Experiment 1

Report

1. List 5 practical applications for Bernoulli random variables.
2. Explain Relation between Bernoulli and Binomial random variable.
3. Using answers of mean and variance in 4(c), how will you identify the computing resources for your server requires.
4. Explain practical significance of the findings in 7.
5. Write an algorithm (in the form of steps) for the performed experiment.

Answer 1:

* Coin toss outcomes
* Defective v/s non defective product in manufacturing
* Success/failure in clinical trials
* Packet arrival in networking
* Customer purchase decision (buy/not buy)

Answer 2:

A Bernoulli random variable models a single trial (success/failure)

A Binomial random variable is the sum of multiple independent Bernoulli trials, giving the total number of successes in ‘n’ experiments

Answer 3:

Using Ti = 5,  t = 0.01 => n = 500T

For p = 0.4: E[X] = np = 200,  Var(X) = np(1−p) = 120,  SD = 10.95

Provision baseline capacity for ~200 concurrent requests

Set the buffer to E[X] + 3 \* SD = 233 (250 for safety)

Absolute theoretical max = 500

Multiply these request counts by per-request CPU/memory to size servers

Answer 4:

As ‘n’ increases, the error between Binomial and Poisson distributions decreases. This validates that for large ‘n’ and moderate ‘p’, the Poisson model (λ = np) approximates the Binomial well. Practically, it allows replacing computationally heavy Binomial calculations with simpler Poisson models to predict server requests efficiently.

Answer 5:

* Define ‘n’ & ‘p’ for Bernoulli/Binomial trials
* Simulate random variables using R functions
* Compute probability mass functions
* Calculate mean and variance
* Compare Binomial with Poisson approximations
* Plot results and error v/s n
* Interpret findings for server resources