GPSS assignment

Fall Term 2002

General Information

- The due date is **Friday 22nd November 2002**, before 23:55.
- Submissions must be done via WebCT. Beware that WebCT's clock may differ slightly from yours. As described on the Assignments page, *all* results must be uploaded to WebCT and accessible from links in the index.html file. There is no need to upload AToM^3.
- The assignment can be made in groups of upto 2 people. It is understood that all partners will understand the complete assignment (and will be able to answer questions about it).
- Grading will be done based on correctness and completeness of the solution. Do not forget to document your assumptions, model, simulation results, conclusions in detail !
- Extensions, if given, will involve extending not only the alotted time, but also the assignment !

The problem statement

Pierre, the owner of the famous restaurant "Chez Pierre" wants to simulate the flow of customers through his restaurant. Based on the simulation results, Pierre wants to, if necessary, make some changes to his restaurant.

Empirical study taught Pierre that customers typically arrive in groups of 1, 2, 3, or 4 customer with relative probabilities of 10%, 50%, 20% and 20%. The distribution of interarrival times between subsequent groups is exponential with an average of 5 minutes.

"Chez Pierre" currently has 10 small tables and at each table, there is room for 2 customers. Tables can be joined to serve parties of more than 2 customers. When a group of hungry customers arrives, they have to wait until they get the undivided attention of Pierre who will seat them, if tables are available. If 10 groups of customers are already queueing, a new arriving group will find another restaurant.

Pierry is rather stingy and does not only receive incoming customers, but also acts as cashier.

If no customers are waiting to be seated, Pierre will go to the cash register. If customers are waiting to be seated, Pierre –who is shortsighted– tries to seat the first group of waiting customers. This, without taking into account the fact that this may block other groups of customers. It is namely possible that though there is no seating space for the first group of customers (as it is too large), one of the other waiting groups could be seated.

In the exclusive restaurant Chez Pierre, it is out of the question that more than one group would be put at the same table.

The time Pierre needs to re-arrange tables and seat a group of customers is uniformly distributed between 1 and 3 minutes.

When a group is seated, Pierre goes to the cash register while the group of customers waits uniformly distributed between 20 and 30 minutes to order and be served (taking customers' orders and serving is done by

waiters –not by Pierre– who are not explicitly modelled here). The time to eat is uniformly distributed over 1h+-15min.

After seating the group, Pierre will serve all customers waiting to pay at the counter. This takes uniformly from 0.5 to 1 minute per group.

If there are no more waiting customers, Pierre looks for 15s at the proceeds of the evening. Then, he again waits for arriving customers.

The assignment

1. Model "Chez Pierre". The model needs to be submitted in graphical form and in textual form.

2. Simulate the flow of customers (and Pierre) in the restaurant during an evening from 18h to 23h. One hour before closing time, no more new customers are allowed in.

3. Output must be generated which describes in detail statistics of:

   - the number of served customers
   - the number of customers leaving due to a too long queue
   - the length of queues
   - the time spent in the restaurant by customers

   Results for the different simulation runs corresponding to alternative modifications (see below) of "Chez Pierre" must be submitted along with the models.

4. Evaluate Pierre's efficiency and suggest improvements.

5. (for bonus marks) How should the model be changed to reflect Pierre employing one person to follow (almost) the same "life cycle" as Pierre ?

Practical information

- Drawing of models may be done with AToM^3 (can be downloaded from atom3.cs.mcgill.ca under Distribution). As for the Petri Net assignment, you will need to load the appropriate formalism (Meta-model). In this case, it's called `GPSSMetaModel.py`. Alternately, you may use any drawing tool.
- Code generation from AToM^3 will soon be supported (use at your own risk).
- For simulation, use GPSS World, student edition which is installed in the SOCS Windows Lab. You can download GPSS World student edition from www.minutemansoftware.com. The software has a builtin help. The online reference manual is at www.minutemansoftware.com/reference/reference_manual.htm.