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Deprt Bs(cs) 4th

Sub Statistics

final assignments

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Q No 1

The Sample Space S for this proble.

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

A) { The Sum is 7 }
B) { The Sum is even }
c) { The Sum is greater then 8 }
d) { The two dic had the Same outcome }

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

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

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$C = \{ (3,6), (4,5), (4,6), (5,4), (5,5),$
$(5,6), (6,3), (6,4), (6,5), (6,6) \}$

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

$A \cap B = \phi$ $\quad A \cap C = \phi$
$A \cap D = \phi$

Now

$p(A) = \frac{6}{36} = \frac{1}{6}$ $\quad p(C) = \frac{10}{36} = \frac{5}{18}$
$p(B) = \frac{18}{36} = \frac{1}{2}$ $\quad p(D) = \frac{6}{36} = \frac{1}{6}$

$p(A \cap B) = 0$ $\quad p(A \cap D) = 0$
$p(A \cap C) = 0$

Hence

$$p(A/B) = \frac{p(A \cap B)}{p(B)} = \frac{0}{1/2} = 0$$

$$p(A/C) = \frac{p(A \cap C)}{p(C)} = \frac{0}{5/18} = 0$$

$$p(A/D) = \frac{p(A \cap D)}{p(D)} = \frac{0}{1/6} = 0$$

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Qno 2 Ans
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when we are rolling two dice there are 36 different combination Counting these up there are 15 posibilities 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)

these probability of getting less then a 7 is

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

There are 6 possible combinations of getting a 7 : (1,6), (2,5), (3,4) (4,3), (5,2) (6,1)

which gives a probability of

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

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This mean that 21 possibilities account for getting less than or equal to 7 So there are 15 remaing possibility of getting more than 7. This is Same as the probability of getting less than 7 So the probability must be $5/12$ as well as calculating this we must assume that each combination is equally likely to roll as any others and Therefore the dice are fair or else calculation doesn't work.

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QNo 3 1) Exactly 4 games
2) At least 4 games
3) from 3 to 6 games

Solution:- Given that

$p = 2/3$

$q = 1 - p$

$1 - 2/3 = q = 1/3$

lets x donates the numbers of games win by A
The

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

$= \frac{1120}{6561} \Rightarrow 0.1707$

(ii) $p(x \geq 4)$
$1 - p(x<4)$
$= 1 - \sum_{x=0}^{3} \binom{8}{x}\left(\frac{2}{3}\right)^x\left(\frac{1}{3}\right)^{8-x}$

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$$1 - \left[\left(\frac{1}{3}\right)^8 + 8\left(\frac{2}{3}\right)\left(\frac{1}{3}\right)^7 + 28\left(\frac{2}{3}\right)^2\left(\frac{1}{3}\right)^6 + 56\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right)^5\right]$$

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

$$= 1 - \frac{577}{6561} \Rightarrow \frac{5984}{6561}$$

$$\boxed{= 0.9121}$$

(iii) $p(3 \leq x \leq 6)$

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

$$= \binom{8}{3}\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right)^5 + \binom{8}{4}\left(\frac{2}{3}\right)^4\left(\frac{1}{3}\right)^4 + \binom{8}{5}\left(\frac{2}{3}\right)^5\left(\frac{1}{3}\right)^3 + \binom{8}{6}\left(\frac{2}{3}\right)^6\left(\frac{1}{3}\right)^2$$

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

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

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Q.No 4
The C_i's form a partition of the Sample Space we can apply the law of total probability for $A \cap B$

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

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

that's why (A and B are conditionally independent

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

So 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 probability)

Hence A and B are independent.

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Ans 5, The probability function for a binomial random variable is

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

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

This is the probability of having x successful in a series of n independent trials when the probability of success in any or random variable with this probability distribution

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

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

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

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

Sine $x=0$ term vareables let $y = x-1$ and $m = n-1$ subbing $x = y+1$ and $n = m+1$ into the leat sum

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

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

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

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

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

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

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

$$(a+b)^m$$

$= (p+1-p)^m$ so $E(x) = np$.

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Similarly, but this time using

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

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

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

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

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

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

So the varian of x is

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

$$E(x)^2 = n(n-1)p^2 + np - (np)$$

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

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Ans 6

Bi-nomial Frequency Distribution:

If the binomial probability distribution in multiplied by N, the Number of experiments or Set the resulting distribution is Know as the binomial frequency distribution formula $N\binom{n}{x}p^x q^{n-x}$

Binomial distribution with formula:

Summarize the number of trials or observation when each trial has the Same probability of attaining one particular value. The ~~bin~~ binomial distribution determine the probability of observation a Specific number of Successful outcomes in a specific number of trials.

$$b(x,n,p) = {}^nC_x * p^x * (1-p)^{n-x}.$$

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Q No 7 find coefficient of variation

$$C.V = \frac{\text{Sample Size}}{\text{Mean}} \times 100$$

data Set A

Mean = 45 Sample Size = 1500

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

$\boxed{CV = 6.7}$

data Set B

Mean = 60 Sample Size 3200

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

$CV = 18.3$

data Set C

Mean 50 Sample Size 500

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

$\boxed{CV = 10}$

data Set D

Mean Sample Size 2700

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

$\boxed{CV = 60}$

data Set A is most accurate

$\boxed{A = 6.7}$