NORTHEASTERN UNIVERSITY
Department of Mechanical and Industrial Engineering
Supply Chain Engineering **Prof. Gupta**
IE 7200 **Spring 2017- Monday**

Homework No. 8
(Due: April 10, 2017)

Problem No. 1. **Make-to-Stock (no contract)** Consider a supply chain for fashion products (such as winter shoes). In this case, the selling season starts in September and is over by December. The sequence of events in this supply chain is as follows. Production starts 12 months before the selling season, before distributors place any orders with the manufacturer. The distributor places orders with the manufacturer six months after beginning of production. At that time, the manufacturer has completed producing the products while the distributor has received firm orders from retailers. Thus, the manufacturer produces winter shoes prior to receiving distributor orders. Demand for winter shoes follows the following pattern:

Demand	Probability
10,000	0.12
12,000	0.15
14,000	0.20
16,000	0.25
18,000	0.18
20,000	0.10

The distributor's pricing and cost information is as follows:

- The distributor sells winter shoes to retailers for $80 per unit.
- The distributor pays the manufacturer $60 per unit.

For the manufacturer, we have the following information:

- Fixed cost of production is $75,000.
- The variable production cost per unit equals $50.
- Any winter shoe not purchased by the distributors is sold to a discount store for $25 per pair.

How much should the manufacturer produce (consider only the 6 demand values)?

Problem No. 2. **Make-to-Stock (pay-back contract)** Refer to Problem 1. Suppose that the distributor offers to pay $15 for each unit produced by the manufacturer but not purchased by the distributor. How much should the manufacturer produce (consider only the 6 demand values)?

Problem No. 3. **Make-to-Stock (cost-sharing contract)** Refer to Problem 1. Suppose that the manufacturer and distributor have a cost-sharing contract, in which the manufacturer agrees to decrease the wholesale price from $60 to $50, and in return, the distributor pays 20 percent of the manufacturer's production cost. How much should the manufacturer produce (consider only the 6 demand values)?

Problem No. 4. A utility company has weekly demand for a certain type of transformer that is normally distributed with a mean of 150 and a standard deviation of 75. Holding costs are 40% and inventory must be held corresponding to a cycle service level of 95%. The utility company is trying to choose between two suppliers, Reliable Components and Value Electric, who offer the following terms. Reliable sells the transformer for $5,000 with a minimum order of 150, and a lead time of 1 week with a standard deviation of 0.1 week. Value sells the transformer for $4000 in batches of 1500 with a lead time of 5 weeks and standard deviation of 4 weeks. In both cases, the lead times are normally distributed. What are the annual costs of using each of the suppliers and which supplier should be chosen?