DESpy Assignment 2

# Description

For this assignment you will implement an Event Graph model in DESpy and execute it for various parameter settings.

# Inventory Model

One of the simplest models for managing a single item of inventory is the <Q,r> model, or “lot size-reorder point” model. Items are held in inventory and are periodically demanded by customers. When the inventory level reaches a certain point r (the “reorder point”), and order of size Q is placed with the vendor. Once placed, the order takes a certain amount of time (“lead time”) to arrive.

If there are not enough items in inventory to completely fulfill a customer’s demand, the remainder are placed on backorder. When orders arrive, they are used to fill any backorders, and the remainder placed in inventory.

Some measures of interest include:

* Average amount on hand
* Average amount on backorder
* Average amount on order
* Average “fill rate”

The fill rate measure is simply the percentage of times a customer requested an item and was able to have their order completely filled.

# Event Graph Model

## Parameters

* {tD} times between customer demands
* {D} amount requested by a customer at a demand
* {tL} Lead time to receive orders
* OH0 initial amount in inventory (“on hand)
* Q order quantity
* r reorder point

# State Variables

* OH: amount in inventory (OH0)
* BO: amount on backorder (0)
* OO: amount on order (0)
* F: 1 if an order can be completely filled; 0 if not

## Event Graph



Figure . Inventory Event Graph

## Notes

* F is an “instantaneous” state variable; as such, it should not notify state change in the run method, but only in the demand method.
* F is 0 or 1 depending on whether a given demand can be completely filled. Therefore, the code for its state transition should look like:

If demand ≤ on\_hand:

filled = 1

else:

filled = 0

* Since the values of F are a discrete sequence of values, the average fill rate will be calculated using a SimpleStatsTally instead of a SimpleStatsTimeVarying, as for the other state variables
* The sequence {D} will be modeled by a discrete RandomVariate instance whose parameters are listed below.

# Deliverable

Your model should be run with the following parameters:

* Run length: 100,000 time units
* {tD}~ Exponential(mean=1.3)
* {tL}~ Gamma(alpha=2.3, beta=1.8)
* {D} ~ The following discrete probability distribution:

Pr{D = 1} = 0.10

Pr{D = 2} = 0.15

Pr{D = 3} = 0.30

Pr{D = 4} = 0.25

Pr{D = 5} = 0.20

* OH0 = 20
* Q = 20
* r: different values

The idea is to find a reorder point r such that the fill rate is at least 0.90.[[1]](#footnote-1)

## Deliverable

* You will write two Python files. One will contain the logic for the Event Graph in Figure 1 and the other will be to run the model. Use a ‘for’ loop to run for different reorder points. Be sure to reset each of your stats objects after EventList.reset().

E-mail these two files (only) to: [abuss@nps.edu](mailto:abuss@nps.edu) with the subject line “DESpy Assignment 2”

1. Recognize that running a single replication is not what should be done, and that multiple independent replications should be run for statistical validity. However, for our purposes now, a single replication will suffice. [↑](#footnote-ref-1)