April 20,2011

CEE 587 Midterm 1

- This exam is closed note, and closed book.
- You have 80 minutes to complete it.
- Please work by yourself.
- You are allowed to use a calculator.
- When you are finished, please feel free to leave quietly.
- There are a total of 45 points.

Name:

Short Answer (2 points each)

1. Provide one way in which the shift from manufacturing to services influenced transportation in this country.

    a. Customers demand more flexible, reliable, timely service.
    b. Traffic growth is greatest for smaller shipments.
    c. Demand for traditional, high-volume transportation services will continue to grow but will account for a smaller portion of the industry's revenues and volume.

    Any were acceptable

2. Has the value of US trade as a percent of GDP has increased or decreased since 1970?

    Increased

3. Why did Clearwater build a saltwater facility in Kentucky to temporarily store live lobsters?

    Reduces paperwork costs at border by using one large rather than many small shipments
    Shorter delivery times

    Cost down and freshness up OK

4. What 2 factors are driving the retreat of globalization?

    increased cost of transport
    Increased variability in transport times

5. How does better infrastructure allow a manufacturer to lower sourcing costs?

    more providers, more competition
    consolidate mfging
    cost are lower in farther away places

Problem 1 (5 points)

The transportation cost per shipment for three modes of travel are provided below. The number of items in a shipment is represented by ***v***. The maximum number of items that can be carried in a vehicle is denoted $v_{max.}$

Mode A: $1,500 +$100***v***
Mode B: $2,000+$50***v***
Mode C: $3,000+$10***v***

a. What is the fixed cost for moving a shipment with Mode A?
   $1500

b. What is the variable cost per item with Mode C?
   $10

c. What shipment size minimizes the transportation cost per item for Mode B?
   vmax

d. What is the least cost mode for a shipment size of 5, and 50 items?
   5 – A
   50 - C

Problem 2 (5 points)

Assume that a logistics system is designed and the total logistics cost per item can be described with the following function

Z = $25v + $600/v + $40

Here $25v represents the inventory cost per item as a function of shipment size, $600/v represents the transportation cost per item as a function of shipment size, and any other costs not dependent on shipment size are included in the $40 term.

a. What is the logistics cost per item with a shipment size of 6 items?

   $290

b. Determine the shipment size that minimizes the logistics cost per item (round to the nearest whole item).

   5

c. Determine the cost per item at that minimum shipment size.

   $285

Problem 3 (5 points)

Assume the following cumulative number of items diagram represents a logistics system that uses constant headways and shipment sizes, and operates with a FIFO queue discipline. On the following diagram:

a. Label one headway, H.

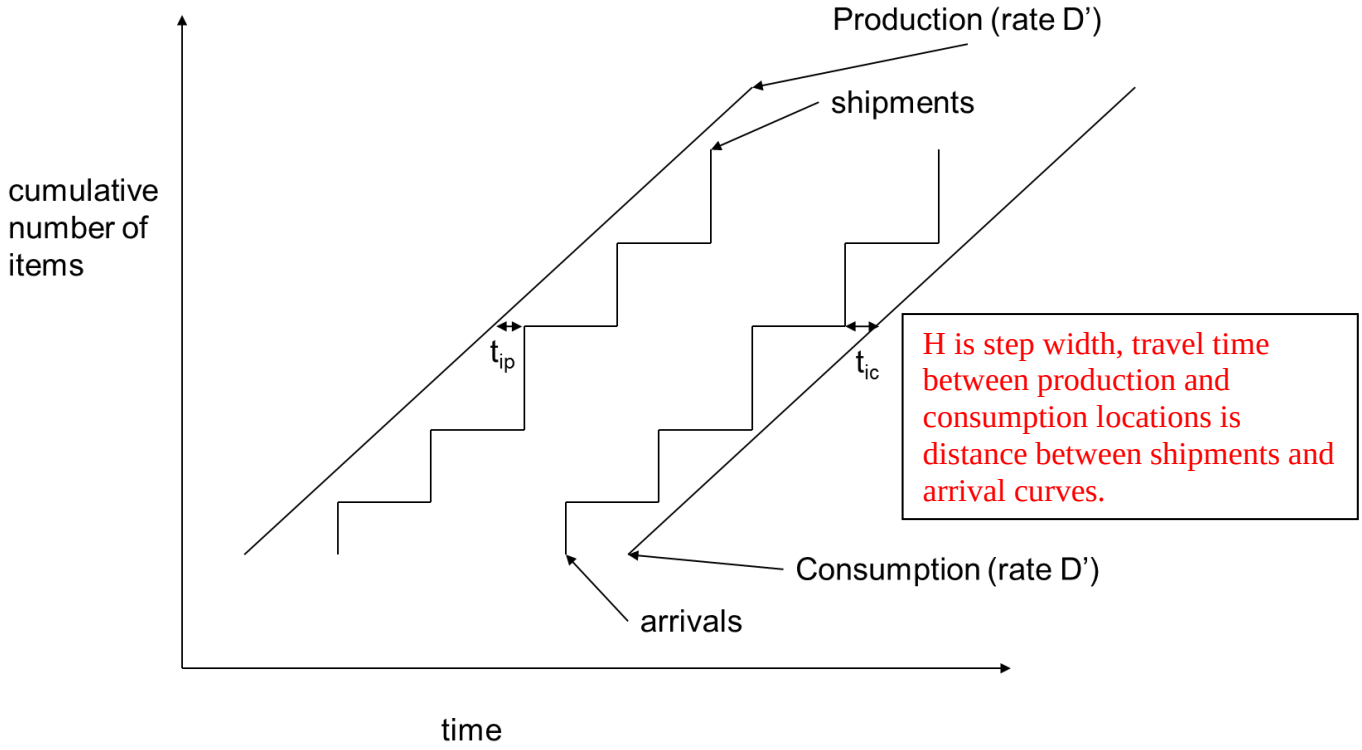
b. Label travel time between production and consumption locations, t_m.

c. Write an expression using H, t_m, t_{ip}, and t_{ic} for the time between production and consumption.

   tip+H+tm+tic

d. Modify the picture to show an inventory strategy at the production location that allows inventory to be reduced to zero just following a truck departure.
   Shift shipment curve to right so it touches Production curve

e. Modify the picture to show the impact of a new vehicle choice that has twice the capacity of the current vehicles.
   Half as many steps.



