AI1103 Assignment-1

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QUESTION

Suppose that 90 % of people are right handed. What is the probability that at most 6 of a random sample of 10 people are right handed?

SOLUTION

One can either be 'right' handed or 'left' handed. Given that 90 % of the population is 'right' handed and since being 'right' handed and being 'left' handed are mutually exclusive,

- Probability of 'right' handed = $\Pr(R) = \frac{9}{10}$
- Probability of 'left' handed = $\Pr(L) = \frac{1}{10}$

One can use binomial distribution to find out the probability that more that 6 people are 'right' handed.

Let X be a variable representing number of people who are 'right' handed in a given sample. Picking different number of people is an example of a Bernoulli trial.

So X has a binomial distribution :

$$\Pr(X = y) = \binom{n}{x} * (l)^{n-y} * (r)^y \qquad (0.0.1)$$

Where

- n = Total number of people = 10
- l = Probability that a person is 'left' handed = $\frac{1}{10}$
- r = Probability that a person is 'right' handed = $\frac{9}{10}$

So,

$$\Pr(X = y) = \binom{n}{y} * \left(\frac{1}{10}\right)^{n-y} * \left(\frac{1}{10}\right)^y \qquad (0.0.2)$$

Pr(at most 6 are right handed) = $\Pr(X \leq 6)$
$\implies$ 1 - $\Pr(X \geq 7)$
Since

$$\sum_{X=1}^{10} Pr(X) = 1) \qquad (0.0.3)$$

Thus, we can write:

$$1 - \Pr(X \geq 7) = 1 - \sum_{X=7}^{10} \Pr(X) \qquad (0.0.4)$$

$$\implies 1 - \sum_{y=7}^{10} \binom{10}{y} * 0.1^{10-y} * 0.9^y \qquad (0.0.5)$$

$$\implies 1 - \binom{10}{7} * 0.1^3 * 0.9^7 - \binom{10}{8} * 0.1^2 * 0.9^8$$
$$- \binom{10}{9} * 0.1^1 * 0.9^9 - \binom{10}{10} * 0.1^0 * 0.9^{10}$$
$$(0.0.6)$$

$$\implies \Pr(X \leq 6) = 0.012795198$$

Thus the probability that at most 6 people are 'right' handed out of a random sample of 10 is 0.012795198