



American University of Sharjah
Department of Mathematics and Statistics

MTH 101-Mathematics for Business I
Test II
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Full Name _____

ID Number _____

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Time of Class: _____

Good Luck.

Problem One

15 Points

Sabreen has \$10000 to invest in three types of securities: Bond A yielding 5% return, Bond B yielding 10% return and Bond C yielding 4% return. Sabreen has been told that she should invest equal amounts in Bond B as in Bond C. If Sabreen aims to have \$650 return per year, how much should she invest in each bond? Solve using Gauss-Jordan Elimination.

$$\begin{aligned} X_1 + X_2 + X_3 &= 10000 \\ 0.05X_1 + 0.1X_2 + 0.04X_3 &= 650 \\ X_2 - X_3 &= 0 \end{aligned}$$

$$\left[\begin{array}{ccc|c} 1 & 1 & 1 & 10000 \\ 5 & 10 & 4 & 65000 \\ 0 & 1 & -1 & 0 \end{array} \right] \xrightarrow{-5R_1+R_2 \rightarrow R_2} \left[\begin{array}{ccc|c} 1 & 1 & 1 & 10000 \\ 0 & 5 & -1 & 15000 \\ 0 & 1 & -1 & 0 \end{array} \right]$$

$$\begin{aligned} &\frac{1}{5}R_2 \rightarrow R_2 \\ -R_2+R_3 \rightarrow R_3 &\sim \left[\begin{array}{ccc|c} 1 & 1 & 1 & 10000 \\ 0 & 1 & -1/5 & 3000 \\ 0 & 0 & 4/5 & 3000 \end{array} \right] \xrightarrow{-R_2+R_1 \rightarrow R_1} \left[\begin{array}{ccc|c} 1 & 0 & 6/5 & 7000 \\ 0 & 1 & -1/5 & 3000 \\ 0 & 0 & 4/5 & 3000 \end{array} \right] \\ &\frac{5}{4}R_3 \rightarrow R_3 \end{aligned}$$

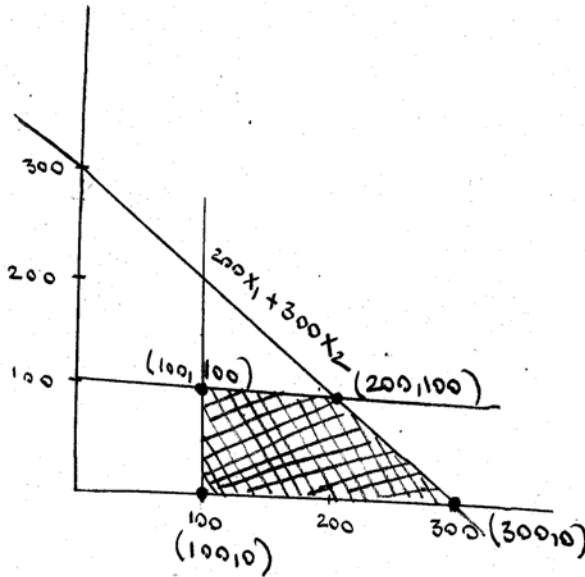
$$\begin{aligned} &\frac{1}{5}R_3+R_2 \rightarrow R_2 \\ -\frac{6}{5}R_3+R_1 \rightarrow R_1 &\sim \left[\begin{array}{ccc|c} 1 & 0 & 0 & 2500 \\ 0 & 1 & 0 & 3750 \\ 0 & 0 & 1 & 3750 \end{array} \right] \end{aligned}$$

$$\begin{aligned} X_1 &= 2500 \\ X_2 &= 3750 \\ X_3 &= 3750 \end{aligned}$$

Problem Two**15 Points**

Use the geometrical approach to solve the linear programming problem:

$$\begin{aligned} \text{Maximize and minimize } P &= 200x_1 + 300x_2 \\ \text{Subject to } x_1 + x_2 &\leq 300 \\ x_1 &\geq 100 \\ x_2 &\leq 100 \\ x_1, x_2 &\geq 0 \end{aligned}$$



$(100, 0)$	$P = 20,000$	Minimum profit
$(300, 0)$	$P = 60,000$	
$(200, 100)$	$P = 70,000$	Maximum Profit
$(100, 100)$	$P = 50,000$	

Problem Three**10 Points**

A confectioner has 600 pounds of chocolate, 100 pounds of nuts and 50 pounds of fruit in inventory with which three types of candy can be made. Sweet Tooth, Sugar Dandy and Dandy Delight. A box of Sweet Tooth uses 3 pounds of chocolate, 1 pound of nuts and 1 pound of fruit and it sells for \$8. A box of Sugar Dandy requires 4 pounds of chocolate, $\frac{1}{2}$ pound of nuts and 1 pound of fruit, and sells for \$5. A box of Dandy Delight requires 5 pounds of chocolate, $\frac{3}{4}$ pound of nuts, and 1 pound of fruit and sells for \$6. How many boxes of each type of candy can be made from the available inventory in order to maximize revenue?

**WRITE THE MATHEMATICAL FORMULATION OF THE PROBLEM ONLY,
DO NOT ATTEMPT TO SOLVE IT.**

Maximize

$$C = 8x_1 + 5x_2 + 6x_3$$

Subject to

$$3x_1 + 4x_2 + 5x_3 \leq 600$$

$$x_1 + \frac{1}{2}x_2 + \frac{3}{4}x_3 \leq 100$$

$$x_1 + x_2 + x_3 \leq 500$$

$$x_1, x_2, x_3 \geq 0$$

Problem Four

10 Points

(1) Use the simplex method to solve the following linear programming problem:

Maximize $P = 2x_1 + x_2 + x_3$
 Subject to $x_1 + x_2 + 3x_3 \leq 10$
 $2x_1 + 4x_2 + 5x_3 \leq 24$
 $x_1, x_2, x_3 \geq 0$

$$\begin{aligned} x_1 + x_2 + 3x_3 + s_1 &= 10 \\ 2x_1 + 4x_2 + 5x_3 + s_2 &= 24 \\ -2x_1 - x_2 - x_3 + P &= 0 \end{aligned}$$

	x_1	x_2	x_3	s_1	s_2	P	
s_1	1	1	3	1	0	0	10
s_2	2	4	5	0	1	0	24
P	-2	-1	-1	0	0	1	0

$-2R_1 + R_2 \rightarrow R_2$

$2R_1 + R_3 \rightarrow R_3$

	x_1	x_2	x_3	s_1	s_2	P	
s_1	1	1	3	1	0	0	10
s_2	0	2	-1	-2	1	0	4
P	0	1	5	2	2	1	20

$P = 20$
 $x_1 = 10$
 $x_2 = 0$
 $x_3 = 0$

(2) Can you use the geometrical approach to solve the above linear programming problem? Why or why not?

NO, 3-dimensional graphing