

# GPSS assignment

Fall Term 2003

## General Information

- The official due date is **Wednesday 3<sup>rd</sup> December 2003**, before 23:55. Late submissions (before 8 December 23:55) will be accepted without penalty.
- You will have the opportunity to finish the assignment “in class” on Wednesday December 3<sup>rd</sup> 18:00 – 20:00 in the Windows lab of the Trottier building.
- 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<sup>3</sup>.
- 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 allotted time, but also the assignment !

## The problem statement

Model, simulate and discuss the operation of a supermarket.

The inter arrival time (IAT) of customers of a supermarket is Poisson distributed with a mean of 2 minutes.

You must tabulate the IAT and plot it.

Every customer intends to buy a number of general items as well as a number of “deli” items. For the latter, they will have to go to a separate section of the supermarket.

10% of the customers will buy no general items, 20% of the customers will buy 5 general items, 30% of the customers will buy 10 general items, 30% of the customers will buy 20 general items, and 10% of the customers will buy 40 general items.

50% of the customers will not buy deli items. For those who do, the distribution of bought items is uniform between 2 and 12.

Every customer will register the intended number of general and deli items to buy in a parameter.

You must verify that the above distributions were correctly generated (and that the simulation ran long enough to become statistically relevant).

Customers who intend to buy more than a total (deli and general combined) of 10 items will want to take a cart. Customers who intend to buy less than a total of 10 items will want to take a basket. Carts/baskets will be returned when the customer leaves the supermarket.

There are 20 baskets and 15 carts available. When a customer arrives and needs but does not find a cart/basket, the customer will go away.

You must count how many customers went away due to shortage of carts and baskets respectively.

Those customers who need to shop for deli items will, if needed, join a queue for the deli section. This section has one server. The server takes 30 seconds per item a customer orders. In addition, it takes 20 seconds to print out the bill. You must gather queueing statistics.

Those customers who need to shop for general items will spend between 10 and 40 seconds per item (uniformly distributed). This time takes into account the moving around in the supermarket.

Finally, the customers come to a series of checkout counters. There are a total of three counters which are all identical (i.e., the cashiers work equally fast). There is a single queue for all counters. You must gather queueing statistics. The service time at a counter is a function of the number of items bought. It takes 20 seconds to process the bill from the deli section (if applicable). It takes 10 seconds per general item, and a total of 30 seconds for packing.

Is it possible for customers to enter the supermarket but not buy any items ?

What is the total number of customers which have successfully shopped ? Tabulate and show the transit time of customers.

## Practical information

- Drawing of models may be done with AToM<sup>3</sup>. A version of AToM<sup>3</sup> with GPSS support is here.
- Code generation from AToM<sup>3</sup> is supported but the result may need to be “cleaned up”. Also, you will need to paste the generated text file into a GPSS World model.
- 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](http://www.minutemansoftware.com). The software has a builtin help. The online reference manual is at [www.minutemansoftware.com/reference/reference\\_manual.htm](http://www.minutemansoftware.com/reference/reference_manual.htm). A note to Linux users: GPSS World can be installed under Linux using the free implementation of Windows for Unix wine.