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4301 A, 2019 Fall, HW 2, Due: 9/3

1. **(5) What are the characteristics of certain sectors in the information technology, such as in Games, popular consumer software, phone apps? Based on the economies of scale, what tends to be the consequences?**

These sectors tend to have high development and entry cost, but low marginal costs. In an economy of scale, this tends to allow the largest companies with the most capacity to excel while smaller firms will have a more difficult time to enter the market.

1. **(5) Please give a concrete example of diseconomies of scale.**

An example of diseconomies of scale is a large company that loses coordination and organization the larger the company becomes. This often results in duplicate work being done and a resistance to progress and innovation.

1. **(5) Please list a major benefits of economies of scale at macro level and a major drawbacks of economies of scale at the macro level?**

Some of the major benefits of economies of scale are lower prices for the consumer, a wider range of products, and accessibility to greater benefits for people in a lower socio-economic strata.

Some of the major drawbacks of economies of scale are that because a large company must operate at such a high capacity in order to realize economies of scale, there can often be an over-supply of goods/services in the market. It also creates a barrier to entry for smaller firms trying to enter the market, because they will have a lower capacity and will not be able to operate at the lower costs of the large firms.

1. **(5) Please give an example of deterministic economic uniformity.**

An example of deterministic economic uniformity is cargo loading in commercial airplanes. In a smaller aircraft, luggage and cargo are all loaded into the cargo bay individually, which makes it much more complicated for the agents to organize the load and to calculate the weight and balance. In larger aircraft, the bags and cargo are all loaded into unit load devices (ULDs), which are all loaded to a similar weight, and then loaded into the airplane by a machine. Utilizing ULDs in larger aircraft makes the system much more uniform, and takes away the variability in size, distribution, and weight of the cargo, and also makes it easier for the agents to plan the load to achieve a safe weight and balance.

1. **(40) If the demand for raw materials is 60 pallets/week. The cost is $100/pallet. The holding cost for the product is $1 per pallet per week. The ordering cost is $200 per order.** 
   1. **What is the economic order quantity and its associated inventory related cost.**

EOQ = = 154.91

Inventory related cost = k \* D/Q + h\*Q/2

= 200 \* 60/154.91 + 1 \* 154.91/2

= $154.91

* 1. **If you round the order quantity to the nearest 100s, what is the order quantity and its associated cost?**

EOQ 🡪 200 pallets

TC(Q) = cD + DF/Q + h/2 \* Q

= 100\*60 + 60\*200/200 + 1/2 \* 200

= 6000 + 60 + 100

= $6160

* 1. **What is the inventory related cost per unit of demand at EOQ?**

Inventory related cost / unit of demand (EOQ) = 154.91 / 60

= $2.58 / unit demand

* 1. **If someone can double the demand, and all other parameters stay the same, what is the inventory related cost per unit of demand?**

EOQ = = 219.09

Inventory related cost = k \* D/Q + h\*Q/2

= 200 \* 120/219.09 + 1 \* 219.09 / 2 = $219.09

Inventory cost / unit demand = $219.09 / 120

= $1.83 / unit demand

1. **(40) A car assembly plant receive weekly deliveries of engines from a supplier in Europe. The order leadtime plus transient time is 1 week. The weekly demand distribution for one model can be approximated by. When short, the engine will be air lifted at an extra cost of $100 each engine. The cost of holding one engine for one week is $15.** 
   1. **Please find the safety stock level and its associated number of overage, underage and total cost.**

SS = z\*σW, W = L + τ, , σ2W= L\* σ2 + D2 σ2T

σW = sqrt(W) \* Phi

σW = sqrt(2)\*400

F(Q\*) = Cu / (Cu + Co) = 100 / (100 + 15) = 0.8696

Z = 1.12

**SS = 1.12 \* sqrt(2) \* 400 = 633.57**

Overage = $100

Underage = $15

TC = 15 \* [(633.57 \* 0.8696 + sqrt(2)) \* 400 \* 0.213] + 100\*[(-633.57 \* 0.1304 + sqrt(2)) \* 400\*0.213]

TC = $13,858.99

* 1. **A smart IE applied demand management via incentives, model consolidation, mass customization to reduce the weekly demand variations. The new demand follows. Please repeat last part.**

W = L + T = 1 + 1 = 2

σW = sqrt(W)\*phi

σW = sqrt(2) \* 200

F(Q\*) = Cu / (Cu + Co) = 100/ (100+ 15) = 0.8696

Z = 1.12

SS = 1.12\*sqrt(2)\*200 = **316.78**

Overage = $100

Underage = $15

TC = 15\*[(316.78 \* 0.8696 + sqrt(2) \* 400 \* 0.213] + 100[(316.78 \* 0.1304 + sqrt(2)\*400\*0.213]

TC = $11,275.27