15.762, ESD.267J, 1.273J
Spring 2011
Problem Set – due on Session 5.

Please do this in groups, and submit one answer set per group. You should use the (approximate) models that were covered in class. For some questions you will need to use material beyond what we did in class, such as models from your introductory class.

Please do all of the problems.

Problems #1 and 6 removed due to copyright restrictions.

2. Consider an item whose inventory is controlled by a periodic review, base-stock policy. Suppose the review period is 1 week (7 days), the replenishment lead-time is 3 days, and the daily demand is normally distributed with mean 20 and standard deviation 4.

a. What is the base stock B to assure that the coverage probability (Type I service) is 0.98? What is the average inventory level? How many stock-out events might you expect per year? (Assume 50 weeks per year)
b. What is the base stock B to assure that the fill rate (Type II service) is 0.98? What is the average inventory level? How many stock-out events might you expect per year? (Assume 50 weeks per year)

3. Consider an item whose inventory is controlled by a *periodic review*, base-stock policy. Suppose the review period is 1 day, the replenishment lead-time is 5 days, and the daily demand is normally distributed with mean 100 and standard deviation 30.

a. What is the base stock B to assure that the coverage probability is 0.90 (Type I service)? What is the average inventory level? How many stock-outs might you expect per year? (Assume 250 days per year)
b. Suppose customers permit a grace period or service time of 2 days. That is, a customer demand on day t can be satisfied on day t + 2. How would you modify the base stock in light of this relaxation of service expectations? By how much does the average inventory change?

4. Consider an item whose inventory is controlled by a continuous review, Q R policy. Suppose the lead time is 5 days, Q = 100, and daily demand is normally distributed with mean 10 and standard deviation 2. The desired fill rate is 0.98 (type II service).

a. Suppose the lead time is primarily transportation time, and you have an alternative option to use premium transportation that would reduce the lead time to 2 days. Suppose you can use only one option – either the premium transportation or the slow transportation mode. How would you decide what to choose? Outline an analysis to help you make the choice.
b. Suppose you could use both options, e. g., ship part of your order by the slow mode and part by the fast mode. Would you ever want to do this? How would you decide how to split the order?

5. Consider a semiconductor wafer fabrication facility. The input into the facility is wafers that are released into the facility in lots (or batches) of 25 wafers. Each wafer can produce a maximum of 50 die or chips. The output from the fabrication facility goes to a testing operation that determines which chips (or die) on the wafer are good and which are bad. The good chips go into an inventory to serve customer demand, and the bad chips are discarded. The production lead-time through fabrication and test is 50 days on average with a standard deviation of 3. The daily demand for chips is 300 per day with a standard deviation of 30. The yield of good chips from each wafer is 20 good chips on average with a standard deviation of 8. Suppose we want to have a 95% Type I service from the chip inventory. Describe an inventory policy to achieve this (You can assume all

uncertainty follows a normal distribution and you probably want to make some assumptions of independence, as well as some simplifications and approximations). In particular, you should decide how to determine when to release a lot of wafers into the wafer fabrication facility. If it is helpful, you might consider a particular instance: suppose the number of batches in progress is 30 and the current position of the finished goods inventory is 1500 chips. Then the question is whether or not we should launch any new batches into production, and if so how many?

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