Course Project Guidelines

Course Project

- There are four aspects to this project

1. A basic M/M/1 queue project
2. A basic M/G/1 queue project
3. A basic M/M/c/N queue project
4. A network of Queues

- Students can choose any language/tool of their choice to implement these. It would be easy to do in JMT. If you have any other project ideas that you want to try out let me know.
- Students work individually and submit reports

Basic M/M/1 Project

- This project studies M/M/1 system in detail
- The following will be studied in detail:
  - Performance metrics L, L_Q, w, w_Q, ρ
  - Statistics collection for inter-arrival and service time distributions
  - Testing of Random number generator used
  - Collection of system state histogram and compare it with theory
- Run the simulations for ρ = 0.1 to 0.80 in steps of 0.1
- Assume service is set to a mean value of 1.0 and vary arrival rate for the given ρ
- Compare the above metrics with theoretical values

Basic M/G/1 Queue

- Change the service distribution to a general one of your choice and repeat the simulation. This will be M/G/1 queue model.
- Compare the above metrics with M/G/1 analysis.
- Service Distribution choices (pick one)
  - Uniform (0,2) mean = 1.0
  - Normal with mean = 1.0 and Standard Deviation=1.0
  - Any other that the tool may allow.

Basic M/M/c/N system

- This project studies M/M/c/N system in detail
- Choose a value for c (between 3 to 5) and a value for N (between 15 to 20)
- Run the simulations for utilization values of 0.1 to 0.8 in steps of 0.1
- Compare the Performance metrics L, L_Q, w, w_Q, ρ with theoretical values and probability of loss.
- Study the loss behaviour (probability of loss) of this system.

Network of Queues

- A simple network of 3 queues. Traffic enters the first queue, then splits into two streams with a p%, (1-p)% split, each stream entering a separate queue. Choose any value of p between 20 to 40.
- Performance study is total response time for each stream.
- Assume service is set to 1.0 for all servers
- Run the simulations for utilization values of 0.1 to 0.8 in steps of 0.1

Projects

The single queue model can equivalently be thought of as a simulation of:

- Bank Teller, Supermarket Cashier, Airline counter, Runway access, Assembly line, E-mail server, Database server, Computer System

Multi-queue model can equivalently though of expansion of the chosen system with functionality divided into sub-systems.

*Please pick any one example for your pr*oject

Simulations

- Make sure you run the simulations long enough to produce enough data
- For each run, collect the stats of server utilization, average number of customers in the system, average number of customers in the queue, average time spent in the system, average time spent in the queue.
- Compute confidence intervals for each of these metrics
- No group work. All students work independently.
- **Project report due by Dec 8.**

Report

- Write the report in the following format:
  - Problem (Project) Description.
  - The problem mapping to each of the queuing models
  - Simulation goals and Simulation parameters
  - Methodology:
    - What tools did you use to translate the model?
    - How did you setup the simulations?
    - How did you collect the stats?
  - Analysis
    - Report the collected statistics including confidence intervals using graphs and tables. Just giving large number of tables is not good enough.
    - Compare them with theoretical results
  - Conclusion
    - Summarize your results. Is there any discrepancy between simulated results and theory?
  - Make sure your report is not huge (a max 20 to 25 pages).

Alternates possible

- In case you have some other thoughts and want to conduct simulations of a problem you know of, please let me know and we can talk more about it.

Extended Queuing Project for CSC 546

- This is for CSC 546 students only
- Instead of M/M/c/N model, extend the basic system to incorporate any of the following:
  - Three queue priority system
  - Three queue round-robin system
  - Three queue Weighted Fair Queuing system
- Compare the simulations with analysis. You can refer to any internet resource for extended queues (such as WFQ, Priority).