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Q.1

A - Ev

Event A - 1 is transmitted

~~Event $\bar{A}$~~ - 0 is transmitted

Event B - 1 is recived

Event $\bar{B}$ - 0 is recived.

Given

$P(A) = 0.5$

$P(\bar{B}/\bar{A}) = 0.95$

$P(B/A) = 0.90$

$P(\bar{A}) = 0.5$

$P(\bar{B}/A) = 1 - P(B/A)$
$= 1 - 0.9$
$= 0.1$

$P(B/\bar{A}) = 1 - P(\bar{B}/\bar{A})$
$= 1 - 0.95 = 0.05$

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a) $P(B) = P(B/A) \times P(A) + P(B/\bar{A}) \times P(\bar{A})$

$= 0.90 \times 0.5 + 0.05 \times 0.5$

$= 0.475$

Hence the probability of being reciv
0.475

$\boxed{P(B) = 0.475}$

b)

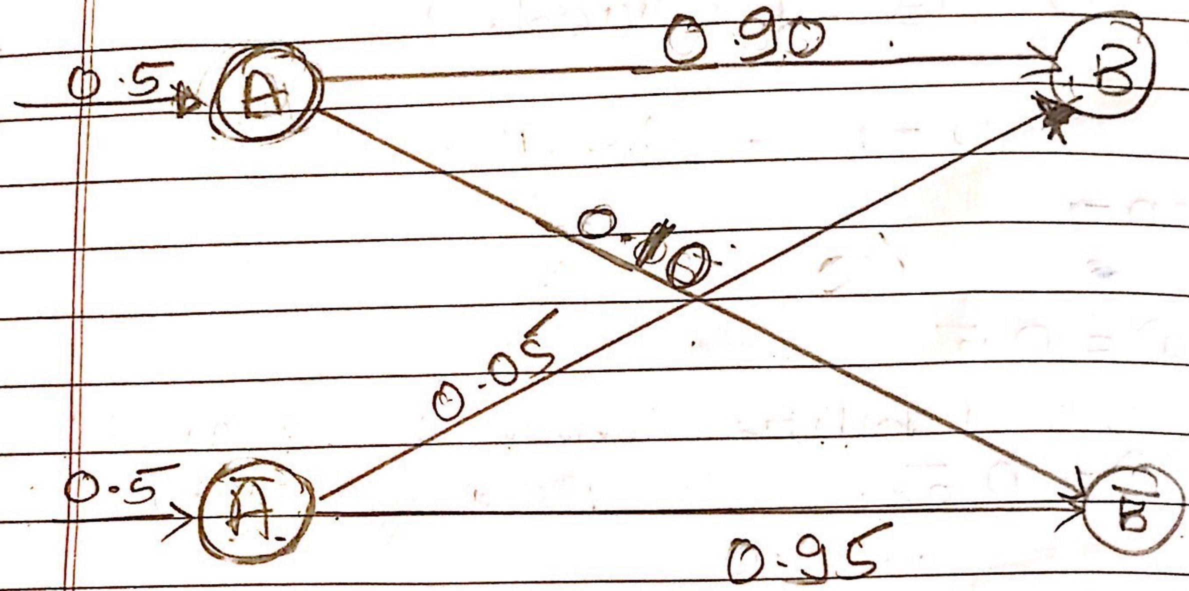

fig 1. binary digital trasmission media

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Q.(2)

P(A) - Student own a car

P(B) - Student own bicycle.

P(C) - Student own two wheeler.

a) Given

$P(A) = 0.3$ $\quad$ $P(B) = 0.6$

$P(B|A) = 0.5$ $\quad$ $P(C) = 0.3$

$$\frac{P(B \cap A)}{P(A)} = 0.5$$

$$P(B \cap A) = 0.5 \times P(A)$$

$$P(B \cap A) = 0.5 \times 0.3$$

$$\boxed{P(B \cap A) = 0.15}$$

The probability that random selected student own a car and bicycle is 0.15.

ⓑ $P(B \cap \overline{A}) = P(B) - P(A \cap B) = 0.6 - 0.15$

$= 0.45$

Probability that randomly selected student own a bicycle but does not own a car is 0.45

ⓒ

$P(C \cup B \cup A) = P(A) + P(B) + P(C) - P(B \cap A) - P(C \cap B)$

$= 0.3 + 0.6 + 0.3 - 0.15 - 0.15$

$= 0.9$

$1 - P(A \cup B \cup C) = 1 - 0.9$

$= 0.1$

Probability that randomly selected student ~~owns a bicycle~~ / does not own any of three is 0.1

d). $P(B \cap \bar{C} \cap \bar{A}) = P(B) - P(B \cap A) - P(B \cap C)$

$= 0.6 - 0.15 - 0.15$

$= 0.3$.

