

Test 2 Review

- 1) In the following problem, define your variables and set up the profit function and constraints and do all the necessary to arrive at your initial simplex tableau. Once you have your tableau set up with the columns appropriately labeled, circle your first pivot element.

A farmer owns a 100 acre farm and can plant alfalfa, oats and millet. The seeds for alfalfa cost \$40 per acre, for oats cost \$20 per acre, and for millet cost \$30 per acre. A maximum of \$3200 can be spent on seeds. An alfalfa crop requires 1 workday per acre, oats requires 2 workdays per acre, and millet requires 1 workday per acre. There are only 160 workdays of labor available. If the farmer can make a profit of \$100 per acre on alfalfa, \$300 per acre on oats, and \$200 per acre on millet, how many acres of each crop should be planted to maximize profit?

- 2) Determine if the following linear programming problems are standard or non-standard. If they are non-standard, be able to explain why.

- a. Maximize $P = 3x + 8y$ subject to

$$x + y \leq 3$$

$$2x - y \leq 1$$

$$x \geq 0, y \geq 0$$

- b. Minimize $P = x + y$ subject to

$$4x - 9y \leq 10$$

$$x \geq 0, y \geq 0$$

- c. Maximize $P = 8x - y + 5z$ subject to

$$2x + 5y \leq 1$$

$$y - 9z \geq 5$$

$$x + 3y - 2z \leq 6$$

- 3) Suppose you're working a problem using the simplex method and arrive at the following tableau. List all the row operations you would perform in order to complete the next step in the simplex method. (To list the row operations, say something like the following: $1/3R_2$ followed by $R_1 - R_2$, $R_3 + 4R_2$, and $R_4 - 27R_2$). Use standard notation for row operations as illustrated in the previous sentence and as used in the text and lectures. You do NOT have to carry out the row operations. Just list them.

$$\begin{array}{ccccccc|c} x & y & z & u & v & w & p & \\ \hline 1/2 & 0 & 1/2 & 1 & 0 & -1/2 & 0 & 20 \\ 30 & 0 & 20 & 0 & 1 & -10 & 0 & 400 \\ 1 & 1 & 1/2 & 0 & 0 & 1/2 & 0 & 80 \\ 0 & 0 & -50 & 0 & 0 & 150 & 1 & 2400 \end{array}$$

- 4) In the following tableau, circle every entry that can legally be used as the next pivot element.

$$\begin{array}{cccc|c} x & y & u & v & w & p \\ \hline 0 & -1 & 1 & 0 & -1 & 0 & -8 \\ 0 & -1 & -2 & 1 & 2 & 0 & 1 \\ 1 & 1 & 0 & 0 & -1 & 0 & 10 \\ 0 & 2 & 0 & 0 & -3 & 1 & 30 \end{array}$$

- 5) In the following tableau, choose a pivot element and carry out the next pivoting step (i.e., converting the column to "unit" form consisting a one and all the rest of the entries zeros). After you've completed the step, give the values for all the variables as obtained from your new tableau.

$$\begin{array}{cccccc|c}
 x & y & z & u & v & p & \\
 \hline
 2 & 4 & 1 & 1 & 0 & 0 & 16 \\
 -2 & -5 & 1 & 0 & 1 & 0 & -10 \\
 -4 & -1 & -2 & 0 & 0 & 1 & 0
 \end{array}$$

6) Solve the following linear programming problems using the simplex method

a. Maximize $P=2x+y$ subject to

$$3x + y \leq 9$$

$$6x + y \leq 12$$

$$x \geq 0, y \geq 0$$

b. Maximize $P = 6x+6y+5z$ subject to

$$x + y + z \leq 12$$

$$3x + 3y + z \leq 30$$

$$x \geq 0, y \geq 0$$

c. Minimize $P = -2x-3y-4z$ subject to

$$x + y + 2z \leq 30$$

$$3x + 5y + 2z \leq 40$$

$$5y + 2z \leq 10$$

$$x \geq 0, y \geq 0, z \geq 0$$

d. Maximize $P = 2x+y$ subject to

$$6x + 3y \leq 1200$$

$$.75x + y \leq 250$$

$$y \geq 100$$

$$x \geq 0, y \geq 0$$

7) Evaluate

a) $C(500,500)$ b) $C(500,0)$ c) $C(500,1)$ d) $C(500, 499)$ e) $C(500, 498)$

8) Draw a Venn diagram showing sets A, B, and C, and then shade the region representing each of the following sets. Do separate pictures for parts a) and b) and do some preliminary work on scrap paper if necessary so that you can turn in a clean picture.

a) $C \cap (B \cup A^c)$ b) $B^c \cup (A \cap C^c)$

9) 550 people were asked whether they own a sedan, truck or van, the results were

235 own a sedan 85 own a sedan and a truck

280 own a truck 70 own a sedan and a van

260 own a van 125 own a truck and a van 20 own all three

a) Put the information into a Venn diagram.

b) How many people own exactly two of these types of cars?

c) How many people own a sedan and a truck but not a van?

d) How many people do not own any of these types of cars?

e) How many people own at least one of these types of cars?

10) If the letters in the word BUTTER are arranged in a random order...

a) How many different arrangements can be made of these letters in alphabetical order?

b) How many different arrangements can be made of these letters as 2 T's will be placed beside each other?

11) people go out for a job, 3 women and 6 men. 3 people will be chosen for this job.

a) How many possibilities are there if exactly 2 women will be chosen?

- b)** How many possibilities are there if at least 2 women are chosen?
- 12)** How many 7-digit phone numbers are possible
- a)** if the first digit can not be 0 or 1?
 - b)** if the first digit can not be 0 or 1, and the last 4 digits are all different odd numbers?
- 13)** Sam and Joe play 3 games of racquetball.
- a)** Draw a tree diagram to represent the possible outcomes of the three games.
 - b)** How many possibilities are there that Sam wins at least 1 game?
- 14)** A coin is tossed until a total of either 3 heads or 2 tails have occurred.
- a)** Draw a tree diagram for this experiment.
 - b)** How many of your outcomes show 3 heads occurring?
 - c)** How many of your outcomes show 2 tails occurring?
- 15)** 3 boys and 2 girls are going to sit in a row of 5 adjacent seats.
- a)** In how many different ways can they seat themselves?
 - b)** In how many different ways can they seat themselves if the 3 boys all sit together and the 2 girls sit together?
 - c)** In how many different ways can they seat themselves if each girl sits between 2 boys?
- 16)** You survey a group of 68 students to find out that
31 like football; 43 like basketball; 37 like volleyball
20 like football and volleyball; 30 like basketball and volleyball;
21 like football and basketball; 10 don't like anything of them
How many students like all three?
- 17)** a) Three students walk into a classroom with four empty seats. How many ways can the 3 people seat themselves in the 4 seats? HINT: How many ways can you arrange the four objects: the three students and the one vacant seat remaining?
- b)** What if there are only 2 empty seats when the 3 students walk in (and so 1 person has to stand)?
 - c)** What if there are 5 empty seats instead of 4 and still 3 students needing to sit down?