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Mid-term Paper

Method of probability in Engineering

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Answer No: 01

Part => (a)

Size of Sample Space = 6x6x6

As output in each roll = 6
and each output is independent of previous output so we will multiply 6 three time.
So
Size of Sample Space = 216

S = {111, 112 ..... 666}

Answer No: 01

Part => (b)

let x be for the third time

x = 1 => P = 0

n = 2 => (1, 1) => P = 1/216

n = 3 => (1, 2) and (2, 1)

P = 2/216

n = 4 => (1, 3), (3, 1), (2, 2)

P = 3/216

P e T f o

$n = 5 \Rightarrow (1,4), (4,1), (2,3), (3,2)$

$P = 4/216$

$n = 6 \Rightarrow (1,5), (5,1), (2,4), (4,2)$
$(3,3)$

$P = 5/216$

So

Total $P = (1+2+3+4+5)/216$

$\therefore P = 15/216$ Ans

Answer NO: 02

Given:

Total players = 9
Selected players = 3

Probability of two players = ??

Sol

We will use permutation concept for selection of two particular player.

P P 1 - P 0

$$^{3}P_{2} = \frac{3!}{(3-2)!} = \frac{3\times2\times1}{1}$$

$$^{3}P_{2} = 6$$

1st particuler player from 9 players = 1/9

2nd particuler player = 1/8

Total Probability = $^{3}P_{2} \times 1/9 \times 1/8 \times 1 = \frac{3!}{(3-2)!} \times 1/72$ Ans

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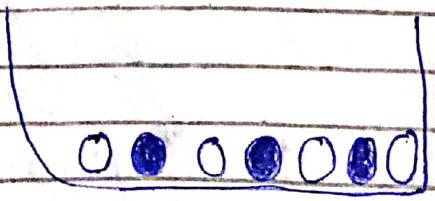
Answer NO ⇒ 3

Given:

Total balls = 8
white balls = 5
black balls = 4

Probability of two black balls = ??
P(B) = ?

Sol



P 4 T 4 0

$$P(\text{two black ball}) = \frac{{}^{5}C_2 \times {}^{3}C_2}{{}^{8}C_4}$$

$$P(B) = \frac{\frac{5!}{2!(5-2)!} \times \frac{3!}{2!(3-2)!}}{\frac{8!}{4!(8-4)!}}$$

$$P(B) = \frac{\frac{5!}{2!(3)!} \times \frac{3!}{2!(1)!}}{\frac{8!}{4!(4)!}}$$

$$= \frac{\frac{5\times4\times3!}{2!\times3!} \times \frac{3\times2!}{2!}}{\frac{8\times7\times6\times5\times4!}{4!(4)!}}$$

$$= \frac{\frac{20}{2} \times \frac{3}{1}}{\frac{8\times7\times6\times5}{4\times3\times2\times1}}$$

$$= \frac{20/2 \times 3/1}{70}$$

$$P(B) = \frac{30}{70}$$

$$\boxed{P(B) = 3/7}$$ Ans

Answer No = 04

a)

$n = 3 \quad K = 5$

Sample Space $= 3^5$

$= 243$

(b)

$P(a,a,a,a,a) = \left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)$

$= \left(\frac{1}{3}\right)^5$

$= \frac{1}{3^5}$ Ans

—— XO —— XO —— X

Answer NO = 05

Required:

$P(A|B) = ?$

$P(B|A) = ?$

Sol

If A & B are the events such that

$P(B) \neq 0$

then probability of A given B is,

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

As

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

$P(A \cap B) = 6/36$

$P(A \cap B) = 1/6$

Also

$P(B) = 6/36$

$P(B) = 1/6$

So

$$P(A|B) = \frac{1/6}{1/6}$$

$$\boxed{P(A|B) = 1}$$

Also

$$P(A) = \frac{21}{36}$$

$$P(A) = 7/12$$

Then

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

$$= \frac{1/6}{7/12}$$

$$\boxed{P(B|A) = 2/7}$$

Answer No = 06

Given:

Valid CNICs = 85%

driving licenses = 75%

both valid CNICs & driving licenses = 65%

%age of valid CNICs and valid driving license = ?

%age of valid driving licenses and valid CNICs = ?

Sol

let

A = the event that a randomly selected person was carrying valid CNICs.

B = person's carrying valid driving licenses.

∴ $A \cap B$ = event carrying both valid CNICs & driving licenses.

then

$P(A) = 85\% = 0.85$

$P(B) = 75\% = 0.75$

and

$P(A \cap B) = 65\% = 0.65$

∴ Probability that a person who was carrying a valid CNIC was also carrying a valid driving license.

= Probability of a person carrying a valid CNIC given that he was carrying a valid driving license.

$= P(A|B)$

$= \frac{P(A \cap B)}{P(B)} = \frac{0.65}{0.75}$

$= 0.87$ or **87%**

And Probability that a person carrying valid driving license was also carrying a valid CNIC

= Probability of a person carrying a valid driving license given that he was carrying a valid CNIC

$= P(B|A)$

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

$= 0.77$ (or) **77%**

Answer No ⇒ 07

Given:

Sources are A, B & C

Their Probabilities are.

$P(A) = 0.005$
$P(B) = 0.001$
$P(C) = 0.010$

Proportions of chips from A B and C are 0.5, 0.1 and 0.4.

Required:

Probability that manufacturer was A = ?

Probability that manufacturer was C = ?

Sol:

Probability that manufacturer was A.

let x denote that the event that the randomly selected chip is defective

A to be the event that the chip was manufactured by Company A.

Now event B & C Similarly.

So In this case we will find

$$P(A|x) = ? \quad \text{(use Bayes' Theorem)}$$

$$P(A|x) = \frac{P(x|A)\,P(A)}{P(x|A)\,P(A)+P(x|B)\,P(B)+P(x|C)\,P(C)}$$

Note: events A, B & C are mutually exclusive and exhaustive.

Now put values we get

$$P(A|x) = \frac{0.005 \times 0.5}{(0.005 \times 0.5)+(0.001 \times 0.1)+(0.010 \times 0.4)}$$

$$= \frac{0.0025}{0.0025+0.0001+0.004}$$

$$P(A|x) = \frac{0.0025}{0.0066}$$

$$= \frac{25}{66} \approx 0.3788$$

Hence

Required Approximate Probability = 0.3788

Probability that manufacturer was B.

Now here we will Compute P(C|X)

again use Bayes Theorems.

$$P(C|X) = \frac{P(X|C)P(C)}{P(X|A)P(A)+P(X|B)P(B)+P(X|C)P(C)}$$

$$= \frac{0.010 \times 0.4}{(0.005 \times 0.5)+(0.001 \times 0.1)+(0.010 \times 0.4)}$$

$$= \frac{0.004}{0.0025+0.0001+0.004}$$

$$= \frac{0.004}{0.0066}$$

$$P(C|X) = \frac{20}{33} \approx 0.6061$$

Hence

Required Approximate Probability

$$= 0.6061$$

The END