

Homework Assignment #1

EEL 5937 Control of Discrete-Event Systems

Topic: Deterministic simulation.

Deterministic Simulation

Recall the investment problem defined in class. Specifically you must decide when to make the long term investment of \$2000. You earn this money at a constant rate throughout one year. Temporarily money may be stores in a short term account that earns interest at a rate of intst . Money may be borrowed at a rate of intbor . Long term investments accrue interest at a rate of intl . We assume all interest is deposited or comes out of a separate non-interest bearing petty cash account.

You are to simulate this process day by day for 365 days (1 year). Use $\text{intst} = 2\%$, $\text{intl} = 6\%$, and $\text{intbor} = 8\%$. Keep track of the total net interest earned. Determine the best time to make the long term investment.

Now modify the simulation to incorporate the compounding of interest. Eliminate the petty cash account and instead, each day, credit any interest earned by the short term account to the short term account, any interest earned by the long term account to the long term account and any interest owed to the loan to the loan balance. Using this modified model determine the best time to make the long term investment.

Homework Assignment #2

EEL 5937 Control of Discrete-Event Systems

Topic: Non-deterministic simulation.

Non-deterministic Simulation

Write a discrete-event simulation of a simple single server queue. Customers may join the queue between 12:00 noon and 1:00 PM. No new customers may join after that but the system continues operating until all customers have been serviced. Let the interarrival times between consecutive customers be independent samples from an exponential distribution with mean equal to 2 minutes and the service times between consecutive customers be independent samples from an exponential distribution with mean equal to 1 minute. Note if u is distributed uniformly on the interval $[0,1]$ then $-m*\ln(u)$ will be distributed exponentially with a mean of m .

Let "one run" correspond to the simulation of the system from noon until all the customers that arrived before 1:00 have been serviced. for each run record

1. The total number of customers served.
2. The total time the customers spent in the system.

Then calculate the average time the customers spent in the system.

Run the simulation 1,000 or 10,000 times and report the average w and the average number of customers processed.

Now imagine that you have the option of using a server who works twice as fast but can not start until 12:10 AM. Any customers who arrive before that will have to wait in the queue. Modify the simulation appropriately and report the output as before.

Which server is better if you are to be nice to the customers and choose the server that reduces the waiting time of the customers.

Compare your results of the first simulation (with the slow server) to the calculated w using the queuing theory presented in class.

Homework Assignment #3

EEL 5937 Control of Discrete-Event Systems

Topic: Simulation using the simulation tool.

Simulation Using the Simulation Tool

Cancelled

Homework Assignment #4 (Final Project)

EEL 5937 Control of Discrete-Event Systems

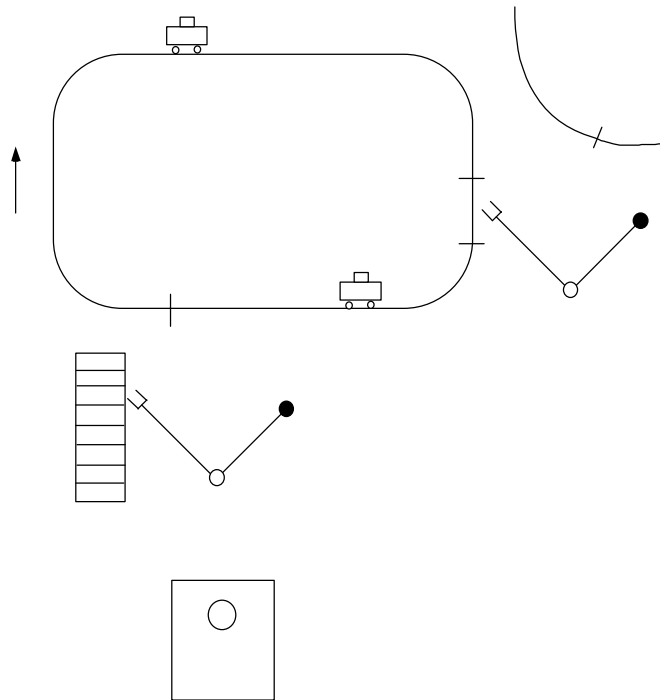
Topic: Simulation using the simulation tool.

Simulation Using Multiple Models

Write a controller for the following system. You will simulate the system using the simulation tool and the HOOPLS function provided. Your controller must consist of several models.

