Background:

Using information from last year’s simulation study, the Blue Ridge Rocket Company implemented several operational changes. The efficiencies achieved from these changes resulted in significantly increased profits. The board decided to use this extra cash flow to diversify the business. The company purchased a vacant building directly across the street and opened Blue Ridge Gourmet Spirits. This new business sells a wide variety of domestic wines, micro brewed beers, and gourmet cheeses. The board believes that having this new business across the street will be a convenience to their fireworks customers and will also enhance employee morale.

Blue Ridge Gourmet Spirits is open 24 hours a day 7 days a week. The store runs the following shifts:

<table>
<thead>
<tr>
<th>Shift Number</th>
<th>Start Time</th>
<th>End Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>08:00 am</td>
<td>04:00 pm</td>
</tr>
<tr>
<td>2</td>
<td>04:00 pm</td>
<td>12:00 am</td>
</tr>
<tr>
<td>3</td>
<td>12:00 am</td>
<td>08:00 am</td>
</tr>
</tbody>
</table>

Management has noticed that customers arrive according to a Poisson process and that arrival rates are shift-dependent. Each shift has a variable number of cashiers to accommodate this variable customer volume. These shift-dependent parameters are listed in the following table:

<table>
<thead>
<tr>
<th>Shift Number</th>
<th>Arrival Rate (customers per hour)</th>
<th>Shopping Time (minutes)</th>
<th>Number of Cashiers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16.8</td>
<td>UNIF(5,15)</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>24.0</td>
<td>UNIF(15,40)</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>0.7</td>
<td>UNIF(1,5)</td>
<td>1</td>
</tr>
</tbody>
</table>
After they are finished shopping, customers join a single FIFO queue for checkout. The times required for customers to checkout are independent and identically distributed. However, these checkout times are dependent on the amount of time the customer spent shopping (longer times shopping tend to result in more items to be processed during checkout). Specifically, a customer’s checkout time is equal to 2 minutes plus a random percentage of the time that they spent shopping. This percentage follows a triangular distribution with a minimum value of 20%, a maximum value of 30%, and a most likely value of 25%.

Blue Ridge Gourmet Spirits is a customer friendly store, so if a customer is checking out when a shift changes, the current clerk continues working until that customer has completed check out. Note that it is possible for a customer to begin their shopping during one shift and depart the store during the next shift. Consider carefully how to handle this when collecting user defined statistics so that your performance measures are consistent.

Requirements:

1. Develop an Arena model of Blue Ridge Gourmet Spirits, and simulate its operation for 30 days (Your simulation should begin at midnight (the start of Shift 3 on Day 1) and end after Shift 2 on Day 30).

2. Capture and report the following statistics:
   a. Average time spent waiting in the queue during each shift
   b. Average time spent waiting in the queue overall
   c. Average per-shift cycle time for customers
   d. Average overall cycle time for customers
   e. Average number of customers completing service for each shift
   f. Cashier instantaneous and scheduled utilization

3. Include appropriate animation
Due dates and times:

All files must be posted to Blackboard by the end of day (that is before midnight) on March 28, 2011. Files required are:

- An Arena .doe file for the simulation of Blue Ridge Gourmet Spirits

A signed statement citing the following is due at the start of class on March 29, 2011:

- Your name, the date, the Homework assignment number, the names of the files that you posted to Blackboard.
- Any outside references used (other than the course textbook by Kelton, or Arena help files). These citations should follow the format of a standard research report reference list.
- The identification and extent of any assistance that you received from other persons.
- If no references were consulted and no assistance was received then the statement should read "The files submitted for this assignment were entirely the result of my own work and I neither sought, nor received any assistance in their preparation."

Your score on this assignment will be weighted as 25% of the total of the 5 graded homework/mini-project assignments.