

Lesson 24. Path Networks and Resources

1 Motivation

- The ProModel file for today's lesson contains a model for the following problem:

Problem 1. At the Milwaukee Machine Shop, two types of jobs are processed: domestic and export. Dan and Ed work at the shop: Dan works on domestic jobs exclusively, while Ed works on export jobs exclusively. The interarrival time of both types of jobs is exponentially distributed with a mean of 30 minutes. Domestic jobs are processed at the domestic machining station, while export jobs are processed at the export machining station. The processing times for all jobs are triangularly distributed with minimum 10 minutes, mode 12 minutes, and maximum 18 minutes. Simulate the shop for 8 hours. How many domestic jobs are processed? How many export jobs are processed?

- Now consider the following twist to the problem:

Problem 2. Ed has decided to take a vacation, leaving Dan to work at the shop all alone. Domestic and export jobs still must be processed separately at their respective stations. It takes Dan 20 minutes to walk between the two stations. Dan works on the longest waiting job in the shop. Simulate the shop for 8 hours under these new conditions. How many domestic jobs are processed? How many export jobs are processed?

- How can we model a single operator for multiple machines?
- **Resources** are objects that are required to perform an operation but may not always be available for use
 - e.g. Dan in the revised problem
- **Path networks** define how resources can move between locations
 - e.g. Dan moves between the two machining stations

2 Path networks

- Select **Build** >> **Path Networks**
- Create a new path network named **Dan Network**
- Click **T/S** and select **Time** to specify transit times in terms of time
- Create a path between the domestic and export machining stations
- Leave the path as bidirectional
- Change the transit time to 20 minutes
- Click **Interfaces** to interface the nodes of the path with the corresponding locations

3 Resources

- Select `Build >> Resources`
- Create a new resource named Dan
- Click `Specs` to link Dan to Dan Network
 - Leave Home Node as N1
 - Make sure the Longest Waiting radio button is checked under Entity Search
 - Change Dan's speed to INFINITE (this will be overridden by the transit time we specified anyway)

4 Changing the processing to use resources

- Select `Build >> Processing`
- Change the processing of domestic jobs at the domestic machining station to

```
# Processing time for domestic jobs
USE Dan FOR T(10, 12, 18, 4) MIN
```
- Make a similar change to the processing of export jobs at the export machining station
- In general, the **USE** statement captures a resource:

```
USE <resource name> FOR <time>
```

- If 1 of multiple resources can be used:

```
USE <resource name 1> FOR <time 1> OR <resource name 2> FOR <time 2>
```

 - Order matters: uses the first resource available, in the listed order*
- Run the simulation. How many domestic jobs are processed? How many export jobs are processed?

5 On your own

- Suppose the two machining stations are actually much closer. Modify the simulation so that Dan moves between stations in 5 minutes. How does the output of the shop change?
- Suppose Ed comes back from vacation, and they decide that they should operate the shop so that whoever is available takes care of the longest waiting job, regardless of its type (domestic or export). Suppose Dan still takes 20 minutes to walk between stations, while Ed takes 10 minutes to walk between stations. Assume Dan starts the day at the domestic machining station, and Ed starts the day at the export machining station. In addition, assume that only 1 person can work at each station. Make the necessary changes to the simulation. How many domestic jobs are processed? How many export jobs are processed?