LECTURE #9
QUEUEING SIMULATION

204528
Queueing Theory and Applications in Networks

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SimPy

https://simpy.readthedocs.io/en/latest/index.html

- A process-based discrete-event simulation framework
- Based on standard Python
- Processes are defined by Python generator functions
  - To model active components
  - E.g. customers, vehicles or agents.
- Provides various types of shared resources
  - To model limited capacity congestion points
  - E.g. servers, checkout counters and tunnels
- Simulations can be performed “as fast as possible”

SimPy

Discrete event simulation for Python

News | PyPI | Bitbucket | Issues | Mailing list

Overview

SimPy is a process-based discrete-event simulation framework based on standard Python.

Processes in SimPy are defined by Python generator functions and may, for example, be used to model active components like customers, vehicles or agents. SimPy also provides various types of shared resources to model limited capacity congestion points (like servers, checkout counters and tunnels).

Simulations can be performed "as fast as possible", in real time (wall clock time) or by manually stepping through the events.

Documentation

Tutorial

learn the basics of SimPy in just a couple of minutes

Topical Guides

guides covering various features of SimPy in-depth

Examples

usage examples for SimPy

API Reference

M/M/1 Simulation

- Queueing Simulation
  - M/M/1 queue system
- The code and assignment are taken from [1]
  - Computer Networks ECS 152A Fall 2017, University of California, Davis
- https://www.coursehero.com/tutors-problems/Computer-Science/11225092-Simulation-of-a-Single-Server-Finite-Buffer-Queue-and-Simulation-Analy/

HW #1

- Walk through SimPy's tutorial

HW #2

- Packets arrive following a Poisson process
- Rate λ packets per seconds (pkts/sec)
- Packets are of variable length and transmitted on the link of rate R bps.
- Assume that the effective service time of a packet is negative exponentially distributed with rate parameter μ pkts/sec
- Assume that $\mu = 1$ pkts/sec
- The buffer size = B packets
- You are required to write a Python code using SimPy to simulate the above system
- Here are the following steps:

HW #2

1. Run the given code for different values of

   λ= 0.2,0.4,0.6,0.8,0.9,0.99 pkts/sec
   * Obtain the mean delay
   * Make a table the compares the simulated value with the theoretical value
   (using the formula that we had derived in class)
2. Using the Markov Chain method derive the packet loss probability Pd as a function of buffer size B packet, arrival rateλpkts/sec, and service rate μ pkts/sec.
3. Modify the given simulation code to simulate a finite buffer system with buffer size B.

   For λ=0.2,0.4,0.6,0.8,0.9,0.99 and B= 10,50, using the simulation, determine the packet loss probability Pd.
4. Compare the above results using the theoretical formula derived in Step 2.