NAME: AMIT SINGH

ID: 15478

SUBJECT: PROBABILITY AND STATISTICS

SEMESTER: 3RD

PROGRAMME: BS (SOFTWARE ENGINEERING)

Date: ....

Q1) A man throws - - - - - - - ?

1) The sum is even
2) The sum is greater than 8
3) The two dice had the same outcome

Sol:-

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

Let

A = { the sum is 10 }
B = { The sum is even }
C = { The sum is greater than 8 }
D = { The dice had same outcom }

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

APM

Date: ....

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

$A \cap C = \{(1,6)(2,5)(3,4)(4,3)(5,2)(6,1)$

$A \cap D = \phi$

$P(A) = \frac{6}{36}, \; P(B) = \frac{18}{36}, \; P(C) = \frac{21}{36}, \; PD = \frac{6}{36}$

$P(A \cap B) = \frac{6}{36}, \; P(A \cap C) = \frac{6}{36}$ and $P(A \cap D) = 0$

Hence

$P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{6}{36} \times \frac{36}{18} = \frac{1}{3}$

$P(A/C) = \frac{P(A \cap C)}{} = \frac{6}{36} \times \frac{36}{21} = \frac{2}{7}$

$P(A/D) = \frac{P(A \cap D)}{P(D)} = \frac{0 \times 36}{6} = 0$

APM

Date: ....

Q2 Show that in a single throw of two dice .... ?

Ans) Sum of 2 has 1 way 1,1
Sum of 3 has 2 ways 1,2 & 2,1
Sum of 4 has 3 ways 1,3; 2; 3,1
5 has 4 ways
6 has 5 ways
8 has 5 ways (symmetry)
9 has 4 ways
10 has 3 ways
11 has 2 ways
12 has 1 ways

They are 15/36 for each side with a sum of 30/36
which leaves a 6/36 = $\frac{1}{6}$ probability for a sum of 7

Date: ....

Q3) A and B play a agame ---?

Sol:-

Given that $P = \frac{2}{3}$ $n = 8$

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

Let x denotes the number of games won by A.

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) $P(x \geq 4)$

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

APM

Date: ....

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

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

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

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

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

$$= 0.9121$$

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

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

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

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

Date: ....

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

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

Ans

APM

Date: ....

Q4) Let C_1, C_2 ------ ?

Sol:-

C_is form a partition of sample space,

Applying law of total probability for $A \cap B$:

$P(A \cap B)$

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

$= \sum_{i=1}^{M} P(A/C_i) P(B/C_i) P(C_i)$ (A,B conditionally independent)

$= \sum_{i=1}^{M} P(A/C_i) P(B) P(C_i)$ (B is independent of all C_i's)

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

$= P(B) P(A)$ (Law of total Probability).

Ans.

APM

Date: ....

Q5 Derive Binominal Distribution ----?

Binominal Probability Distribution:

A bionominal experiment is a statistical experiment that has the following properties.

- The experiment consists of repeated trials
- The the trials are independent that is the outcome one trial does not affect the outcome of other trials.
- The probability of success, denoted by P is the same on every trial.

Mean and Variance:

$\mu_x = n(P)$ → Mean (expected value)

$\sigma_x^2 = n(P)(q)$ → variance.

Date: ....

Q6 Differentiate between Binominal ---?

Binominal Frequency Distributions:-

If the binomial probability distribution is multiplied by N, the number of experiments or sets, the resulting distribution is known as the binomial frequency distribution.

Formulae:-

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

Bionominal Distribution Formulae:-

$$P(x=x) \; f(x) = {}^{n}C_{x}\, P^{x} q^{n-x} \qquad x = 0, 1, 2 \ldots$$

where

n = The number of sample size
x = The number of success
p = The probability of success
q = The probability of failure

Date: ....

Q7) Below you will find ----?

Sol:-

Measure	Data set A	B	C	D
Coefficient of variation	$CV = \frac{3}{45} \times 100$	$CV = \frac{11}{60} \times 100$	$CV = \frac{5}{50} \times 100$	$CV = \frac{15}{25} \times 100$
	$CV = 6.7$	$CV = 18.3$	$CV = 10$	$CV = 60$