

# Ethan's Car Wash

Project 5 150 points

**Due Tuesday November 25**

(20 point bonus if submitted Thursday November 20)

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This project may be done in pairs, but the pairs cannot be the same as on any other project, including the final project. Submissions that otherwise are very similar will be given an automatic 70 point deduction. In particular, if more than 15 lines of code are identical or very similar to the code of another student, 70 points will be automatically deducted from both students.

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Ethan's Car Wash has decided to do a study of their business, which they believe has not been as good as they would have liked. Based on some data they have obtained, they assume the following:

- Customers arrive at the car wash in random integer intervals of 1 to 6 minutes. That is, when a customer arrives, the next customer will arrive in the next 1 to 6 minutes.
- Customers are served in random integer intervals of 2 to 5 minutes. That is, when a car is actually washed, it will take anywhere from 2 to 5 minutes to finish depending on the level of wash that was selected.
- The car wash can only hold up to 4 cars waiting to be serviced. If a customer arrives and there are 4 cars waiting, the customer will have to bypass the car wash.

Ethan wants a program to implement a car wash simulation as follows:

**1. Initialization:**

- a. Read in the number of hours and number of minutes for the car wash shift.
- b. Read in the number of customers waiting in line when the car wash opens.

**2. For each minute of the shift:**

- a. If the time matches the next customer's arrival time
  - Print a message that a customer has arrived
  - Enqueue the customer's arrival time if there are less than 4 cars waiting
  - Schedule the arrival time for the next customer (in the next 1 to 6 minutes)
- b. If the time is the next customer's service time (i.e. the car wash is free)
  - Print a message that a customer has started service
  - Dequeue the customer's arrival time
  - Calculate this customer's wait time
  - Determine this customer's service time (2 to 5 minutes) and
  - Calculate this customer's completion time (thus when a new customer can begin service).

**3. At the completion of the shift, report the following information:**

- a. Total number of customers served
- b. Number of minutes the car wash was idle
- c. Average wait time
- d. Longest wait time
- e. The number of customers that bypassed the car wash

Ethan wants the program to simulate service for a shift of 8 hours (480 minutes), and of course, see the output. The service line must be implemented as a queue that will contain the customer's arrival time (in minutes from the start of the 8 hour period). You must define *your own class* to implement a queue.

Ethan requires that the program be implemented with a GUI. A very simple GUI will suffice. You may append all output to a simple JScrollPane, and use three JTextField's, one for input of the hours, one for input of the minutes, and one for the input of the number of cars waiting when the car wash opened.

For testing the program, use a much smaller time period (say 60 minutes), and consider printing a message when a customer arrives, step 2a, and when a customer's car has started being serviced, step 2b.

For this project, you need to submit a printed version. See the posted file [Printed Submission of Projects.pdf](#)