

Name: _____

Instructions: All solutions should be prepared carefully and neatly. All solution sets shall be completed on this packet and submitted by uploading a scan or picture of your written work to D2L by 11:59 PM on the due date below. **Submit only a single pdf file of your entire packet. Submit any Excel or Python files as well.** The mobile app called *Genius Scan* works well. Use a PENCIL and if you make a mistake, use an eraser. Careless presentation (e.g. bad handwriting, pen scribbles, doodles, wasted space, etc) will result in a deduction of points at my discretion. Submitted work that does not demonstrate clearly the process by which one arrived at the answer will not receive credit of any kind. Academic dishonesty will not be tolerated.

PROBLEM SET V

MAT 362-010 – OPERATIONS RESEARCH II

DUE: FRIDAY, MAY 3 BY 11:59 PM ON D2L

READ: SECTIONS 9.1–9.6

Problem Number	Available Points	Your Points
1	5	
2	5	
3	5	
4	5	
5	5	
6	5	
7	5	
Total	35	

1. Jobco is planning to produce at least 2000 widget on three machines. The minimum lot size on any machine is 500 widget. The following table gives the pertinent data of the situations. [(5)]

Machine	Setup Cost	Production Cost per Unit	Capacity (in Units)
1	300	2	600
2	100	10	800
3	200	5	1200

Formulate the problem as an IP and find the optimal solution in Excel.

2. Consider the following puzzle. You are to pick out 4 three-letter “words” from the following list:

[(5)]

DBA DEG ADI FFD GHI BCD FDF BAI

For each word, you earn a score equal to the position that the word’s third letter appears in the alphabet. Your goal is to choose the four words that maximize your total score, subject to the following constraint: The sum of the positions in the alphabet for the first letter of each word chosen must be at least as large as the sum of the positions in the alphabet for the second letter of each word chosen. Formulate and solve in Excel an IP to this problem.

3. Kutztown University is in the process of forming a committee to handle the students' grievances. The directives received from the administration is to include at least one female, one male, one student, one administrator, and one faculty member. Ten individuals (identified, for simplicity, by letters a through j) have been nominated. The mix of these individuals in the different categories is given in the table below. KU wants to form the smallest committee while guaranteeing a representation of each of the five categories. What kind of problem is this? Formulate an IP and solve it in Excel.

[(5)]

Category	Individuals
Females	a, b, c, d, e
Males	f, g, h, i, j
Students	a, b, c, j
Administrators	e, f
Faculty	d, g, h, i

4. To graduate from Basketweavers University with a major in OR, a student must complete at least two math courses, at least two OR courses, and at least two computer courses. Some courses can be used to fulfill more than one requirement:

[(5)]

- Calculus can fulfill the math requirement,
- Operations Research fulfills the math and OR requirements,
- Data Structures fulfills the computer and math requirements,
- Business Statistics fulfills the math and OR requirements,
- Computer Simulation fulfills the computer and OR requirement,
- Intro to Computer Programming fulfills the computer requirement,
- and Forecasting fulfills the OR and math requirements.

Some courses are prerequisites for others:

- Calculus is a prerequisite for Business Statistics,
- Intro to Computer Programming is a prerequisite for Computer Simulation and Data Structures,
- and Business Statistics is a prerequisite for Forecasting.

Formulate and solve in Excel an IP that minimizes the number of courses needed to satisfy the major requirements.

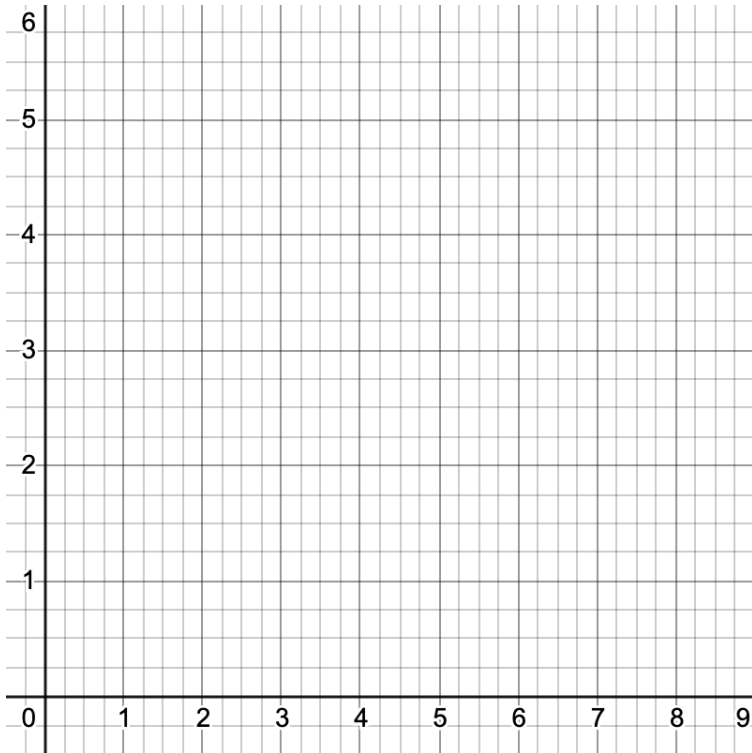
5. Develop the full Branch-and-Bound tree for the following two-dimensional pure IP. After solving LP1, choose x_1 as the branching variable. [(5)]

$$\text{Maximize: } z = x_1 + x_2$$

$$\text{Subject to: } 2x_1 + 5x_2 \leq 16$$

$$6x_1 + 5x_2 \leq 27$$

$$x_1, x_2 \geq 0, \text{ integer}$$



6. You are moving from Kutztown to Butztown and have rented a truck that can haul up to 1,100 cubic feet of furniture. The volume and value of each item you are considering moving on the truck are given in the table below. Which items should you bring to Butztown? Formulate this problem as a knapsack problem and solve it using the Branch-and-Bound method. [(5)]

Item	Value (\$)	Volume (ft ³)
Bedroom set	60	800
Dining room set	48	600
Stereo	14	300
Sofa	31	400
TV Set	10	200

7. A book salesperson who lives in Basin must call once a month on four customers located in Wald, Bon, Mena, and Kiln before returning home to Basin. The following table gives the distances in miles among the different cities. [(5)]

	<u>Miles between cities</u>				
	<i>Basin</i>	<i>Wald</i>	<i>Bon</i>	<i>Mena</i>	<i>Kiln</i>
<i>Basin</i>	0	120	220	150	210
<i>Wald</i>	120	0	80	110	130
<i>Bon</i>	220	80	0	160	185
<i>Mena</i>	150	110	160	0	190
<i>Kiln</i>	210	130	185	190	0

Formulate a TSP that minimizes the total distance traveled by the salesperson. Solve the TSP using both the Branch-and-Bound method and an LP formulation in Excel.