Lesson 21. Model Parameters and Scenarios

1 Overview

- Often we want to compare a baseline model with an alternate model, where the alternate system is simply the baseline system with one or more parameters changed
- For example, in the Bellman Air problem from Lesson 19 (on the back of this sheet), we want to investigate what happens when we change the number of check-in agents
- In ProModel, we can declare **model parameters**
- We can then define **scenarios** – combinations of different values for model parameters – and run simulations for all scenarios
- The ProModel file for today's lesson contains a model for the Bellman Air problem
- Let's create scenarios for different numbers of check-in agents for the Bellman Air problem

2 Model parameters

- Select Build → Macros
- Create a new parameter:
  - ID = NumberCheckInAgents
  - Text = 1 (this is the default value of this parameter)
  - Options → RTI (this stands for "run time interface"), enter valid numeric range (say, 0 to 9999)
- Change the capacity of the "CheckInCounter" location to "NumberCheckInAgents"

3 Scenarios

- Select Simulation → Scenarios
- Click Add to create a new scenario
- Create a name for the new scenario (e.g. "1 agent") and change the values of the model parameters accordingly
- Repeat for 2, 3, 4, 5, and 6 agents
- Click Run Scenarios to run all scenarios
- Bring up the location summary table in the output viewer
- Make sure all scenarios are checked, and just the queue item is checked
- In this view, we can easily see the maximum number of passengers in the queue at any time, for each scenario

Problem 1. Passengers arrive at the main entrance of the Bellman Air terminal, according to an exponential interarrival-time distribution with mean 1.6 minutes. The travel time from the entrance to the check-in counter is distributed uniformly between 2 and 3 minutes. 80% of passengers are traveling economy class, 20% of passengers are traveling business class. At the check-in counter, economy class passengers have a service time (in minutes) following a gamma distribution with shape value $\alpha = 14.4$ and scale value $\beta = 0.42$, while business class passengers have a service time (also in minutes) following a gamma distribution with shape value $\alpha = 15.7$ and scale value $\beta = 0.54$. Bellman Air is trying to determine how many agents it should have at its check-in counter.

a. Simulate the system for 16 hours with x check-in agents, for $x \in \{1, 2, 3, 4, 5, 6\}$. While doing these simulations, consider the two questions below.

b. For each x, what fraction of the passengers served wait more than 20 minutes? (Start a passenger's waiting time at the moment he or she enters the check-in counter queue.)

c. What is the minimum number of agents needed to ensure that no more than 20 passengers are waiting at the check-in counter at any time?