The System

The system consists of a machine, an AGV and two carts. The AGV tracks form a single loop. The 2 carts on the tracks can not pass one another. There are 2 robotic arms. One for the loading between the machine and the cart and the other for the loading between the cart and the outside system. The segment of track that is in the top right is the deliver and pick up jobs. It is not part of this system. The two carts can only move in a clockwise direction. There are two loading spots for transferring jobs between the plant on the outside. If a cart is done loading and wants to leave it must wait for the cart in front of it to leave first. There is only one lane. The controller must be able to move a cart out of the way in order to make way for the other cart. At the machine center, the loading is done with robotic arm. This arm shown at the bottom can transfer jobs between the cart, any of the 8 holding positions in the storage device, and the machine. The cart must be placed in front of the line in order for the arm to reach it. The other arm, shown at the right, can transfer jobs between any of the two parking spots on the track and the cart on the outside track.



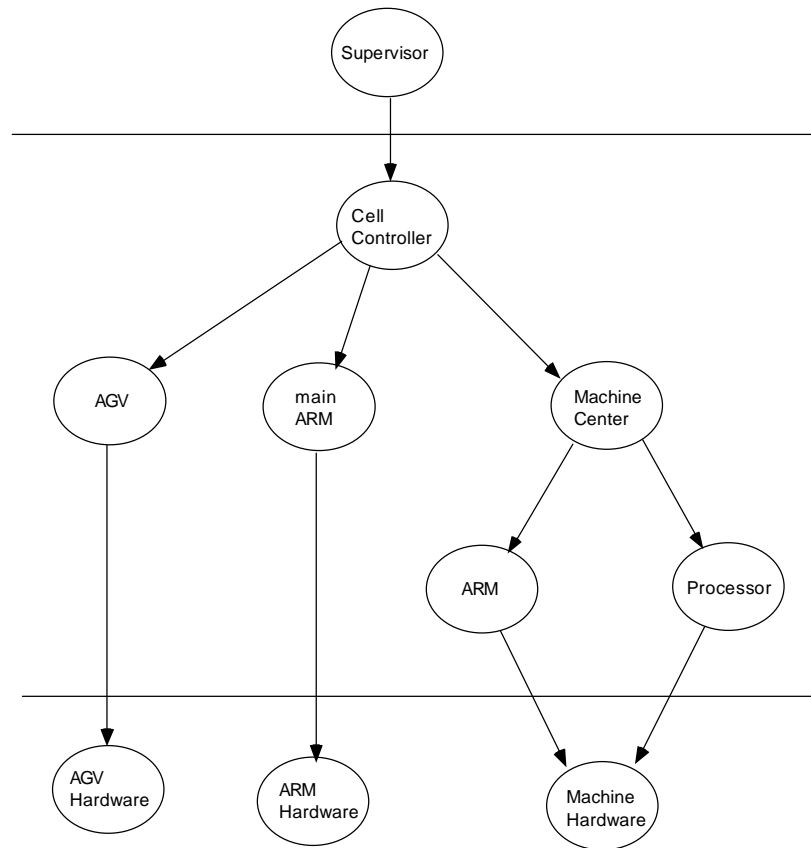
Assume the following:

- The cart travels at a constant speed of one loop per minute.
- Carts can not pass each other.
- The machine's robotic arm takes 1 minute to transfer a job between the cart and the storage device or between the storage device and the machine.
- The other arm takes 2 minutes to transfer a job.
- The machine does not indicate when a job is done processing. The controller must remember to turn off the machine when the job is done.
- The following operation can be performed by the machine.

OP1	6 minutes.
OP2	25 minutes
OP3	90 minutes
OP4	120 minutes

- The supervisor will give a message with the operation to perform.
- The plant does not control the piece of the track on the top right.
- The cell controller must not pick up a job if it does not have a place to store it. You may design the supervisor so that it ask the cell controller if a space is available before giving it the job. The NeedSpace message may be used. If space is not available the supervisor queues the job.

You may consider the following decomposition:



For simulation purposes you must include models for the supervisor and the hardware.

The Simulation

For the simulation assume the following.

The supervisor assigns the following operation with the following probabilities.

OP1	0.4
OP2	0.1
OP3	0.2
OP4	0.3

A new job arrives every 30 minutes.

Output

Print reports for each model.

Print a copy of the message transcript.