"Probability & Statistics"

— (Assignment-01) —

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~(Question-1)~

The table below shows the results of a study in which researches examined a child's IQ and the presence of a specific gene in the child. Find the Probability that the child has a high IQ, given that the child has the gene

	Gene Present	Gene not present	Total
High IQ	33	19	52
Normal IQ	39	11	50
Total IQ	72	30	102

using the conditional Probability formula

$$P(\text{High IQ} \mid \text{Gene present}) = \frac{P(\text{High IQ and Gene present})}{P(\text{Gene Present})}$$

$P(\text{High IQ and Gene present}) = 33$

$P(\text{Gene present}) = 72$

$$P(\text{High IQ} \mid \text{Gene present}) = \frac{33}{72}$$

$= 0.4583$

(45.83%)

Probability of the child having having High IQ with their Gene's present

$= 45.83\%$

~(Question-2)~

In a Jury selection pool, 65% of the people are female. Of these 65%, one out of four works in a health field.

1. Find the probability that a randomly selected person from the jury pool is female and works in a health field.

2. Find the probability that a randomly selected person from the jury pool is female and does not work in a health field.

- The probability of being female is 65% or 0.65
- Given that someone is a female, the probability of working in a health field is 1 out of 4, $\frac{1}{4}$

Probability of being female and working in a health field:

$$P(\text{Female \& health field}) = P(\text{Female}) \times P(\text{Health field} \mid \text{Female})$$
$$= 0.65 \times \frac{1}{4}$$
$$= 0.1625 = (16.25\%)$$

Probability of being female and not working in a health field:

$$P(\text{Female and Not health field}) = 0.65 - 0.1625$$
$$= 0.4875$$
$$= (48.75)\%$$

~(Question-3)~

A blood bank catalogs the types of blood, including positive or negative Rh-factor, given by donors during the last five days. The number of donors who gave each blood type is shown in figure. A donor is selected at random.

1- Find the probability that the donor has the type O or type A blood.

2- Find the probability that the donor has the type B-blood or is Rh-negative

		Blood TYPE				
		O	A	B	AB	total
Rh-factor	Positive	156	139	37	12	344
	Negative	28	25	8	4	65
	total	184	164	45	16	409

i- **Probability that the donor has type O or type A :**

$$P(\text{Type O}) = \frac{\text{Number of Type O donors}}{\text{Total}} = \frac{184}{409} = 0.4498$$

$$P(\text{Type A}) = \frac{\text{Number of Type A donors}}{\text{Total}} = \frac{164}{409} = 0.40097$$

$$P(\text{Type O}) + P(\text{Type A}) = 0.04498 + 0.40097$$
$$= 0.85077$$
$$= (85.077)\%$$

ii- **Probability that the donor has type B blood or Rh-negative:**

$$P(\text{Type B}) = \frac{45}{409} = 0.11002$$

$$P(\text{Type Rh-negtive}) = \frac{65}{409} = 0.15892$$

$$P(\text{Type B} \cap \text{Type Rh-negative}) = 8/409 = 0.0195$$

$$P(\text{Type B}) + P(\text{Type Rh-negative}) - P(B \cap \text{Rh-neg}) = 0.11002 + 0.15892 - 0.0195$$
$$= 0.26894 - 0.0195$$
$$= 0.24939$$
$$= (24.93)\%$$

~(Question 4)~

There are 16 students giving final presentation in your history course.

a) Three students present per day. How many presentation orders are possible for the first day

b) Presentation subjects are based on the units of the course. Unit B is covered by three students, unit C is covered by 5 students. Unit A and D each are covered with four students each other.

a) Possible presentation orders:

$n = 16$

$r = 3$

$^nP_r = \dfrac{n!}{(n-r)!}$

$^{16}P_3 = \dfrac{16!}{(16-3)!} = \dfrac{(16 \times 15 \times 14 \times \cancel{13})!}{\cancel{13}!}$

$= 16 \times 15 \times 14 = 3360$ ways

b) Presentation subjects:

$n = 16$

formula $= \dfrac{n!}{n_1!\, n_2!\, n_3!\, n_4!}$

$= \dfrac{16!}{4!\,3!\,5!\,4!}$

$= 50,450,400$

~ (Question 5) ~

Rotator coff surgery has 90% chance of success. The surgery is performed on three patient find the probability of surgery being successful on exactly two patients.

$n = 3$

$p = 0.9$

$q = 1 - p = 0.1$

$x = 2$

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

$= {}^3C_2 \, p^2 q^1$

$= {}^3C_2 \, (0.9)^2 (0.1)$

$= 3 \times 0.81 \times 0.1$

$= 0.243$

$= (24.3)\%$