Math 1324 - Practice Exam 2 - Spr18

MULTIPLE CHOICE. (5pts each) Choose the one alternative that best completes the statement or answers the question.

Write the system as a matrix equation of the form AX = B.

1) $8x_1 + 9x_2 = 117$ 1) _______

$4x_1 + 6x_2 = 66$

A) $\begin{bmatrix} 8 & 9 \\ 6 & 4 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 66 \\ 117 \end{bmatrix}$

B) $\begin{bmatrix} 8 & 4 \\ 9 & 6 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 117 \\ 66 \end{bmatrix}$

C) $\begin{bmatrix} 8 & 9 \\ 4 & 6 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 117 \\ 66 \end{bmatrix}$

D) $\begin{bmatrix} 117 & 9 \\ 66 & 6 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 8 \\ 6 \end{bmatrix}$

Solve the system as matrix equations using inverses.

2) A company produces three models of MP3 players, models A, B, and C. Each model A machine requires 3.2 hours of electronics work, 2.8 hours of assembly time, and 4.4 hours of quality assurance time. Each model B machine requires 5.4 hours of electronics work, 2.4 hours of assembly time, and 3.4 hours of quality assurance time. Each model C machine requires 2.2 hours of electronics work, 5.8 hours of assembly time, and 4.8 hours of quality assurance time. There are 303 hours available each week for electronics, 393 hours for assembly, and 416 hours for quality assurance. How many of each model should be produced each week if all available time must be used? 2) _______

A) Model A: 30
Model B: 15
Model C: 50

B) Model A: 28
Model B: 22
Model C: 45

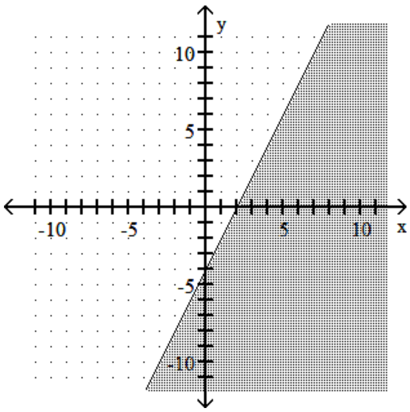
C) Model A: 31
Model B: 20
Model C: 44

D) Model A: 30
Model B: 20
Model C: 45

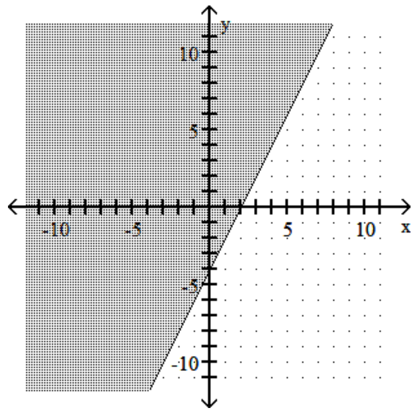
Graph the inequality.

3) $4x - 2y \leq 8$ 3) _______

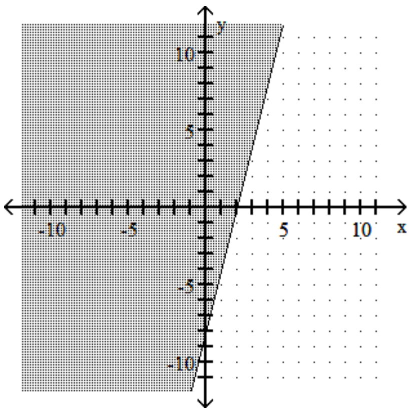
A)



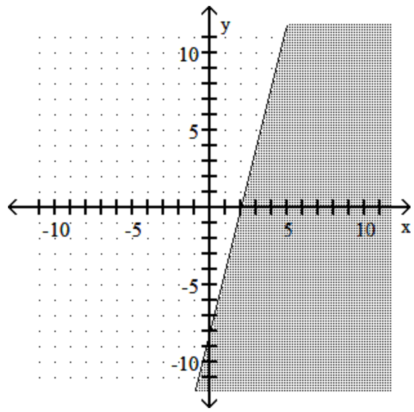
B)



C)



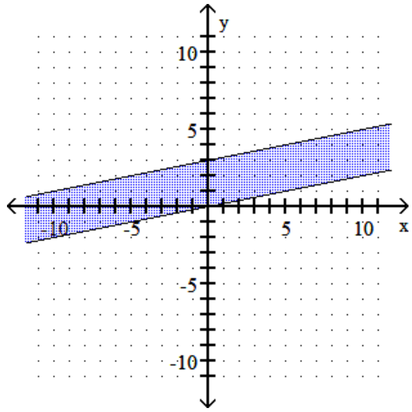
D)



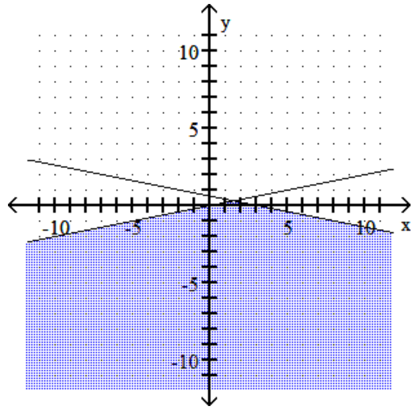
Graph the solution set of the system of linear inequalities and indicate whether the solution region is bounded or unbounded.

