

Assignment 2

AI1110: Probability and Random Variables
Indian Institute of Technology, Hyderabad

Gunethra Bommineni*

10.15.1.12 A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 (see Fig. 4), and these are equally likely outcomes. What is the probability that it will point at:

- (i) 8?
- (ii) an odd number?
- (iii) a number greater than 2?
- (iv) a number less than 9?

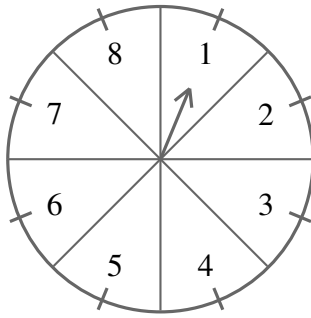


Fig. 4. Spinner

Solution: Let X be a random variable defined as the value given by the pointer. The distribution is uniform since all the outcomes are equally likely.

$$\therefore \Pr(X = i) = \frac{1}{8} \quad (1)$$

Let $F_X(i)$ be the Cumulative distribution function(CDF) such that;

$$F_X(i) = P(X \leq i) \quad (2)$$

$$= \begin{cases} 0, & i \leq 0 \\ \frac{i}{8} & 1 \leq i \leq 8 \\ 1, & i \geq 9 \end{cases} \quad (3)$$

See python code for PMF and CDF plots: [1]

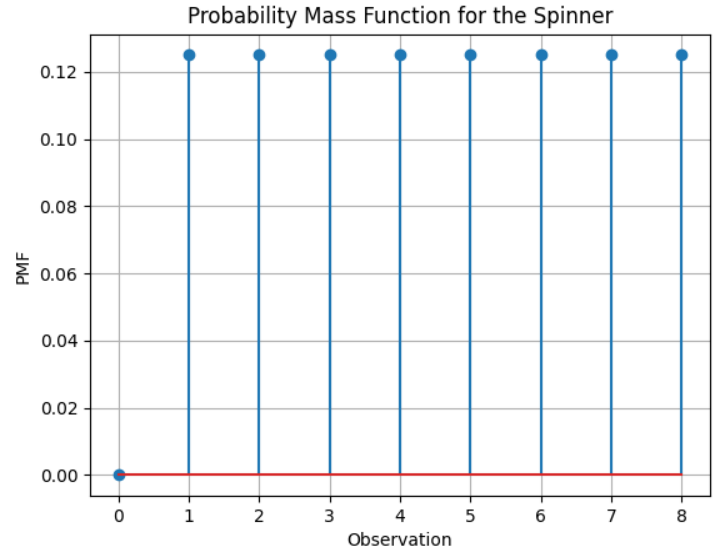


Fig. 4. Plot of Probability Mass Function

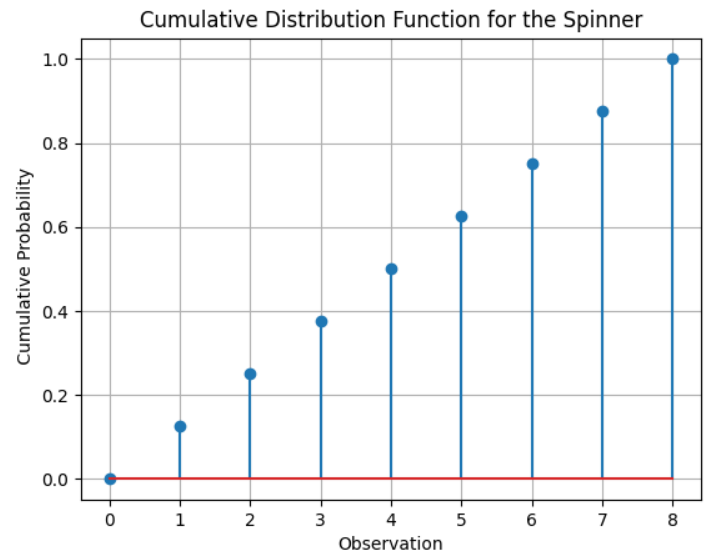


Fig. 4. Plot of Cumulative Distribution Function

*The student is with the Department of Electrical Engineering, Indian Institute of Technology, Hyderabad 502285 India e-mail: ee22btech11205@iith.ac.in.

(i) For $i = 8$, required probability is equivalent to;

$$\Pr(X = 8) = \frac{1}{8} \quad (4)$$

$$= 0.125 \quad (5)$$

(ii) For i being odd, required probability is equivalent to;

$$\Pr(X = \{1, 3, 5, 7\}) = \frac{4}{8} \quad (6)$$

$$= 0.5 \quad (7)$$

(iii) For i greater than 2, required probability is equivalent to;

$$\Pr(X > 2) = 1 - \Pr(X \leq 2) \quad (8)$$

$$= 1 - (F_X(2) - F_X(0)) \quad (9)$$

$$= \frac{6}{8} = 0.75 \quad (10)$$

(iv) For i less than 9, required probability is equivalent to;

$$\Pr(1 \leq X < 9) = F_X(8) - F_X(0) \quad (11)$$

$$= \frac{8}{8} = 1 \quad (12)$$

See simulation using python: [2]

REFERENCES

- [1] https://github.com/Gunethra/AI1110_2023/tree/master/Assignment_2/code/pmf.py
https://github.com/Gunethra/AI1110_2023/tree/master/Assignment_2/code/cdf.py.
- [2] https://github.com/Gunethra/AI1110_2023/tree/master/Assignment_2/code/code.py.