I. THE FOLLOWING ARE FINAL MATRICES FROM LINEAR PROGRAMMING PROBLEMS. READ THE SOLUTIONS FROM EACH MATRIX. YOU NEED **NOT** GIVE THE VALUES OF THE SLACK VARIABLES. **ASSUME THAT PROBLEMS #1, #2, AND #3 ARE MAXIMIZE PROBLEMS. PROBLEMS #4, #5, AND #6 ARE MINIMIZE PROBLEMS.**

1. $\begin{bmatrix} 0 & 1 & 4 & 0 & 4 & 0 & 0 & 45 \\ 1 & 0 & -3 & 0 & 4 & 0 & 0 & 30 \\ 0 & 0 & 5 & 0 & 7 & 1 & 0 & 60 \\ 0 & 0 & 10 & 1 & 7 & 0 & 0 & 75 \\ 0 & 0 & 3 & 0 & 2 & 0 & 1 & 900 \end{bmatrix}$

2. $\begin{bmatrix} 7 & 0 & 3 & -4 & 1 & 11 & 6 & 0 & 42 \\ 4 & 1 & 8 & 5 & 0 & 5 & 2 & 0 & 55 \\ 3 & 0 & 2 & 1 & 0 & 3 & 1 & 1 & 940 \end{bmatrix}$

3. $\begin{bmatrix} 0 & 1 & 1 & -2 & 16 & 0 & 8 \\ 1 & 10 & 0 & 11 & 8 & 0 & 3 \\ 0 & 0 & 0 & 6 & 11 & 1 & 17 \end{bmatrix}$

4. $\begin{bmatrix} 9 & 0 & 0 & 1 & 7 & 3 & 0 & 20 \\ 9 & 0 & 1 & 0 & 8 & -5 & 0 & 44 \\ -1 & 1 & 0 & 0 & 2 & 12 & 0 & 37 \\ 5 & 0 & 0 & 0 & 11 & 10 & 1 & 116 \end{bmatrix}$

5. $\begin{bmatrix} 1 & 0 & 4 & 17 & 3 & 0 & 48 \\ 0 & 1 & 7 & 5 & -1 & 0 & 36 \\ 0 & 0 & 2 & 22 & 9 & 1 & 1140 \end{bmatrix}$

6. $\begin{bmatrix} 0 & 1 & 4 & 0 & 4 & 0 & 0 & 45 \\ 1 & 0 & -3 & 0 & 4 & 0 & 0 & 30 \\ 0 & 0 & 5 & 0 & 7 & 1 & 0 & 60 \\ 0 & 0 & 10 & 1 & 7 & 0 & 0 & 75 \\ 0 & 0 & 3 & 0 & 2 & 0 & 1 & 900 \end{bmatrix}$

II. WE JOIN THESE PROBLEMS ALREADY IN PROGRESS. FOR EACH MATRIX, DETERMINE THE PIVOT ROW AND COLUMN. SHOW ALL YOUR COMPUTATIONS.

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7. $\begin{bmatrix} 1 & 0 & 9 & 0 & 4 & 0 & 0 & 45 \\ 0 & 1 & -10 & 0 & 4 & 0 & 0 & 30 \\ 0 & 0 & 5 & 0 & 7 & 1 & 0 & 60 \\ 0 & 0 & 10 & 1 & 7 & 0 & 0 & 75 \\ 0 & 0 & -3 & 0 & -2 & 0 & 1 & 420 \end{bmatrix}$ *ROW#* _____ *COL#* _____

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8. $\begin{bmatrix} 30 & 20 & 10 & 5 & 1 & 0 & 0 & 60 \\ 10 & 10 & 30 & 15 & 0 & 1 & 0 & 90 \\ -45 & -20 & -33 & -52 & 0 & 0 & 1 & 0 \end{bmatrix}$ *ROW#* _____ *COL#* _____

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9. $\begin{bmatrix} 0 & \frac{9}{2} & 10 & 1 & 0 & 0 & \frac{5}{2} \\ 1 & 7 & \frac{1}{8} & 0 & 0 & 0 & \frac{7}{4} \\ 0 & \frac{11}{4} & \frac{7}{2} & 0 & 1 & 0 & \frac{1}{2} \\ 0 & -2 & -4 & 0 & 0 & 1 & \frac{35}{2} \end{bmatrix}$ *ROW#* _____

COL# _____

III. FOR EACH OF THE FOLLOWING FIND THE INITIAL SIMPLEX TABLE. YOU NEED **NOT** FIND PIVOT POSITIONS, SOLVE, ETC. SIMPLY GENERATE THE INITIAL MATRIX, WHICH WOULD BE READY FOR THE COMPUTER.