4) $x \geq 5y$
$x + 5y \leq 3$ 4) _______

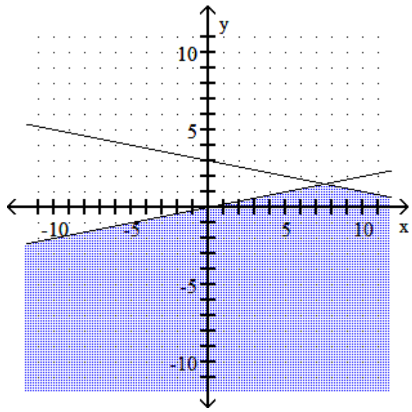
A) Bounded



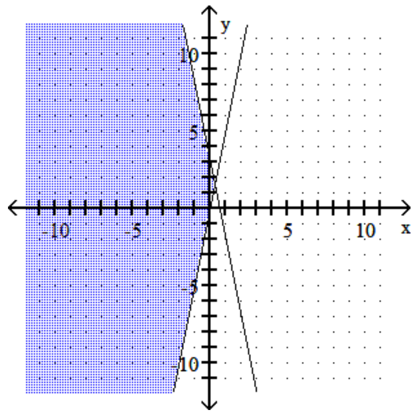
B) Unbounded



C) Unbounded



D) Unbounded



Introduce slack variables as necessary, and write the simplex tableau for the problem.

5) Find $x_1 \geq 0$ and $x_2 \geq 0$ such that 5) _______

$x_1 + x_2 \leq 87$

$3x_1 + x_2 \leq 189$

and $z = 2x_1 + x_2$ is maximized.

A)
$$\begin{array}{c} \begin{array}{cccccc} x_1 & x_2 & s_1 & s_2 & z & \end{array} \\ \left[\begin{array}{ccccc|c} 1 & 1 & 1 & 0 & 0 & 87 \\ 3 & 1 & 0 & 1 & 0 & 189 \\ \hline -2 & -1 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

B)
$$\begin{array}{c} \begin{array}{cccccc} x_1 & x_2 & s_1 & s_2 & z & \end{array} \\ \left[\begin{array}{ccccc|c} 1 & 1 & 1 & 0 & 0 & 189 \\ 3 & 1 & 0 & 1 & 0 & 87 \\ \hline -2 & -1 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

C)
$$\begin{array}{c} \begin{array}{cccccc} x_1 & x_2 & s_1 & s_2 & z & \end{array} \\ \left[\begin{array}{ccccc|c} 1 & 1 & 1 & 0 & 0 & 189 \\ 3 & 1 & 0 & 1 & 0 & 87 \\ \hline 2 & 1 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

D)
$$\begin{array}{c} \begin{array}{cccccc} x_1 & x_2 & s_1 & s_2 & z & \end{array} \\ \left[\begin{array}{ccccc|c} 1 & 1 & 1 & 0 & 0 & 87 \\ 3 & 1 & 0 & 1 & 0 & 189 \\ \hline 2 & 1 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

Pivot once about the circled element in the simplex tableau, and read the solution from the result.

6) 6) ________

$$\begin{array}{c} \begin{array}{cccccc|c} x_1 & x_2 & x_3 & s_1 & s_2 & z & \end{array} \\ \left[\begin{array}{cccccc|c} 2 & 1 & 4 & 1 & 0 & 0 & 48 \\ 2 & 4 & 1 & 0 & 1 & 0 & 32 \\ \hline -1 & -3 & -2 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

A) $x_1 = 24$, $s_2 = -16$, $z = 24$; $x_2, x_3, s_1 = 0$

B) $x_1 = 48$, $s_2 = 16$, $z = 48$; $x_2, x_3, s_1 = 0$

C) $x_1 = 48$, $s_2 = -16$, $z = -48$; $x_2, x_3, s_1 = 0$

D) $x_1 = 24$, $s_2 = -16$, $z = -24$; $x_2, x_3, s_2 = 0$

Provide an appropriate response.

7) Formulate the dual problem for the linear programming problem: 7) ________

Minimize $C = 22x_1 + 15x_2$

subject to

$$x_1 + 2x_2 \geq 3$$
$$x_1 + x_2 \geq 2$$
$$x_1, x_2 \geq 0$$

A) Maximize $P = 3y_1 + 2y_2$

subject to

$$y_1 + y_2 \leq 22$$
$$2y_1 + y_2 \leq 15$$
$$y_1, y_2 \geq 0$$

B) Maximize $P = 3y_1 + 2y_2$

subject to

$$y_1 + y_2 \geq 22$$
$$2y_1 + y_2 \geq 15$$
$$y_1, y_2 \geq 0$$

C) Maximize $P = 22y_1 + 15y_2$

subject to

$$y_1 + y_2 \leq 22$$
$$2y_1 + y_2 \leq 15$$
$$y_1, y_2 \geq 0$$

D) Maximize $P = 3y_1 + 2y_2$

subject to

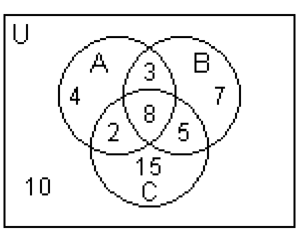
$$y_1 + y_2 \geq 3$$
$$2y_1 + y_2 \geq 2$$
$$y_1, y_2 \geq 0$$

Use a Venn Diagram and the given information to determine the number of elements in the indicated region.

