Name:________________________ Any 4 digits PIN:__________ Score:________

1(15pts) A college textbook publishing company is introducing three new textbooks, *Calculus*, *Biology*, and *Anatomy*, at the same time. The expected profit is \$10 per book on *Calculus*, \$12 on *Biology*, and \$15 on *Anatomy*. Management wishes to establish the number of books produced for each subject area to maximize the total profit. The work requirements are as follows:

	Work-Hours per Book			
Department	*Calculus*	*Biology*	*Anatomy*	**Work-Hours Available**
Color Print	0.1	1	1.2	600
Production	0.2	0.3	0.1	100
Sale	0.02	0.01	0.005	20

Formulate a linear programming model for this problem. **Do not solve for the optimal solution.**

2(15pts) For this following linear optimization problem:

$$\begin{array}{ll} \text{Maximize} & z = c_1x_1 + c_2x_2 + \cdots + c_nx_n \\ \text{subject to} & x_1 + x_2 + \cdots + x_n = \sum_{i=1}^{n} x_i = 1 \\ & x_i \geq 0,\ 1 \leq i \leq n. \end{array}$$

(a) Find all CPF (corner point feasible) solutions, and their z-values.

(b) Find the optimal solution of the maximization problem.

3(30pts) Consider the linear programming problem

$$\begin{array}{ll} \text{Minimize} & z = x_1 + 3x_2 \\ \text{subject to} & x_1 + x_2 \leq 4 \\ & 2x_1 + x_2 \geq 2 \\ & x_1 + 2x_2 \geq 2 \\ & x_1 \geq 0,\ x_2 \geq 0. \end{array}$$

(a) Use the graphical method to solve the problem.

(b) Reformulate the problem as a standard linear programming model and write down *only* the initial tableau of the model for the simplex method. **Do NOT find the last tableau.**

4(40pts) Consider a game having the following payoff table for Player 1:

		Player 2	
	Strategy	**1**	**2**
	1	4	0
Player 1	**2**	3	1
	3	1	2

(a) Let $E_M(y_1) = \max_{\{x_i \geq 0, \sum x_i = 1\}} E(x, y)$ with E being the expected pay-off to Player 1, x and y the mixed strategies for Player 1 and Player 2 respectively. Sketch the graph of $E_M(y_1)$, and find the game value $v = \min_{\{y_j \geq 0, \sum y_j = 1\}} \max_{\{x_i \geq 0, \sum x_i = 1\}} E(x, y)$ and find the optimal strategy y^* for Player 2.

(b) Set up a linear programming problem for the optimal strategy y^*, and write down the corresponding initial tableau of the problem for the simplex method.

(c) You are given the fact that the optimal strategy for Player 1 of a game (not necessarily the game above) does not include Strategy #2, and that the second last tableau is as follows

	w	y_1	y_2	y_3	y_4	y_5	y_6	y_7	b
w	1	0	$-\frac{5}{3}M + \frac{8}{3}$	0	$\frac{1}{3}M - \frac{1}{3}$	0	$-\frac{1}{3}M + \frac{4}{3}$	0	$-M$
y_3	0	0	$-\frac{8}{3}$	1	$\frac{1}{3}$	0	$-\frac{4}{3}$	0	0
y_5	0	0	$-\frac{1}{3}$	0	$-\frac{2}{3}$	1	$-\frac{1}{3}$	0	0
y_1	0	1	$-\frac{2}{3}$	0	$\frac{1}{3}$	0	$-\frac{1}{3}$	0	0
y_7	0	0	$\frac{5}{3}$	0	$-\frac{1}{3}$	0	$\frac{1}{3}$	1	1

Here, y_4, y_5, y_6 corresponds to the slack variables to Player 1's strategy number 1, 2, 3's constraint equations and y_7 is the linear programming problem's only artificial variable. Use these information to find the optimal strategies for both players. You must include the work showing the application of the optimality test and the justification for your choice of the entering and leaving variables.

End