(Q 4)

Proof:- Since the C_i's form a partition of the sample space we can apply the law of total of probability for $A \cap B$.

$$P(A \cap B) = \sum_{i=1}^{m} P(A \cap B / C_i)$$

$$P(A \cap B) = \sum_{i=1}^{m} P(A/C_i)\, P(B/C_i)\, P(C_i)$$

$\because$ (A and B are conditionally independent)

$$P(A \cap B) = \sum_{i=1}^{m} P(A/C_i)\, P(B)\, P(C_i)$$

$\because$ (B is independent of all C_i's)

$$P(A \cap B) = P(B) \sum_{i=1}^{m} P(A/C_i)\, P(C_i)$$

$$P(A \cap B) = P(B)\, P(A)$$

$\because$ (law of total proabality)

hence A and B are independent.

(Q 5)

Derive the binomial distribution and find its mean and variance.

Ans

The probability function for a binomial random variable is

$$b(x; n, p) = \binom{n}{x} p^x q^{n-x}$$
$$b(x; n, p) = \binom{n}{x} p^x (1-p)^{n-x} \quad q = 1-p$$

This is the probability of having x success in a series of n independent trials when the probability of succes in any on of the trials is p if x is a random variable with this probability distribution.

$$E(x) = \sum_{x=0}^{n} x \binom{n}{x} p^x (1-p)^{n-x}$$
$$= \sum_{x=0}^{n} x \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x}$$
$$= \sum_{x=0}^{n} \frac{n!}{(x-1)!(n-x)!} p^x (1-p)^{n-x}$$

Since $x=0$ term vanishes, let $y = x-1$ and $m = n-1$ Subbing $x = y+1$ and $n = m+1$ into the last sum

$$E(x) = \sum_{y=0}^{m} \frac{(m+1)!}{y!(m-y)!} p^{y+1} (1-p)^{m-y}$$
$$= (m+1)p \sum_{y=0}^{m} \frac{m!}{y!(m-y)!} p^y (1-p)^{m-y}$$

$$= np \sum_{y=0}^{m} \frac{m!}{y!\,(m-y)!}\, p^y (1-p)^{m-y}$$

By binomaial theoram

$$(a+b)^m = \sum_{y=0}^{m} \frac{m!}{y!\,(m-y)!}\, a^y b^{m-y}$$

Set $a = p$ and $b = 1-p$

$$\sum_{y=0}^{m} \frac{m!}{y!\,(m-y)!}\, p^y (1-p)^{m-y}$$

$$= \sum_{y=0}^{m} \frac{m!}{y!\,(m-y)!}\, a^y b^{m-y}$$

$$= (a+b)^m$$

$$= (p+1-p)^m$$

$$= (p+1-p)^m$$

$$= 1$$

So that

$$\boxed{E(x) = np}$$

Simlorly but this time using

$y = x-2$ and $m = n-2$

$$E(x(x-1)) = \sum_{x=0}^{n} x(x-1) \binom{n}{x} p^x (1-p)^{n-x}$$

$$= \sum_{x=0}^{n} x(x-1) \frac{n!}{x!\,(n-x)!}\, p^x (1-p)^{n-x}$$

$$= \sum_{x=2}^{n} \frac{n!}{(x-2)!\,(n-x)!}\, p^x (1-p)^{n-x}$$

$$= n(n-1)p^2 \sum_{x=2}^{n} \frac{(n-2)!}{(x-2)!\,(n-x)!}\, p^{x-2} (1-p)$$

$$= n(n-1)p^2 \sum_{y=0}^{m} \frac{m!}{y!(m-y)!} p^y (1-p)^{m-y}$$

$$= n(n-1)p^2 (1p + (1-p))^m$$

$$= n(n-1)p^2$$

So the varonce of x is

$$E(x^2) - E(x)^2 = E(x(x-1)) + E(x) - E(x)^2 =$$

$$n(n-1)p^2 + np - (np)^2$$

$$= \boxed{np(1-p)}$$

7) 6 Ans

Binomial Distribution:

may experiment consist of repeated independent trials each trial Having two possiable outcomes

eg The two possiable outcomes of a trial may head one tail. Suces and failub. True and false et.

The formula of binomial distribution is:

$$p(X=x) \; f(x) = {}^{n}C_{x} \, p^{x} \, q^{n-x}$$

P.T.O

Binomial frequency Distribution :-

If the binomaial prababilitty distribution is the multiplied by N, then the number of experiments or sets the resulting distribution is known as the binomial frequency distribution
The formula of binomial frequency distribution is :

$$N \binom{n}{x} p^x q^{n-x}$$

Q 2

ANS:- When we are rolling two dice there are 36 different combination are Counting these up there are 15 possiable less then 7 : (1,1),(1,2),(1,3),(1,4),(1,5) (2,1),(2,2),(2,3),(2,4), (3,1),(3,2) (3,3) (4,1),(4,2),(5,1),(~~5,2~~) The Prabability of getting less then of a 7

$$\frac{15}{36} = \frac{5}{12}$$

There are 6 possable combination of getting a 7 : (1,6) (2,5),(3,4),(4,3) (5,2),(6,1) which gives a prabability of

$$\frac{6}{36} = \frac{1}{6}$$

This mean that 21 possibilites account for getting less than or equal to 7
So there are 15 remaining possiabilies

possiable of getting more than 7. This is the Same as the prabability of getting less than "7" so the prabability must b $\frac{5}{12}$ as well

must assume that each combination is equally likely to all as any other and therefore the dice are fair or else the calculation don't work.

(Q7)

Cofficient of variation

for Data set A:-

$$CV = \frac{\sigma}{\mu} * 100$$

$$CV = \frac{3}{45} \times 100$$

$$\boxed{CV = 6.7}$$

for Data Set B:-

$$CV = \frac{11}{60} \times 100$$

$$\boxed{CV = 18.3}$$

for Data Set C:-

$$CV = \frac{5}{50} \times 100$$

$$\boxed{CV = 10}$$

for Data Set D:-

$$CV = \frac{15}{25} \times 100$$

$$\boxed{CV = 60}$$

The END