MIT Sloan School of Management   Prof. Jérémie Gallien

15.760 Introduction to Operations Management   Spring 2004

Littlefield Technology Simulation Exercise

This assignment is based on the Littlefield Technology factory simulator and overview, designed by Sunil Kumar and Samuel C. Wood, Assistant Professors at the Stanford University Graduate School of Business. For more information about the Littlefield Simulation, see: http://littlefield.responsive.net:8000/littlefield/littlefieldHome.html (accessed June 7, 2004).

Assignment Description

Background

In early January, Littlefield Technologies (LT) opened its first and only factory to produce its newly developed Digital Satellite System (DSS) receivers. LT mainly sells to retailers and small manufacturers using the DSS's in more complex products. LT charges a premium and competes by promising to ship a receiver within 24 hours of receiving the order, or the customer will receive a rebate based on the delay.

The product life cycle of many high-tech electronic products is short, and the DSS receiver is no exception. After 203 days of operation, the plant will cease producing the DSS receiver, retool the factory, and scrap any old tools. In the initial months, demand is expected to grow at a roughly linear rate, stabilizing after about 4 months or 120 days. The release of the next generation product (which will be manufactured in another facility using a different process) is scheduled after exactly 194 days of production on the current version. At that point, it is expected that demand on the current version will collapse down to zero in about a week or so. Although orders arrive randomly to LT, the marketing department expects that, on average, demand will follow the trends outlined above.

Management's main concern is managing the capacity of the factory in response to the complex demand pattern predicted. Delays resulting from insufficient capacity would undermine LT's promised lead times and ultimately force LT to turn away orders. In addition, customers would pay dramatically higher prices for the DSS receivers if they could be delivered within 6 hours instead of 24 hours. However, management is skeptical the 6 hour lead time could ever be consistently achieved.

Assignment

It is now late February, and after 35 (simulated) days of operation LT is starting to fear that a few of their receivers may be soon delivered after their due dates given the increase in demand. In response, management has installed a high-powered operations team (you) to manage the factory's capacity. For the next 168 simulated days (i.e. 7 real days) you must buy or sell machines to maximize the factory's overall cash position. Currently there is one board stuffing machine, one tester, and one tuning machine. You may also

change the way testing is scheduled. Currently, jobs at the tester are scheduled First-In-First-Out (FIFO), but you can give priority status either to the short initial tests or the long final tests.

Orders for receivers arrive in batches of 60, and currently each order travels through the factory in one lot of 60 kits. However, you may divide each order of 60 kits into 2 lots of 30 receivers, 3 lots of 20 receivers, or 5 lots of 12 receivers. Each lot travels independently through the factory, but the order is not shipped until all the lots that make up the order are completed. The manufacturing step on each machine consists of a complex combination of automated and manual tasks such as loading the group of boards and setting up fixtures. Your shop-floor supervisor has recently completed the following processing time estimates:

Processing Time (hours):

Step	Station	Set-up time (per lot)	Operation time (per unit)
1	1	0	0.0625
2	2	0	0.02
3	3	1.5	0.00138
4	2	0	0.02088

In addition, very little variability was observed around the processing times indicated above, so that they can be considered deterministic for practical purposes.

You have two contracts to choose from:

• In the default contract, jobs completed within 24 hours earn $1000. Late jobs incur a revenue penalty of $500 per day (prorated by fractions of a day), and jobs that take longer than 3 days to complete earn no revenue.

• In the fast lead time contract, jobs completed within 6 hours earn $1500. Late jobs incur a penalty of $250 per hour (prorated by fractions of an hour), and jobs that take longer than 12 hours to complete earn no revenue.

You may change lot size or contracts by clicking on the "Customer Order Queue" icon and then clicking on "edit data." You can buy, sell, or change scheduling at machines by clicking on the icon corresponding to the machine type.

You will also need to manage the raw materials procurement process, namely set the reorder point and order quantity. Raw kits are purchased from a single supplier and cost $10 per kit ($600 per order). There is also a fixed cost of $1000 per shipment of raw kits,

independent of the shipment size, and the supplier requires four days to ship any quantity of raw kits.

The balance on your bank account earns interest (compounded every simulated day) at a compounded rate of 10% per year.

When the assignment begins, there will already be 35 days of history available for your review. The simulator will run at a rate of 1 simulated day per 1 real hour for the next week. Thus, there will be a total of 203 days of simulation corresponding to a product life cycle of a bit less than 7 months (you only gain access to the simulation after 35 days have elapsed however).

After this simulation is over, you can check the status of your factory, but the factory will no longer be running.

Report

By Tuesday May 11 at 10am, your team must turn in a written report of at most 4 pages and up to 4 exhibits containing:

1. Description of the strategy that was followed, with a detailed explanation of its underlying rationale and justification (i.e. a description of all quantitative models and analysis used to design this strategy);

2. Assessment of its performance;

3. A posteriori suggestions for improving your performance in this simulation;

4. Description of the most important lessons you learned or insights you gained.