DATA 604 Assignment 6: Intermediate Modeling

Dan Smilowitz

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Problem 1

Object properties dictate the behavior of an object, including things like mean inter-arrival or service time for model entities. They can not be changed during the running of a model. Object states indicate characteristics of an object at a given point in time, possibly including things like customers served or utilization. States often change during modeling, and can be edited while a model is running.

Problem 2

The token's parent object is an instance of object in which the token is currently going through the process – in this case, the process associated with the Server object. The associated object is the object that triggered the process associated with the Server – in this case, the model entity, which generated the entry of the token into the Server process.

Problem 3

The interarrival time at the placement server is $\lambda_p = 10$. Since all of the PCBs entering the placement station go to the inspection station, $\lambda_i = \lambda_p$. Using the mean or mode for the two server stations, their values are $\mu_p = 15$, $\mu_i = 20$.

Using these values, the utilizations can be solved:

$$\begin{array}{cc} \rho_p = \frac{\lambda_p}{\mu_p} & \rho_i = \frac{\lambda_i}{\mu_i} \\ \rho_p = \frac{10}{15} & \rho_i = \frac{10}{20} \\ \rho_p = 0.667 & \rho_i = 0.5 \end{array}$$

Since each of the servers represents an $M/M/1$ system, the values of L can be calculated:

$$\begin{array}{cc} L_p = \frac{\lambda}{\mu_p - \lambda} & L_i = \frac{\lambda}{\mu_i - \lambda} \\ L_p = \frac{10}{15-10} & L_i = \frac{10}{20-10} \\ L_p = 2 & L_i = 1 \end{array}$$

So the total number in the system is

$$L = L_p + L_i = 3$$

Little's Law can be applied to calculate the time in the system:

$$W = \frac{L}{\lambda} = \frac{3}{10} = 0.3$$

Problems 4 & 5

A model is set up with a source, 3 servers, and a sink, each 15 feet away from one another. The three servers are set up with the given distributions; the written exam server is set with an initial capacity of 3, to represent the three computer testing stations.

Each of the server entities is set to a work schedule `DMVSchedule`, established as shown below:

Work Schedules

Name	Start Date	Description	Days	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
DMVSchedule	1/3/2011	M-F 9-5	7	DMVDay	DMVDay	DMVDay	DMVDay	DMVDay		

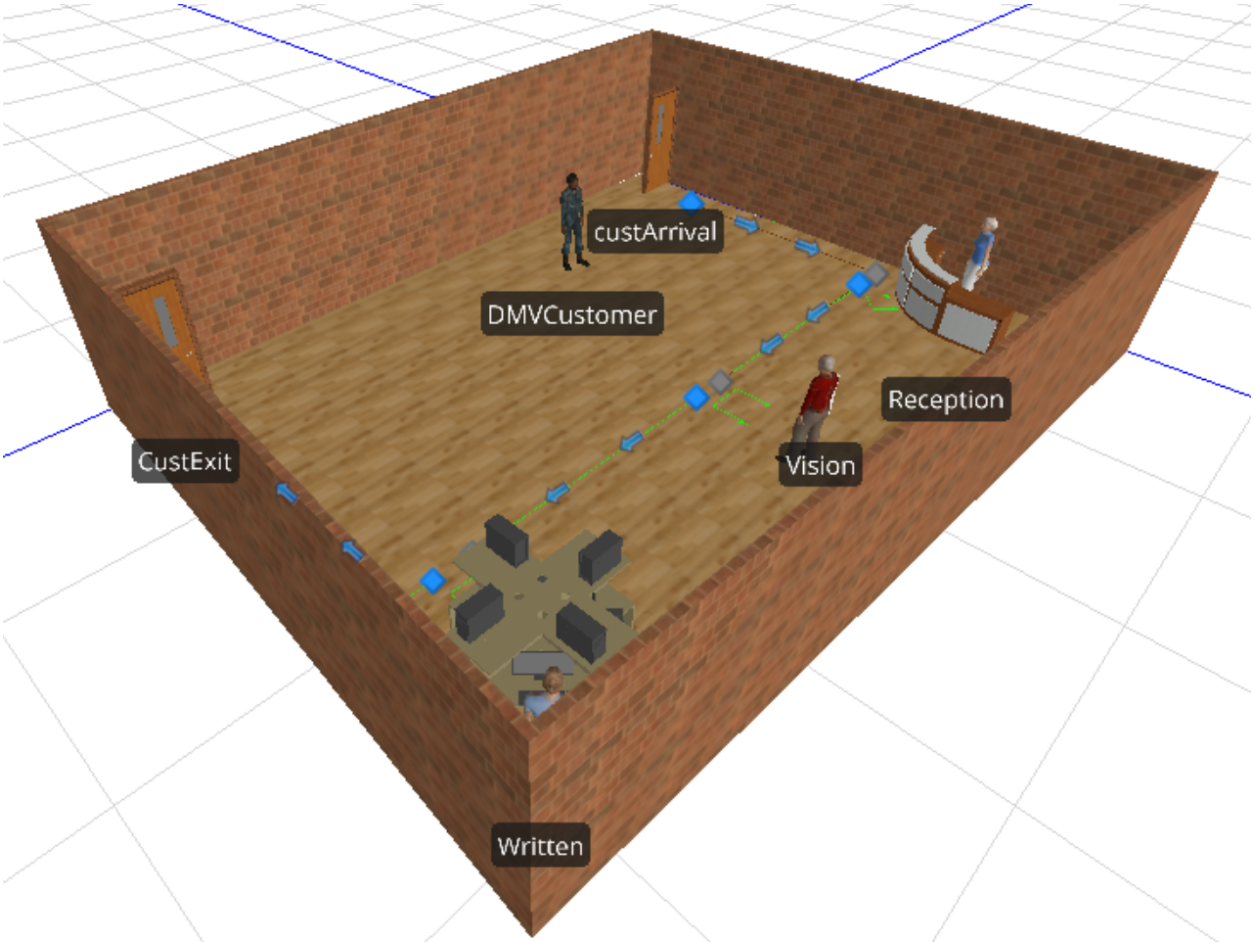
Day Patterns

Name	Description
DMVDay	9-5 day, no lunch

Work Periods

Start Time	Duration	End Time	Value	Cost Multiplier	Description
9:00 AM	8 hours	5:00 PM	1	1	

The model is animated using downloaded symbols and random symbols for customers from the standard library:



An experiment is run with 365 replications of 24 hours each – this represents a full year. No startup time is considered since the first 9 hours of each period are off-shift hours. 365 replications yields a reasonably narrow half-width for response estimates. The results of this experiment are presented below:

	Mean	Half-Width
W	5.256	0.1998
ρ_{rec}	0.0211	0.001
ρ_{vis}	0.0106	5e-04
ρ_{writ}	0.0434	0.002
$\bar{L}_{rec}$	0.8245	0.0334
$\bar{L}_{vis}$	0	0
$\bar{L}_{writ}$	0.0161	0.002
$max(L_{rec})$	2.567	0.1125
$max(L_{vis})$	1	0
$max(L_{writ})$	1.403	0.0601