

1. Assume that you have a barbershop with 100 customers that will at some time want to enter one time to get a haircut. There are 3 barbers each of whom can act as a cashier when the haircut is finished. Using *semaphores, mutexes, condition variables*, coordinate this problem according to the following conditions:
  - a. Assign each of the customers a customer number.
  - b. Simulate customers, barbers, and cashiers with *threads*.
  - c. The fire marshal only allows 15 customers at a time in the barbershop. Others must wait outside the door until space is available.
  - d. A sofa with 4 places to sit is located just inside the barbershop. When space is available, customers must sit on the sofa before being served by the barber.
  - e. Do not allow a barber to cut hair with no customer in the barber chair.
  - f. Do not allow more than one customer to sit in the barber chair at a time.
  - g. Make sure the customer who finishes a haircut is the one who leaves the barber chair and not another customer with an unfinished haircut in another barber.
  - h. Although there are 3 barbers, there are only 2 cash registers.
  - i. Payment is face-to-face. The customer places payment on the cash register and waits for the cashier to accept it. The cashier waits for payment. When not cutting hair, the cashier accepts payment and allows the customer to continue and leave the shop.
  - j. Make sure the customer who pays is the one who is allowed to leave the barbershop and not another customer who has not yet paid.
  - k. Have the customers, barbers, and cashiers report each completed activity with print statements to a data file called *output*. Barbers and cashiers should identify which customer number the activity applies to in each print statement.
2. Turn in a project design and documented source code with instructions on how to run the project. I require the source code in both electronic and hard copy forms.