4301 A, 2019 Fall, HW 1, Due: 8/27

1. (60) Please type or print your answer the questions below concisely (50 words max for each question, 10 points each).
   1. What is the objective most supply chain engineers and managers try to optimize? Please use an example to illustrate this single objective is often sufficient.

Minimizing cost.

It is actually quite difficult to find a good example. The cost reduction alone often have public relations, quality, work environment, social and environmental impact. It is sufficient only if there is pure waste of materials, time, and resources. A concrete example, having the heating and air conditioning going at the same time. It drives up the cost. Some changes in the system can reduce cost and comes with other benefits at the same time. After years of lean drive, such pure waste has reduced a lot. Customer take too much food and through away left over in all you can eat buffet, idle facilities due to bad scheduling.

* 1. Other than the objective above, what can be other important objectives in collaboration with supply chain partners and compete with competitors?

The other financial objectives can be revenue. Revenue is often based on forecast and therefore less accurate. The profit, the revenue minus cost, can also be objectives.

Some objectives can be non-financial. Minimum emission, most number of people helped, maximize health performance, maximum customer satisfaction, maximum employee satisfaction,

* 1. Please give one example in which financial objective is insufficient to help human beings.

In many situations, cost reduction alone may not be sufficient. We have shown a few examples in the introduction. Here are more examples:

1. Some universities can reduce the cost by hiring instructors. However, the quality may be a concern.
2. Universities can use AI to develop systems for academic advising and reduce cost. One of the
3. Using coal as source of energy cost less than using other forms of energy in certain places. However, it lead to more health and environmental problems. This can cause public relations problems.
4. Our sourcing logistics services often leads to lower cost for smaller suppliers. However, the service provider may not have the same priorities as the supplier themselves.
5. Develop tasty and addictive treats for profit that lead to health problems.
   1. What does triple bottom line objective include?

Social, environmental and economic, where economic really mean financial because economics is a social science that does consider social issues, as well as environmental issues.

Social include livelihood, or employment. In late 2010s, the employment is a major political issue. Reduction in cost can lead to lower level of employment. Education is another. Good and affordable public education is one of the ways to ensure accessibility of education.

Environment. This should mean sustainability. Engineers and business has good command of financial measures. However, when the environment is involved, it more complicated. When you compare different energy sources, GMO vs. non-GMO, you will understand the complexity.

* 1. Please give an example scarce resource and one of natural resource scarcity in US today and an example of product that are in abundance.

Human rest or sleep. Sleep shortage is one of the major problems in modern society. Hard wood, oil from convenient or from developed land site and not fracked. In many other countries, fresh air, fresh water, etc.

* 1. How would you define sustainability (you do not have to agree with me)?

Sustainability: the ability to be maintained at a certain rate of level (Oxford), or the quality of being able to continue over a period of time (Cambridge). No definition from Mariam-Webster. The earth can maintain and can continue to exist for long times (if free from meteor attach). Human beings can live in rather narrow band of environment of temperature, pressure, air composition, acceptable water and food supplies. Human beings have developed so much, we take most resources, make most conversions of our surroundings to serve ourselves. We may be able to hurt ourselves advertently. We have to be careful in our decisions within what we do to sustain ourselves.

I would define sustainability as human sustainability.

1. (40) A firm invests to make gears for wind turbines. It can invest in a traditional gear machine at an annual cost of $30,000 per year. The incremental cost is $60/gear. The annual maximum production capacity is 1,000. The demand is estimated to be between 600 and 1200 per year. If the demand exceeds production capacity, it will run over time at an extra cost of $20 per gear.
   1. (20) Please find and plot the total cost, average cost and marginal cost as a function of the production or demand.

(plot is given at the end. If you used software, programming method or online plotting tools, some lines may not be shown because MC(q)’s intercept on y-axis is a relatively small value compared to intercepts of other cost functions)

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or

(note: )

* 1. (10) The firm can also invest in a computer numerical controlled machine at $40,000/year. The incremental cost for each gear is $50 per piece. The annual maximum capacity is 1,500. It can also produce more gear types. Please repeat the above.

(plot should be given as well)

Assume the estimated demands are accurate, then the demand is always less than the capacity, so no extra costs/gear needs to be considered.

* 1. (10) What should the firm do and why (please make assumptions if necessary).

The firm should be able to make different business strategies based on the estimated demand for short term and long term. The break-even point can be found by setting total or average cost equal:

Set ,

The solution is at the boundary between two ranges, we do not need to check the other side. Therefore, *q* =1,000 as break-even point.

If the demand is less than 1,000, the traditional gear machine has lower cost. If the demand is greater than 1,000, the computational gear machine incurs lower cost. They incur the same cost when demand is 1,000.

If the product has increasing trend, the computational machine is better at adapting to the higher demand up to 1500. In addition, it can be used to make other types of gears to grow the market.