8) At Southern States University (SSU) there are 399 students taking Finite Mathematics or Statistics. 238 are taking Finite Mathematics, 184 are taking Statistics, and 23 are taking both Finite Mathematics and Statistics. How many are taking Finite Mathematics but not Statistics? 8) ________

A) 376 B) 215 C) 192 D) 161

Use the Venn diagram below to find the number of elements in the region.



9) $n(A \cap C)$ 9) ________

A) 37 B) 18 C) 2 D) 10

Use the addition principle for counting to solve the problem.

10) If $n(B) = 24$, $n(A \cap B) = 5$, and $n(A \cup B) = 42$, find $n(A)$. 10) ______

A) 25 B) 23 C) 21 D) 24

SHORT ANSWER. (5pts each) Write the word or phrase that best completes each statement or answers the question. Write the answer in the space provided. No work will be graded. No partial credit.

Provide an appropriate response.

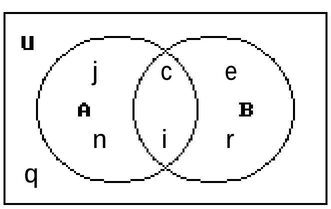
11) Solve the matrix equation $\begin{bmatrix} -3 & 4 \\ 1 & -2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 25 \\ -11 \end{bmatrix}$ by using the inverse of the coefficient matrix. 11) ______

Solve the problem.

12) Formulate the following problem as a linear programming problem (DO NOT SOLVE), that is, set up the constraints and the objective function. A company which produces three kinds of spaghetti sauce has two plants. The East plant produces 3,500 jars of plain sauce, 6,500 jars of sauce with mushrooms, and 3,000 jars of hot spicy sauce per day. The West plant produces 2,500 jars of plain sauce, 2,000 jars of sauce with mushrooms, and 1,500 jars of hot spicy sauce per day. The cost to operate the East plant is $8,500 per day and the cost to operate the West plant is $9,500 per day. How many days should each plant operate to minimize cost and to fill an order for at least 8,000 jars of plain sauce, 9,000 jars of sauce with mushrooms, and 6,000 jars of hot spicy sauce? (Let x_1 equal the number of days East plant should operate and x_2 the number of days West plant should operate.) 12) ______

Use the Venn diagram to find the requested set.

13) Find $A \cup B$. 13) ______



Provide an appropriate response.

14) The access code to a house's security system consists of five digits. How many different codes are available if each digit can be repeated? 14) ______

ESSAY. Show all work to justify your answer. Answer with no work or insufficient work will receive no credit. Partial credit may be given.

Solve the problem using the simplex method. Show all work. (10 points)

15) A stereo manufacturer makes three types of stereo systems, I, II, and III, with profits of $20, $30, and $40, respectively. No more than 100 type-I systems can be made per day. Type-I systems require 5 man-hours, and the corresponding numbers of man-hours for types II and III are 10 and 15, respectively. If the manufacturer has available 2000 man-hours per day, determine the number of units from each system that must be manufactured in order to maximize profit. Compute the corresponding profit.

Formulate the dual problem and form the simplex tableau. DO NOT SOLVE the tableau. (10 points)

16) Minimize $C = 6x_1 + 3x_2$

subject to: $3x_1 + 2x_2 \geq 34$

$2x_1 + 5x_2 \geq 43$

$x_1, x_2 \geq 0$

Use a Venn Diagram to solve the problem. (10 points)

17) In a marketing survey involving 1,000 randomly chosen people, it is found that 660 use brand P, 440 use brand Q, and 220 use both brands. How many people in the survey use brand P and not brand Q?

1) C
2) D
3) B
4) B
5) A
6) A
7) A
8) B
9) D
10) B
11) $x = -3, y = 4; x = -7, y = -5$
12) Minimize $C = 8{,}500x_1 + 9{,}500x_2$

subject to

$$3{,}500x_1 + 2{,}500x_2 \geq 8{,}000$$
$$6{,}500x_1 + 2{,}000x_2 \geq 9{,}000$$
$$3{,}000x_1 + 1{,}500x_2 \geq 6{,}000$$
$$x_1, x_2 \geq 0$$

13) {e, c, i, j, n, r}
14) 100,000
15) 100 of type-I, 150 of type-II, and none of type-III systems; maximum profit = $6500
16) Maximize $P = 34y_1 + 43y_2$

subject to: $3y_1 + 2y_2 \leq 6$

$$2y_1 + 5y_2 \leq 3$$
$$y_1, y_2 \geq 0$$

17) 440