QNo1

A = {sum is ~~even~~}
B = {Sum is even}
def = C = {Sum is greater than 8}
D = {2 dice same outcome}

$A = \{(1,6), (2,5), (3,4), (4,3), (5,2), (6,1)\}$
$B = \{(2,2), (2,6), (4,2), (6,2) \cdots\}$
$C = \{(6,6), (6,4)\}$
$D = \{(1,1), (2,2), (4,4), (6,6)\}$

$P(A) = \frac{6}{36}$
$P(B) = \frac{4}{36}$
$P(C) = \frac{2}{36}$
$P(D) = \frac{4}{36}$

$P(A \cap B) = \frac{\phi}{36} = \phi = 0$
$P(A \cap C) = \frac{\phi}{36} = \phi = 0$
$P(A \cap D) = \frac{\phi}{36} = \phi = 0$

Hence

$P(A/B) = P\frac{(A \cap B)}{P(B)} = \frac{0}{4/36} = 0$
$P(A/C) = P\frac{(A \cap C)}{P(C)} = \frac{0}{2/36} = 0$
$P(A/D) = P\frac{(A \cap D)}{P(D)} = \frac{0}{4/36} = 0$

the results show that probability is zero in all the cases given.

Q2

throwing off one single dice can give 6 outcomes i.e 1,2,3,4,5,6.

So, throw of 2 dice can give us $6 \times 6 = 36$ outcomes

Sequence leading to get atleast 1.

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

therefore notable outcomes for getting at least $7 = 1+2+3+4+5+6 = 21$

So, Probability is $= 21/36 = \frac{7}{12} = 0.58$

Q No. 3

Solution

Given $P = 2/3$ $n = 8$

$q = 1 - P$

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

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

Let x denotes number of games won by A.

(1) $P(X=4)$

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

$\frac{1120}{6561}$

$= 0.1707$

(2) $P(x \geq 4)$ $1 - P(x<4)$

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

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

$\left.\left(\frac{1}{3}\right)^6 + 56\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right)^5\right]$

$= 1 - \frac{1}{6561}[1+16+112+448)$

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

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

$= \frac{5984}{6561} = 0.9121$

3 $P(3 \leq x \leq 6)$

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

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

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

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

$$= 0.7852$$

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Q5

the binomial distribution

$$P(X=x) = \binom{n}{x} p^x (1-p)^{n-x}$$

for $x = 0, 1, 2, \ldots$

$$\mu = np, \quad \sigma^2 = np(1-p)$$
$$E(x) \quad , \quad var(x)$$

let $U_1 \ldots U_n$ to the independent Binomial random variables.

$$E(U_i) = p \qquad var(U_i) = p(1-p)$$

$$X = U_1 + \ldots + U_n$$
$$E(X) = E(U_1 + \ldots + U_n)$$
$$E(X) = E(U_1) + \ldots + E(U_n)$$
$$= p + \ldots + p = np$$

let $U_1 \ldots U_n$ be the independent Binomial variables

$$E(U_i) = p, \quad var(U_1) = p(1-p)$$
$$X = U_1 + \ldots + U_n$$
$$var(X) = var(U_1 + \ldots + U_n)$$
$$var(X) = var(U_1) + \ldots + var(U_n)$$
$$= p(1-p) + \ldots + p(1-p)$$
$$= np(1-p)$$

The binomial theorem

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

$E(x) = \sum_x x\, p(x)$

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

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

here

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

$= np \sum_{x=1}^{n} \frac{(n-1)!}{(x-1)!(n-1)-(x-1)!}$

$x p^{x-1} (1-p)^{(n-1)(x-1)}$

$m = n-1$

$y = x-1$

Now

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

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

$Var(x) = E[(x-M)^2]$

$= \sum (x-M)^2 p(x)$

$E[(x-M)^2] F(x)^2 = [E(x)]^2$

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

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

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

$$p^{x-2}(1-p)^{n-x}$$

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

$$\sum_{x=2}^{n} \frac{(n-2)!}{(x-2)!(n-2)-(x-3)!}^{x-2}$$

$$(1-p)$$

here $m = n-2$

$y = x-2$

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

$$p^{y}(1-p)^{m-y}$$

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

$$E[x(x-1)] = n(n-1)p^2$$

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

$$var(x) = E(x)^2 - [E(x)]$$

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

$$= np[(n-1)p + 1 - np]$$

$$= np(1-p)$$

Q 6

Binomial Distribution.

→ if "x" is a discrete random variable with Probability mass function

Binomial Distribution formula

$$P(x) = n C x \, p^x \, (1-p)^{n-x}$$

~~X~~ = random variable x
x = No of success
C = Combination of x successes from n trials
P - Probability of success
– = Probability of failure
(n-x) = number of failures

Important points

→ where f.a should be greater than 1

→ p+q = 1 because ~~probability~~ probability cannot be more

– X is a discrete random variable which may take on only countable number of distinct value such as 1, 2, 3, 4 . . . .

Q 7. Sol

Data A

Cofficient variation = $\frac{\text{Standard deviation}}{\text{Mean}} \times 100$

Here.

SD = 3

mean = 45

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

$= 6.666$

$= 7$ (rounding off to nearest 10)

Data B SD = 11 . mean = 60

$CV = \frac{SD}{mean} \times 100$

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

$= 18.3 = 18$

Data C SD = 5 mean = 50

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

10 (rounding off to nearest 10)

Conclusion

Hence the results of all 3 datas are mentioned above as 7.18 and 10. being the highest value of 18 and lowest of 7.

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Conditions for binomial distubution

1. The random repeiment is ~~perfo~~ performed repeatedly a finite and fixed number of times

2. The outcome of the random experiment (trials) results in the dischotomous clacification of events

3. All the trials are independent

Formulas

mean $\mu = n.p$

Variance $\sigma^2 = n.p.q$