CSE/ECE 6730 Project 1: Pedestrian Traffic After a Football Game

Due Dates:

- Project Checkpoint: due: 11:59 PM, Friday, February 5, 2016
- Final Report: 11:59 PM, Friday February 26, 2016
- Poster: in class, Friday, February 26, 2016

Problem Statement

This project involves completing a modeling and simulation study in order to develop and evaluate a strategy to manage the egress of people from the area around Georgia Tech's Bobby Dodd Stadium after a football game. A major focus of the project will concern the development of a computer simulation of *pedestrian* traffic (no vehicles) leaving the area. You need not simulate movements within the stadium, although you will have to develop a model of people leaving the stadium exits that will "drive" your simulation of the surrounding area. You should assume the stadium is at or near full capacity when the game ends.

You will need to develop a plan for efficiently moving people after the game. This strategy should try to minimize the total amount of time required to move people out of the area. Your plan will likely involve closing certain streets around the stadium, and routing people to leave the area. You can assume people leaving the stadium will be walking to nearby parking lots, dormitories, or the MARTA station to leave the area. You will need to derive estimates of where people are trying to walk to after the game.

You should model individuals (as opposed to aggregated flows) in your simulation. Specifically, you should use a cellular automata model for pedestrian movement. You must identify and review the relevant literature applicable to developing such a model. You should incorporate behavioral aspects of individuals in your model that you think are important.

The simulation must be stochastic, i.e., it must use random numbers to model unpredictable or unknown elements of the system. You will need to identify the places where randomness is appropriate to use in the model, and document this in the final report.

You will need to determine what data you need, and collect and incorporate these data into the simulation model. For example, you will need to determine the maximum flow rate of people leaving each exit. You could determine estimates by measuring the maximum flow of people exiting a building (e.g., a building on campus after a class) as an example to estimate traffic leaving the stadium through each exit, and use these data in your simulation model.

You will need physical dimensions of the streets and sidewalks in the area. Use google maps to estimate these dimensions. You should assume pedestrians stay on sidewalks and obey traffic signals (clearly a simplification!). You may assume some of the smaller roads around the stadium may be closed to vehicle traffic after the game in constructing your strategy, but major streets such as North Avenue should remain open to vehicle traffic. You need not model vehicles in your simulation.

As is the case of many simulation projects, many details of the model are left unspecified. For example, you will need to determine what areas outside the stadium your simulation model will cover. All modeling and simulation projects are constrained by the time and resources available to complete the study. This project is no different and will require you to make simplifying assumptions. You should be aware of your assumptions and simplifications, document them, and justify your decisions in your report.

Software

You may use any high level programming language to implement your simulator (C, C++, Java, Python, etc.). The simulator must involve the development of software for the model. You should build the simulator "from scratch." You may not utilize existing simulation software for the project, however, you are free to use software components (e.g., data structures) you developed for other projects or found on the web. All such software imported to your project must be clearly identified in the software files and their use documented in written reports. Every student in each team is expected to be responsible for some software development. Each team includes a mix of individuals with different amounts of coding experience. Members with more experience are expected to help those with less (but not write the code for other team members!).

The software must be developed in a modular fashion, with well-defined, documented interfaces. For example, the software must include a random number generator developed by someone in your team (you may *not* use an existing generator) for required probability distributions. Your software should also include test "driver" programs as needed to verify correct operation of library modules. The validity of random number generators must be verified using appropriate statistical tests.

Teams and Deliverables

You will work in teams of three or four students. You will need to develop a plan to divide up this task among team players. One person in your team must be designated as the lead who will have the responsibility for organizing the team, scheduling meetings, etc.

Your grade will be based on the following items that must be turned in:

- *Project checkpoint*. The checkpoint should include the problem description (a more detailed version of the description here), literature review, conceptual model, and an initial simulation model. You should have an initial operational simulation, though it may not be the final model used in the project. These should be written up, and turned in. Results of your literature review and appropriate citations must also be included. The project checkpoint represents a large portion of the work on the project. You will add to this document to complete the final report.

- *Software implementation and data*. Source code for all software in your simulation must be turned in with the project checkpoint and final report. In addition to the actual code, the software deliverable must include documentation that you have verified the validity of your random number generator. Any data collected and used in the project should also be included.

- *Poster session*. You will present your project in a poster session conducted in class, at which time each person on the team should be prepared to give a concise (5 minute) presentation of the entire project completed by the team, and be prepared to answer questions.

- *Final report*. The final report includes all documentation for the simulation study. All work you completed for the project must be documented in this report. It should document your work in all steps of the modeling and simulation life-cycle discussed in class. The source code for your simulator as well as data files must also be provided. The final report should be self-contained.

Distance Learning Students

Distance learning students have the option to work with other DL students or individually. If you are working on the project on your own, you will complete a simpler version of the project. Specifically, you will model the egress from one exit of the stadium and simulate dispersion of people from that exit. We will assume you will be working individually, but if you would like to form a team, please email the instructor. DL students working individually will not participate in the Friday discussion sessions; other arrangements will be made for DL teams. Deadlines are 1 week later than that indicated above.

Final Comments

This simulation problem is, by design, open-ended. A detailed, realistic study would require much more time than what is allowed here. While you will be expected to do some data collection, clearly you will not have all the information you need, and many assumptions and approximations will have to be made. Nevertheless, time constraints and missing important information are the reality in all real world studies. Do the best you can, but be sure you are conscious of and document the limitations and assumptions you make in completing this study.