CS 4830/6830
Final Project

Identify a real system that is of some interest to you (and your partner). Pose a question about the behavior or structure of the system and then develop a system simulation program to address the question. The goal of this project is to apply the techniques described in class and in the textbook to the task of developing a complete simulation project.

A good project will consist of the following items.

1. A well-defined question that can be answered using a computer simulation.

2. A clear description of the real system that is being investigated. This should include a description of the major components of the real system and their basic interactions. Also, remember to clearly state any assumptions that are made about the structure or behavior of the system.

3. A model should be specified that describes the relationship among the state variables, input variables, output variables, and parameters that are relevant to the question being addressed. Keep the model as abstract as possible. Do not include extra features that are not needed to address the question.

4. Gather data (if appropriate) to formulate input distributions. Use theoretical distributions if they are consistent with the system you are studying. Set the parameters of the distribution using data gathered from the real system. Alternatively, build empirical distributions using data gathered from the real system. In either case, try to gather extra data that can be used to validate the model.

5. Implement the model in SimPy (other languages allowed with instructor approval).

6. If possible, attempt to validate the model using data gathered from the real system.

7. Conduct a series of experiments to address the question you have posed. Make sure to perform enough experiments so that the results are statistically significant.

8. Analyze the results and prepare a short report (< 10 pages) that motivates the problem, describes the system, reports the results, and presents the conclusion(s).

9. Prepare a short presentation (~10 minutes) consisting of 8-10 transparency that describes the question, system, and results. Presentations will be made during the last week of class.

10. On the last day of class, submit the report, a listing of the source code, and the slides that you use in your presentation to the dropbox.

This project is worth 40% of your total grade. You will receive two grades, one for the simulation project (35%) i.e. model, data collection, simulation software, experimental design, analysis, and

report, and one for the presentation (5%). **Prior to starting your project, you must submit a short description of your project for approval.**

Sample Projects

(A) The Russ Engineering Building is famous for its slow elevators. The elevators appear to operate on demand. In other words, when a user presses the button on any floor, if one of the elevators is available it travels to the requested location. Once the last person leaves the elevator, it remains parked on the floor until another call button is pressed.

Question: Could a different scheduling strategy be applied to the elevators in the Russ Building to reduce the average waiting time?

For example:

- Idle elevators always travel to the first floor.
- One elevator always returns to the first floor and the other moves to the top floor when not in use.
- One elevator only travels up (sequence of floors 1-2-3-4-1 etc.) the other only travels down (4-3-2-1-4 etc.)

(B) Most fast-food restaurants have an electronic order station and one or two staffed windows. One window is staffed by a person who takes orders and collects payments. The other window is staffed by a person who dispenses food.

Question: What criteria should be applied to decide if a restaurant should use the one-window or two-window strategy?

(C) Most fast-food restaurants allow customers to order food outside or go inside to order food.

Question: When the restaurant is busy, is it faster to go inside a restaurant or go through the drive-through window?

(D) Many large grocery stores have installed self-checkout counters where a customer can scan and bag their groceries.

Question: Is it faster to ring up your order or go through the express line where a trained cashier rings up the items?

(E) Traffic patterns (i.e. dedicated turn lanes, one-way streets, roundabouts, etc.) and traffic signals (signs, lights) are often interesting problems. Pick your favorite "bad" intersection and try to determine whether some modifications to the lanes or the traffic signals improve the system.

(F) Define your own project! These are usually the most interesting projects.