$\boxed{P(B \cap \bar{C} \cap \bar{A}) = 0.3}$

Q.3

$p = 30/100$

$q = \frac{70}{100}$

$n = 500$

mean $= n \times p$

$= 500 \times \frac{30}{100}$

$= 150$

$\sigma = \sqrt{n \times p \times q} = \sqrt{500 \times 30/100 \times 70/100} = \sqrt{105}$

$= 10.2469$

for $x = 84.5$

$z = \frac{84.5 - 150}{10.2469}$ $\therefore$ $\boxed{Z = \frac{x - \mu}{\sigma}}$

$= -6.3921$

$P(Z \geq -6.3921) = 1 - P(Z < -6.3921)$

$= 1 - 0$

$= 1$

3 (b) ~~p(~~

$p = \frac{60}{100}$ $q = \frac{40}{100}$ $n = 500$

$u = n \times p = 500 \times \frac{60}{100} = 300$

$\sigma = \sqrt{npq} = \sqrt{500 \times \frac{60}{100} \times \frac{40}{10}} = \sqrt{120}$

$= 10.9544$

for $x = 84.5$

$z = \frac{84.5 - 300}{10.9544}$

$= -19.6724$

$P(z \geq -19.67)$ $1 - P(z < 19.6724)$

$= 1 - 0$

$= 1$

(b)

Q.4

A- ~~P(~~ Number of ways of arraging 5 digits = $5!$
$= 120$

B-
(i) There is One digit between 1 and

$\underset{(i)}{X}$ — $\underset{(ii)}{X}$ — —

— $\underset{(i)}{X}$ — $\underset{(ii)}{X}$ —

— — $\underset{(i)}{X}$ — $\underset{(ii)}{X}$

Number of way Rearrenging 3 Number=
Number of way Rearrenging 1,2 is =

~~P(A) = P(A)~~

$$P(A) = \frac{(3! \times 2) \times 3}{5!}$$

$$= \frac{6 \times 2 \times 3}{\cancel{120}_{20}}$$

$$= \frac{6}{20} = 3/10 = 0.3$$

$\boxed{P(A) = 0.3}$

(b) C - Therere are exactly 2 digit between them -

$\underline{x}$ _ _ $\underline{x}$ _

_ $\underline{x}$ _ _ $\underline{x}$

Number of way of arranging 3 Numbers = 3!

Number of ways Rearreng 2 Numbers = 2.

$$P(C) = \frac{(3! \times 2) \times 2}{5!}$$

$$= \frac{\cancel{3 \times 2}\ 6 \times 2 \times 2}{120}$$

$$= \frac{4}{20}$$

$$= \frac{2}{10}$$

$$\boxed{P(C) = 0.3}$$

(c) -D - There are exactly three digits between 1 and 2.

X _ _ _ X

~~P(1)~~

Number of ways arranging 3 Number
$= 3!$

Number of ways arranging 2 Number
$= 2.$

$$P(D) = \frac{(3! \times 2) \times 1}{5!}$$

$$= \frac{\cancel{6} \times 2}{\cancel{120}\ 20}$$

$$= \frac{2}{20}$$

$$= 0.1$$

$$\boxed{P(D) = 0.1}$$

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(5) $\int_{-\infty}^{\infty} f(x)\, dx = 1$

Given $f(x) = \begin{cases} 0 & x < 0 \\ 0.5 & 0 \le x \le 1 \\ Ce^{-x} & x \ge 1 \end{cases}$

$$\int_{-\infty}^{\infty} f(x)\, dx = 1$$

$$\int_0^1 0.5\, dx + \int_1^{\infty} Ce^{-x} = 1$$

$$\left|0.5x\right|_0^1 - C\left|e^{-x}\right|_1^{\infty} = 1$$

$$0.5 - C(0 - e^{-1}) = 1$$

$$0.5 - 1 = C \times (0 - e^{-1})$$

$$\cancel{-}0.5 = C \times \cancel{-}e^{-1}$$

$$0.5 = C \times e^{-1}$$

$$e \times 0.5 = C$$

$$2.718 \times 0.5 = C$$

$$\boxed{C = 1.359}$$

(b) ~~x<1~~ Given $x<1$

$$E(x) = \int_{-\infty}^{0} x f(x)\,dx + \int_{0}^{1} x f(x)\,dx$$

$$= 0 + \int_{0}^{1} 0.5 \times x\,dx$$

$$= \left| \frac{0.5x^2}{2} \right|_{0}^{1}$$

$$= \frac{0.5}{2}$$

$$= 0.25.$$

$$\boxed{E(X<1) = 0.25}$$

5 (c) Given $x \geq 1$

$$E(x \geq 1) = \int_1^{\infty} x f(x)\, dx.$$

$$= \int_1^{\infty} e \times e^{-x}\, dx.$$

$$= \int_1^{\infty} \frac{e}{2} x \times e^{-x}\, dx$$

$$= \frac{e}{2}\left[-x e^{-x} - e^{-x}\right]_1^{\infty}$$

$$= \frac{e}{2}\left[e^{-1} + e^{-1}\right]$$

$$= \frac{e}{2} * \frac{2}{e}$$

$$\boxed{E(x \geq 1) = 1}$$

5 d) $E(X) = E(X<1) + E(X \geq 1)$

$$= 1 + 0.25$$

$$= 1.25$$

expected value of x is 1.25

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(6)

X - denoting no of bits recived in error

~~we have~~,

Given -:

$p = 0.00001$

$n = 10 \times 10^6$

$x = 100$.

Soln

probaility that more than 100 error occor

$$= \sum_{x=101}^{10\times10^6} (x;\ 10\times10^6,\ 0.00001).$$

as $n \to \infty$ & $p \to 0$

we will perform poisson's approximation

$$b(x; n, p) \xrightarrow{n\to\infty} p(x; \mu)$$

mean $= \mu = np = 10^{-5} \times 10^7 = 100$.

Required probability

$$p(x>100) = \sum_{x=101}^{n} P(x; 100)$$

$$= 0.47344$$

probability of more than 100 errors occourred $= 0.47344$

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