MATH3290 Mathematical Modeling 2023/2024
Assignment 2
Due Date: 5pm, April 2nd

Note: Submit your assignment via Blackboard. Late submissions are not allowed.

1. The advertising alternatives for a company include television, radio, and newspaper advertisements. The costs and estimates for audience coverage are given in the table below.

	Television	Newspaper	Radio
Cost per advertisement	$2,000	$600	$300
Audience per advertisement	100,000	40,000	18,000

The local newspaper limits the number of weekly advertisements from a single company to *ten*. Moreover, in order to balance the advertising among the three types of media, *no more than half* of the total number of advertisements should occur on the radio, and at least 10% should occur on television. The weekly advertising budget is $18,200. How many advertisements should be run in each of the three types of media to maximize the total audience?

Solve the problem by the *simplex method*. In each step, clearly state the entering and leaving variables, independent and dependent variables, and the current value of objective function.

2. Your company sells a product whose demands over the next *four* months are 100, 140, 210 and 180 units, respectively. You can stock just enough supply to meet the demand each month, or you can overstock to meet the demand for two or more consecutive months. In the latter case, a holding cost of $1.2 is charged per overstocked unit per month. You estimate the unit purchase prices for the next 4 months are $15, $12, $10 and $14, respectively. A set-up cost of $200 is incurred each time a purchase order is placed. For example, if your company wants to purchase enough products for next *two* months at the beginning of the first month, it needs to pay

$$\$200 + \$15 * (100 + 140) + \$1.2 * 140 = \$3968;$$

if your company wants to purchase enough products for next *three* months at the beginning of the first month, then it needs to pay

$$\$200 + \$15 * (100 + 140 + 210) + \$1.2 * 140 + \$1.2 * 210 * 2 = \$7622.$$

Your company wants to develop a purchasing plan that will minimize the total costs of ordering, purchasing and holding an item in stock.

   (a) Find the optimal solution by *Dijkstra's algorithm*. Write down the steps clearly.

   (b) Find the optimal solution by *Dynamic Programming* (with backward recursion). Write down the steps clearly.

3. Find the maximum flow from s to t in the graph shown below using the Ford and Fulkerson algorithm. Show the steps clearly.