**Lecture 4 Making and Delivering**

*Product Design*

* Product design also implies other types of designs like marketing

*Production Scheduling*

* Direct Costs (recurring per use) are directly proportional to the amount produced (materials, labor).
* Setup Cost (static per use/ once) include the labor and material to ready a machine for production including work orders and inspections.
* Carrying Cost (storage cost) is the average cost associated with storing an average production unit for the average time it will be in inventory.
* Economic Lot Size Model:
  + Formulates Total Annual Cost and finds our optimal lot size via derivative.
  + Example included with some numbers @ 24:38.
  + We can solve for:
    - Length of Production run
    - Length of Production cycle
    - Number of Productions runs/year

*Facility Management*

* Location

*Order Management*

* Passing information through ordering system to the actual shipments (delivery dates, substitutions, backorders, ect.)
* Can be useful to build a spaghetti flow chart to show inputs and outputs for who receives what pieces of the chain (mainly in terms of information).
* Example: Catalog system

*Delivery Scheduling*

* Routing
* Moving Products
* Different techniques and methods to do this (single driver or multiple routes?) mathematical models can be used in this piece.

*Delivery Sources*

*Return Processing*

* Reverse logistics, valuing things when items come back in 6-8 months.

*Outsourcing*

* Is losing control worth the lower cost?

*Monte Carlo*

*Simulation*

* Advantages
  + More general than a mathematical model
  + Allows confidence intervals
  + Easy to make assumptions and get averages
* Disadvantages
  + Takes a long time
  + Not as robust as a parametric formula

*Quantitative Risk Analysis*

* Deterministic Finish Date
* Deterministic Cost
* Probability we are able to do it by a date-time.
* Duration of cost uncertainty
* Probability \* Severity

*Uncertainty*

* Pessimistic Worst Case
* Optimistic – Best Case
* Most Likely – The best estimate of the actual
* Requires three point estimate