11.16.3.3.3

EE24BTECH11030 - KEDARANANDA

Question:
A die is rolled, Find the probability that a number greater than or equal to one will appear
Solution:
Textual solution:
The probability of a given event 'A' (A: Outcome is greater than or equal to 1) can be calculated as follows:

$$\text{P(A)} = \frac{\text{Number of favorable outcomes}}{\text{Total possible outcomes}} \tag{0.1}$$

Since all outcomes on a standard die $(1, 2, 3, 4, 5, 6)$ are greater than or equal to 1, all outcomes are favorable.

$$\text{P(A)} = \frac{6}{6} = 1 \tag{0.2}$$

Computational solution:

Introduction

This document describes a computational experiment where a six-sided die is rolled 10,000 times. The outcomes are stored in a shared file, and Python is used to analyze these outcomes. The analysis calculates the probabilities of specific results ($\geq 1, = 1, = 2, = 3, = 4, = 5, = 6$) and visualizes the probabilities using a stem plot.

The workflow consists of two main parts:

- Generating random die rolls using a C program and storing the results in a file.
- Analyzing and plotting the probabilities using Python.

C Code Description

The C program is responsible for simulating 10,000 rolls of a six-sided die. It utilizes the `rand()` function to generate random numbers between 1 and 6. These outcomes are then written to a file named `outcomes.so`.

Key features of the C program:

- The random number generator is seeded using the current time to ensure variability in results.
- A loop runs 10,000 iterations to generate the required number of outcomes.
- Each generated outcome is written line by line to the output file.

The file `outcomes.so` serves as a bridge between the C and Python programs, enabling the latter to perform statistical analysis on the data.

Python Code Description

The Python program reads the outcomes stored in `outcomes.so`, calculates probabilities for specific outcomes, and visualizes the results using a stem plot.

Key steps in the Python program:

- Read the data from `outcomes.so` and store it in a list.
- Calculate the probability of each outcome ($\geq 1, = 1, = 2, = 3, = 4, = 5, = 6$) by counting occurrences and dividing by the total number of outcomes.
- Use the Matplotlib library to create a stem plot where:
  - The x-axis represents the outcome categories ($\geq 1, = 1, = 2, = 3, = 4, = 5, = 6$).
  - The y-axis represents the probabilities, ranging from 0 to 1.

The stem plot provides a clear visualization of the distribution of outcomes, making it easy to interpret the results.

Graphical Output

The graphical output consists of a stem plot that shows the probability distribution of the die roll outcomes. The probabilities are calculated based on the 10,000 simulated rolls.

Key observations from the plot:

- The probability of ≥ 1 is always 1, as all outcomes are between 1 and 6.
- The probabilities for $= 1, = 2, = 3, = 4, = 5, = 6$ are approximately equal, reflecting the fairness of the die.

The stem plot serves as a visual summary of the experiment, highlighting the uniform probability distribution of a fair six-sided die.

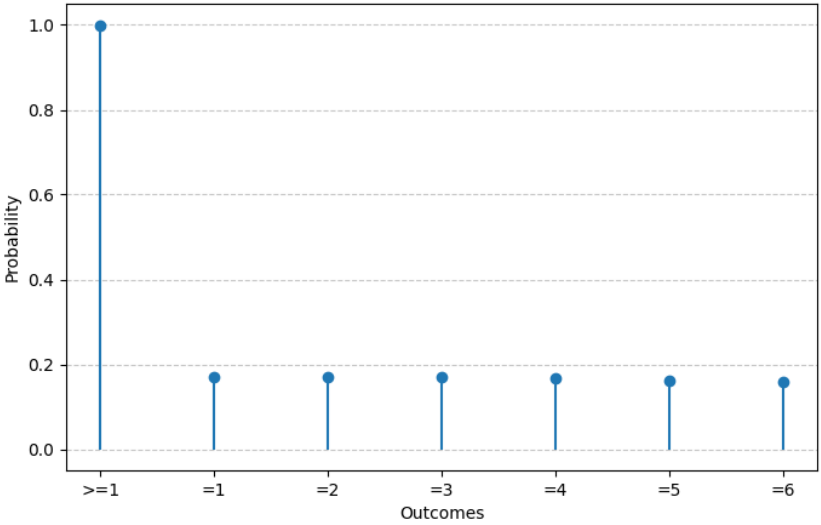

Fig. 0.1: Solution of the system of linear equations