Problem 4 (10 points)

Safeway is considering the use of a regional warehouse to reduce the cost of safety stock. They have the following data about demand for a particular product at each of their stores. In either case, their policy will be to hold the mean, plus 2 standard deviations of demand in inventory.

	University District	Fremont	Ballard	Sand Point	Wallingford
Average daily demand	100 units	20 units	50 units	5 units	100 units
Standard deviation in daily demand	5 units	5 units	10 units	5 units	15 units

a) By how much would the inventory held be reduced if a central facility was used rather than holding the inventory at each store? You can ignore any in-transit inventory between the holding facility and the stores.

40 units (4 points)

b) If costs are increased by $50 a day in using this strategy, is the cost off-set by the reduced daily inventory cost? Assume a 10% interest rate, and value per unit of $10.

40*10*.1/365<50, NO (2 points)

c) Although safety inventory is decreased, describe ***two*** components of inventory that are increased.

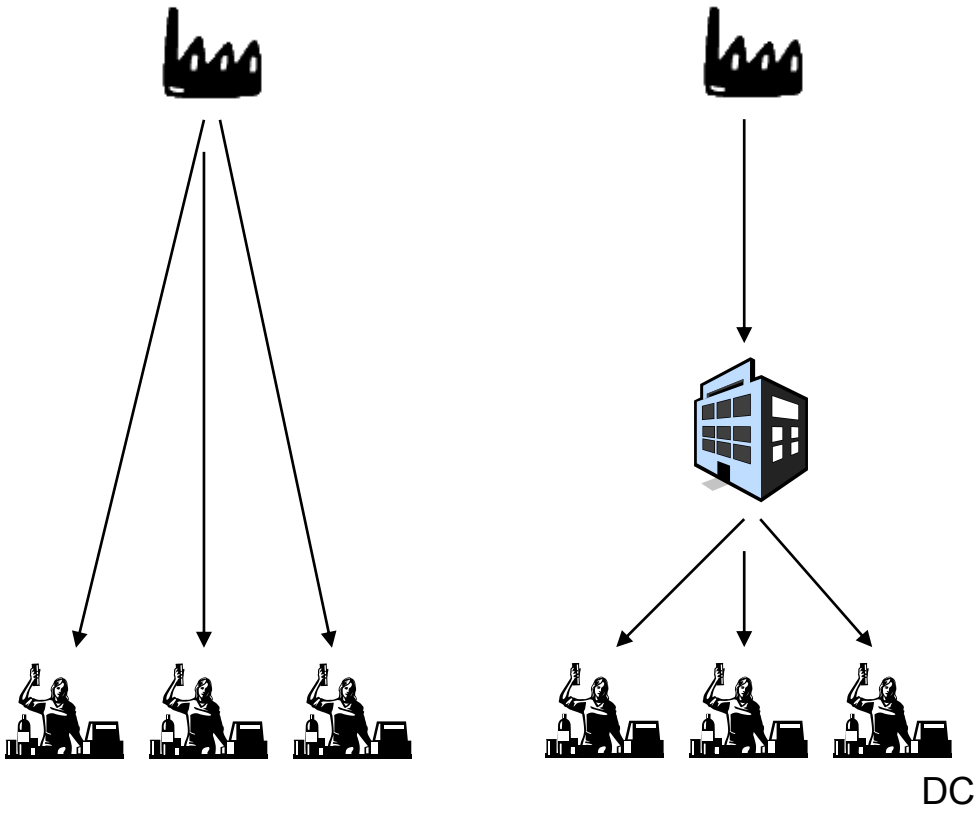
In transit between DC and safeways,
cycle inventory (2 points)

d) If every store had a standard deviation of 15 units, instead of the values shown above, would you be more or less likely to use a central facility?

more variable, more likely (2 points)

Problem 5 (10 points)

Determine the network structure (direct shipping or DC) with smallest daily logistics cost if each destination requires 5 items.



- Ignore depreciation of the vehicle and insurance
- Include the cost of transportation, inventory at the distribution center, and in transit inventory
- Assume one trip is made between the factory and the distribution center each day, and one delivery is made to each destination each day.
- Trucks delivering to destinations are of type B, however between the factory and the DC trucks of type A are used.

	Transportation cost per day	Inventory Cost	Handling	Total Logistics Cost per day of serving 3 destinations
DC	200*4/10+200*15/50= $140 $186	20000*5*.1*18.4/8760= $21	$50	$211 $257
Direct	300*4/10+300*15/50=	20000*5*.1*18/8670=		$374

Shipping	$210	$20.76 $164		$230.76

Other information:
Fuel economy: 10 miles per gallon
Driver wages: $15/hour
Average vehicle speed: 50 miles per hour
Price of fuel: $4.00/gallon
Value of item: $20,000
Capacity of vehicle A: 15 items
Capacity of vehicle B: 5 items
Interest rate: 10% per annum
Time at distribution center: 4 hours
Cost of handling an incoming truck at the DC (no charge for outgoing): $50