Assignment 1

AI1110: Probability and Random Variables
Indian Institute of Techonology Hyderabad

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Question 13.2.12:

1) **Problem Statement**

A die is tossed thrice. Find the probability of getting an odd number at least once.

Solution

Given:

We are given that the die is tossed thrice.

Need to find:

Probability of getting an odd number at least once in the three trials.

Solving steps:

Let X be a random variable defined as the number of odd number occurrences in three trials. Possible values of random variable X are;

$$X = \{0, 1, 2, 3\} \tag{1}$$

Required values of X are;

$$X = \{1, 2, 3\} \tag{2}$$

which correspond to at least one odd number. Probability of an observation being odd is;

$$p = \frac{3}{6} = \frac{1}{2}$$

We know that;

$$P(X = i) = {}^{n}C_{i} \times p^{i} \times (1 - p)^{(n-i)} \tag{3}$$
$$where\ n = 3\ and\ i \in \{0, 1, 2, 3\}$$

On solving;

$$P(X = 1) = {}^{3}C_{1} \times \left(\frac{1}{2}\right)^{1} \times \left(\frac{1}{2}\right)^{(3-1)} \tag{4}$$

$$P(X = 1) = \frac{3}{8}$$

$$P(X = 2) = {}^{3}C_{2} \times \left(\frac{1}{2}\right)^{2} \times \left(\frac{1}{2}\right)^{(3-2)} \tag{5}$$

$$P(X = 2) = \frac{3}{8}$$

$$P(X = 3) = {}^{3}C_{3} \times \left(\frac{1}{2}\right)^{3} \times \left(\frac{1}{2}\right)^{(3-3)} \tag{6}$$

$$P(X = 3) = \frac{1}{8}$$

Required probability of at least one odd observation is equivalent to sum of P(X=1), P(X=2) and P(X=3). Therefore, probability of at least one odd observation is;

$$\therefore \Pr(At\ least\ one\ odd) = \frac{7}{8} = 0.875 \tag{7}$$

Conclusion

The probability of getting an odd number at least once is 0.875 as also calculated using the python code. [1]

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References

[1] https://github.com/Gunethra/AI1110_2023/tree/master/code.