Please complete the problems below in an R Notebook and submit the html file to Canvas. Use R to solve the problems and submit your html file.

To prepare for the homework assignment I recommend first completing the following problems, but do not turn them in. The goal of these problems is for you to learn from several algorithmic problems to better prepare you for the homework. Code each problem in R; I've given the optimal solution so you can check your results.
Chapter 9: 9.1-2 (cost = $20,200), 9.1-4 (cost = $88,400), 9.3-1 a, b & d (cost = $20)
Chapter 10: 10.3-2 (cost/time = 160), 10.6-2 (use code from class to set up the problem in R)

Problem 1: Heart Start produces automated external defibrillators (AEDs) in each of two different plants (A and B). The unit production costs and monthly production capacity of the two plants are indicated in the table below. The AEDs are sold through three wholesalers. The shipping cost from each plant to the warehouse of each wholesaler along with the monthly demand from each wholesaler are also indicated in the table. How many AEDs should be produced in each plant, and how should they be distributed to each of the three wholesaler warehouses so as to minimize the combined cost of production and shipping?

	Unit Shipping Cost			*Unit Production Cost*	*Monthly Production Capacity*
	Warehouse 1	*Warehouse 2*	*Warehouse 3*		
Plant A	*$22*	*$14*	*$30*	*$600*	*100*
Plant B	*$16*	*$20*	*$24*	*$625*	*120*
Monthly Demand	*80*	*60*	*70*		

(a) Draw a diagram of the problem.
(b) Formulate this problem as a **transportation problem** by constructing the appropriate parameter table. Note the form above isn't quite right as not all costs are combined and there is less demand than supply.
(c) Code and solve a linear programming model using lpSolveAPI. What is the shipping cost and allocation from each plant to each warehouse?
(d) Would it be more cost effective to increase capacity at Plant A or B?

Problem 2: 10.6-5 except answer the questions below rather than those in the text.
(a) Draw a diagram of the network in a Plant—Warehouse—Retail Outlets diagram where the nodes of each group are lined up Add all cost and capacity information to each route
(b) Code the problem in R as a Minimum Cost Flow problem
(c) What is the total cost of shipping?
(d) Which Plant/Warehouse route would you recommend expanding? Why?
(e) Capacity from Warehouse 2 to Retail Outlet 3 is lower than all other capacities. The manager has been complaining that it needs to be expanded to meet demand. What would you recommend based on this analysis?

Problem 3: The coach of a men's college swim team needs to assign swimmers to a 200-yard medley relay team. Since most of the best swimmers are very fast in more than one stroke, it is not clear which swimmer should be assigned to each of the four strokes. The five fastest swimmers and the best times for 50-yards of each stroke are below. The coach wishes to determine how to assign four swimmers to get the fastest overall time in the four event medley.

Stroke	Carl	Chris	David	Tony	Ken
Back	37.7	32.9	33.8	37.0	35.4
Breast	43.3	33.1	42.2	34.7	41.8
Butterfly	33.3	28.5	38.9	30.4	33.6
Freestyle	29.2	26.4	29.6	28.5	31.1

(a) Though this is an assignment problem, formulate this problem as a **transportation problem** by constructing the appropriate parameter table. Note the form above isn't quite right so you will need to make some adjustments.

(b) How many decision variables are there in your final table? What makes the problem complicated from the coach's perspective?

(c) Code and solve a linear programming model using lpSolveAPI. What is the expected finishing time and who swims which stroke of the race?