SUPPLY CHAIN NETWORK DESIGN PROBLEMS

PROBLEM #1: Basic Transportation Model Network

A company has to decide on the most cost effective way of shipping products from three DCs to their 11 retail outlets in the Northeast. The three DCs are located in Staten Island, Secaucus and Bridgeport. The eleven retail outlets are spread across multiple states. Shipping costs from a DC to a retail outlet are based on the distance and other factors such as tolls. Shipping costs per ton of material shipped are as follows.

	Retail Outlets										
DCs	NYC UES	NYC UWS	Stamford	Danbury	Providence	Syracuse	Buffalo	NE Philly	SE Philly	Hoboken	Princeton
Secaucus, NJ	25	30	35	35	40	30	25	30	45	40	35
Bridgeport, CT	30	40	40	40	35	30	25	40	60	50	50
Staten Island, NY	35	45	65	50	60	65	60	20	35	25	55
Total Demand	**1000**	**1500**	**500**	**300**	**200**	**500**	**600**	**400**	**1500**	**1000**	**500**

The last row in the above table shows the total demand at the eleven retail locations. The three DCs have capacities of 4000, 2000 and 3000 tons respectively. Note that the company wants to ensure the following –

1. All demand at the retail locations must be satisfied. It is Ok to ship more than the demand to a retail location.
2. The DC capacities limit the total amount that can be shipped from a DC.
3. The company wants to minimize the total shipping costs across all DCs and retail locations.

Determine the quantities shipped from each DC to each retail location.

Run sensitivity analysis on the above solution.

PROBLEM #2: Location Decisions

The additional decision regarding a supply chain network design problem is the location decision. There are a few variants of this problem but let us look at one specific scenario. This particular company considers its global network across five regions. The shipping costs associated with shipping from one region to another are shown below. The last row shows the total annual demand in each region in Million Tons

Shipping Costs ($/'000s ton)	**North America**	**South America**	**Europe**	**Asia**	**Africa**
North America	810	920	1010	1300	1150
South America	1170	770	1080	980	1000
Europe	1020	1050	950	1190	1110
Asia	1150	1250	900	590	740
Africa	1420	1000	1030	1050	710
Annual Demand ('000s Tons)	**22**	**28**	**14**	**16**	**7**

The company wants to make the most effective location decision knowing that each region's facility has different costs and only one type of facility (low or high capacity) can be open at a location. The details are as follows.

Locations	***Fixed Cost @ Low Capacity ($'000s)***	***Low Capacity ('000s Tons)***	***Fixed Cost @ High Capacity ($'000s)***	***High Capacity ('000s Tons)***
North America	6.00	10	9.00	20
South America	4.50	10	6.75	20
Europe	6.50	10	9.75	20
Asia	4.10	10	6.15	20
Africa	4.00	10	6.00	20

Determine the location decision and quantities shipped among the regions.

Run sensitivity analysis on the above solution.