Homework #5 – due Friday, March 5th, 2020

1. Steel mills in three cities produce the following amounts of steel:

Location	Weekly Production (tons)
A. Bethlehem	150
B. Birmingham	210
C. Gary	<u>320</u>
	680

These mills supply steel to four cities, where manufacturing plants have the following demand:

Location	Weekly Demand (tons)
1. Detroit	130
2. St. Louis	70
3. Chicago	180
4. Norfolk	240
	620

Shipping costs per ton of steel are as follows:

	To (cost)			
From	1	2	3	4
А	\$14	\$9	\$16	\$18
В	11	8	7	16
С	16	12	10	22

Because of a truckers' strike, shipments are prohibited from Birmingham to Chicago. Formulate this problem as a linear programming model and solve it using Excel.

2. The Roadnet Transport Company expanded its shipping capacity by purchasing 90 trailer trucks from a competitor that went bankrupt. The company subsequently located 30 of the purchased trucks at each of its shipping warehouses in Charlotte, Memphis, and Louisville. They ship goods from each of these warehouses to terminals in St. Louis, Atlanta, and New York. Each truck is capable of making one shipment per week. Given the influx of new trucks, terminal managers have been asked to indicate how many extra shipments per week they can handle from these new trucks. The manager in St. Louis can accommodate 40 additional trucks per week, the manager in Atlanta can accommodate 60 additional trucks, and the manager in New York can accommodate 50 additional trucks. The profits differ as a result of differences in products shipped, shipping costs, and transport rates:

	Terminal (profit)			
Warehouse	St. Louis	Atlanta	New York	
Charlotte	\$1,800	\$2,100	\$1,600	
Memphis	1,000	700	900	
Louisville	1,400	800	$2,\!200$	

Use Excel to determine how many trucks to assign to each route (i.e., warehouse to terminal) in order to maximize profit.

3. CareMed, an HMO health care provider, operates a 24-hour outpatient clinic in Draperton, near the Tech campus. The facility has a medical staff with doctors and nurses who see regular local patients according to a daily appointment schedule. However, the clinic sees a number of Tech students who visit the clinic each day and evening without appointments because their families are part of the CareMed network. The clinic has 12 nurses who work according to three 8-hour shifts. Five nurses are needed from 8:00 a.m. to 4:00 p.m., four nurses work from 4:00 p.m. to midnight, and 3 nurses work overnight from midnight to 8:00 a.m. The clinic administrator wants to assign nurses to a shift according to their preferences and seniority (i.e., when the number of nurses who prefer a shift exceeds the shift demand, the nurses are assigned according to seniority). While the majority of nurses prefer the day shift, some prefer other shifts because of the work and school schedules of their spouses and families. Following are the nurses' shift preferences (where 1 is most preferred) and their years working at the clinic:

		\mathbf{Shift}		
Nurse	8 a.m. to 4 p.m.	4 p.m. to Midnight	Midnight to 8 a.m.	Years of Experience
Adams	1	2	3	2
Baxter	1	3	2	5
Collins	1	2	3	7
Davis	3	1	2	1
Evans	1	3	2	3
Forrest	1	2	3	4
Gomez	2	1	3	1
Huang	3	2	1	1
Inchio	1	3	2	2
Jones	2	1	3	3
King	1	3	2	5
Lopez	2	3	1	2

Formulate and solve in Excel a linear programming model to assign the nurses to shifts according to their preferences and seniority.