10. MINIMIZE $z = 10y_1 + 17y_2 + 12y_3$

SUBJECT TO:
$$5y_1 + 4y_2 + y_3 \geq 40$$
$$2y_1 + y_2 + 11y_3 \geq 24$$
$$y_1 + 2y_2 + 4y_3 \geq 12$$
$$y_i \geq 0$$

11. MAXIMIZE $z = 20x_1 + 40x_2$

SUBJECT TO:
$$5x_1 + 4x_2 \leq 8$$
$$2x_1 + x_2 \leq 4$$
$$x_1 + 2x_2 \leq 12$$
$$2x_1 + 6x_2 \leq 20$$
$$x_i \geq 0$$

12. A COMPANY MANUFACTURES THREE TYPES OF TOILET PLUNGERS: POO-GO, RID-O-C"LOG", AND WHOOSH-AWAY. EACH POO-GO PLUNGER REQUIRES 12 MINUTES IN THE FABRICATION DEPARTMENT, 3 MINUTES IN THE ASSEMBLY DEPARTMENT, AND 5 MINUTES IN THE PACKAGING DEPARTMENT. EACH RID-O-C"LOG" PLUNGER REQUIRES 15 MINUTES IN FABRICATION, 3 IN ASSEMBLY, AND 6 IN PACKAGING, AND EACH WHOOSH-AWAY PLUNGER REQUIRES 20 MINUTES IN FABRICATION, 6 IN ASSEMBLY AND 6 IN PACKAGING. THE MAXIMUM LABOR TIME IN EACH DEPARTMENT IS 1400 IN FABRICATION, 2000 IN ASSEMBLY, AND 1200 IN PACKAGING. THE PROFIT FOR EACH IS \$5, \$7, AND \$10, RESPECTIVELY. GENERATE THE INITIAL MATRIX THAT YOU WOULD USE TO DETERMINE HOW MANY OF EACH PLUNGER SHOULD BE MADE TO MAXIMIZE THE PROFIT AND FIND THE MAXIMUM PROFIT.

13. A FARMING CONGLOMERATE CAN USER THREE TYPES OF PLANT FOOD, MIX A, MIX B AND MIX C. THE AMOUNTS (IN POUNDS) OF NITROGEN, PHOSPHORIC ACID AND POTASH IN EACH CUBIC YARD OF MIX A ARE 12, 12, AND 16; OF MIX B ARE 16, 8, 8; OF MIX C ARE 8, 16, 16. SOIL TESTS INDICATE THAT THE FIELD NEEDS AT LEAST 800 POUNDS OF POTASH AND 700 POUNDS OF PHOSPHORIC ACID. HOWEVER, CONDITIONS ARE THAT THE AMOUNT OF NITROGEN NEEDS TO BE MAXIMIZED. GENERATE THE INITIAL MATRIX YOU WOULD USE TO DETERMINE HOW MANY CUBIC YARDS OF EACH PLANT FOOD MIX SHOULD BE ADDED TO THE FIELD TO SATISFY THE POTASH AND PHOSPHORIC ACID REQUIREMENTS WHILE MAXIMIZING THE AMOUNT OF NITROGEN APPLIED.

IIII. SOLVE THE FOLLOWING LINEAR PROGRAMMING PROBLEMS, USING MAPLE, AS DEMONSTRATED IN CLASS.

14. MINIMIZE $C = 16y_1 + 8y_2 + 4y_3$

SUBJECT TO:
$$3y_1 + 2y_2 + 2y_3 \geq 16$$
$$4y_1 + 3y_2 + y_3 \geq 14$$
$$5y_1 + 3y_2 + y_3 \geq 12$$
$$y_i \geq 0$$

MINIMUM COST:_____ x_1 = _____ x_2 = _____ x_3 = _____

15. A DISAGREEMENT HAS ARISEN IN THE MANAGER'S OFFICE AND YOU ARE CALLED TO RESOLVE THE ISSUE. YOUR COMPANY MAKES THREE ITEMS, J, K, AND L, EACH OF WHICH REQUIRE PRODUCTION TIME IN THREE DEPARTMENTS, FABRICATION, ASSEMBLY AND PACKAGING. THE LABOR HOURS REQUIRED FOR EACH ITEM (AS WELL AS THE PROFIT PER ITEM) ARE GIVEN IN THE TABLE.

DEPARTMENT	ITEM J	ITEM K	ITEM L
FABRICATION	2	2	8
ASSEMBLY	1	3	2
PACKAGING	3	2	1
PROFIT	100	200	300

HERE IS THE DISPUTE. TWO ASSOCIATE MANAGERS ARE ARGUING ABOUT THE BEST WAY TO DEPLOY THE WORK FORCE IN THE THREE DEPARTMENTS. CHRIS BELIEVES THAT WEEKLY PROFIT WILL BE LARGER BY APPORTIONING THE WEEKLY LABOR HOURS AS FOLLOWS: 600 HOURS IN FABRICATION, 600 IN ASSEMBLY AND 400 IN PACKAGING. KELLY, ON THE OTHER HAND, BELIEVE MORE PROFIT WILL BE REALIZED BY USING 600 HOURS IN FABRICATION, 400 IN ASSEMBLY AND 600 IN PACKAGING. YOUR JOB IS TO SOLVE THE DISPUTE. WHOSE DEPLOYMENT METHOD WILL PRODUCE THE LARGER PROFIT? BE SURE TO TURN IN ALL YOUR WORK FROM BOTH SOLUTIONS, AND FILL IN THE FOLLOWING:

CHRIS' METHOD:	KELLY'S METHOD:
# OF ITEM J (x1):	# OF ITEM J (x1):
# OF ITEM K (x2):	# OF ITEM K (x2):
# OF ITEM L (x3):	# OF ITEM L (x3):
PROFIT:	PROFIT: