Assignment #5 – *due Friday, February 14th, 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	320
	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**
A	$14	$9	$16	$18
B	11	8	7	16
C	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 by using the computer.

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. The company makes shipments from each of these warehouses to terminals in St. Louis, Atlanta, and New York. Each truck is capable of making one shipment per week. The terminal managers have indicated their capacity of extra shipments. The manager at St. Louis can accommodate 40 additional trucks per week, the manager at Atlanta can accommodate 60 additional trucks, and the manager at New York can accommodate 50 additional trucks. The company makes the following profit per truckload shipment from each warehouse to each terminal. 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

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

3. Kathleen Taylor is a freshman at Roanoke College, and she wants to develop her schedule for the spring semester. Courses are offered with class periods either on Monday and Wednesday or Tuesday and Thursday for 1 hour and 15 minutes duration, with 15 minutes between class periods. For example, a course designated as 8M meets on Monday and Wednesday from 8:00 a.m. to 9:15 a.m.; the next class on Monday and Wednesday (9M) meets from 9:30 a.m. to 10:45 a.m.; the next class (11M) is from 11:00 a.m. to 12:15 p.m.; and so on. Kathleen wants to take the following six freshman courses, with the available sections shown in order of her preference, based on the professor who's teaching the course and the time:

Course	**Sections Available**
Math	11T, 12T, 9T, 11M, 12M, 9M, 8T, 8M
History	11T, 11M, 14T, 14M, 8T, 8M
English	9T, 11T, 14T, 11M, 12T, 14M, 12M, 9M
Biology	14T, 11M, 12M, 14M, 9M, 8T, 8M
Spanish	9T, 11M, 12M, 8T
Psychology	14T, 11T, 12T, 9T, 14M, 8M

For example, there are eight sections of math offered, and Kathleen's first preference is the 11T section, her second choice is the 12T section, and so forth.

   (a) Determine a class schedule for Kathleen that most closely meets her preferences.

   (b) Determine a class schedule for Kathleen if she wants to leave 11:00 a.m. to noon open for lunch every day.

   (c) Suppose Kathleen wants all her classes on two days, either Monday and Wednesday or Tuesday and Thursday. Determine schedules for each and indicate which most closely matches her preferences.

4. 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:

	Shift			
Nurse	8 a.m. to 4 p.m.	4 p.m. to Midnight	Midnight to 8 a.m.	**Years 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 a linear programming model to assign the nurses to shifts according to their preferences and seniority.