

**CS3151 Data Structures and Discrete Mathematics I**  
**Assignment 5**  
**Due: 11:55pm, Friday, April 12, 2013**

**Learning Objectives**

- Model a problem using heaps and priority queues.
- Design, implement, test, and debug a program in an object-oriented programming language.

**Sizing a Parking Lot**

The owner of a new restaurant wants to determine the number of parking spaces for the restaurant's parking lot. Based on data of similar restaurants at comparable locations, the owner anticipates that a car arrives every 5 to 10 minutes between 11am to 1pm, every 10 to 30 minutes between 1pm and 5pm, and every 2 to 10 minutes between 5pm and 9:30pm. The restaurant does not serve any customers that arrive between 9:30pm and 11am. A parked car that arrives before 2pm leaves after 20 to 35 minutes. A parked car leaves after 20 to 60 minutes if it arrives between 2pm and 5pm and after 30 to 60 minutes if it arrives after 5pm. Customers that arrive short before the closing time at 9:30pm are allowed to stay until they have finished their meal.

If more than 90% of the parking spaces are occupied, there is a 20% chance that an arriving car does not find an empty parking space (possibly, because the driver overlooks a free space or because some car occupies two spaces) and thus will leave without parking.

You can assume that all given data is uniformly distributed. For example, if a car arrives every 10 to 30 min, then it is equally likely that car arrives 10 or 11 or 12 or ... or 30 minutes after the arrival of an earlier car.

The owner of the restaurant wants to size the parking lot so that every customer will find a parking space. Specifically, at most 1% of arriving cars should leave without finding a parking space. However, in order to save costs, a minimum number of parking spaces should be built.

**Task**

1. Download the bank or ice cream parlor simulation. Note that the `add` method of class `Heap` is not correctly implemented. Correct the method.
2. Use the ice cream parlor or bank simulation as a template to implement the parking lot simulator. Note that the ice cream parlor situation is closely related to the given problem in respect to its design.
3. Experiment with different parking lot sizes. Determine an optimum number of parking spaces by running the simulation with different parking lot sizes.

## Submission

The following files have to be submitted:

- The documentation that includes
  - a description of the simulation design. For example, describe the type of occurring events.
  - a description of the conducted tests and the optimal number of parking spaces that you have determined. For example, name the different parking lot sizes you tried, for how many (simulated) days you ran the simulation, etc.
- The eclipse project that contains all files with the source code necessary to compile and run your solution.

## Grading

You can receive up to 60 points on this assignment. The assignment is weighted the same as the first two assignments together. Points will be assigned as follows:

- Implementation of method add in class Heap: 25%
- Implementation of Simulation: 25%
  - Simulation framework
  - Choice of events
  - Processing of events
- Documentation: 10%
  - Description of simulation
  - test runs including resulting parking lot size

A solution that cannot be compiled will receive 0 points.