MA 162 **Russell Brown**
Final Exam **19 December, 1992**

Answer all of the following questions. Use the backs of the question papers for scratch paper. Additional sheets are available if necessary. No books or notes may be used. When answering these questions, please be sure to 1) check answers when possible, 2) clearly indicate your answer and the reasoning used to arrive at that answer **(unsupported answers will receive NO credit)**, and 3) label all variables and equations.

Question	Score	Total
1		15
2		15
3		15
4		15
5		15
6		15
7		15
8		15
9		15
10		15
Total		150

Name ____

Section ____________________

Seat number ____________

1. Consider the following information describing the supply and demand of new and improved β-widgets at two prices:

Demand	Supply	Price
22	13	\$5
8	20	\$12

a) Find the supply and demand curves under the assumption that they are linear.

b) Find the equilibrium price.

c) Suppose the price is set at \$10. Will there be surplus or shortage?

2. a) Perform the following matrix operations, if possible. If on operation is not allowed, explain why.

i) $\begin{pmatrix} 2 \\ 3 \end{pmatrix} + (2 \;\; 3)$

ii) $\begin{pmatrix} 2 \\ 3 \end{pmatrix} \; (2 \;\; 3)$

iii) $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \; \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}.$

b) Let $A = \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix}$

and $C = \begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & 0 \\ 0 & -1 & 1 \end{pmatrix}$. Determine if B or C is the inverse of A.

Justify your answer.

3. Consider the system of equations

$$\begin{array}{rrrr} w+ & x+ & 2y+ & z = 1 \\ w+ & 2x+ & y- & z = 0 \end{array}$$

Find two solutions to this system.

4. Consider the tableau

P	x	y	s_1	s_2	s_3	RHS
1	0	0	-1	0	-3	5
0	1	0	0	0	0	4
0	0	1	2	0	1	3
0	0	0	1	1	2	4

a) List the basic and nonbasic variables.

b) Give the coordinates of the associated corner point.

c) Perform exactly one simplex pivot.

d) Is the new tableau optimal?

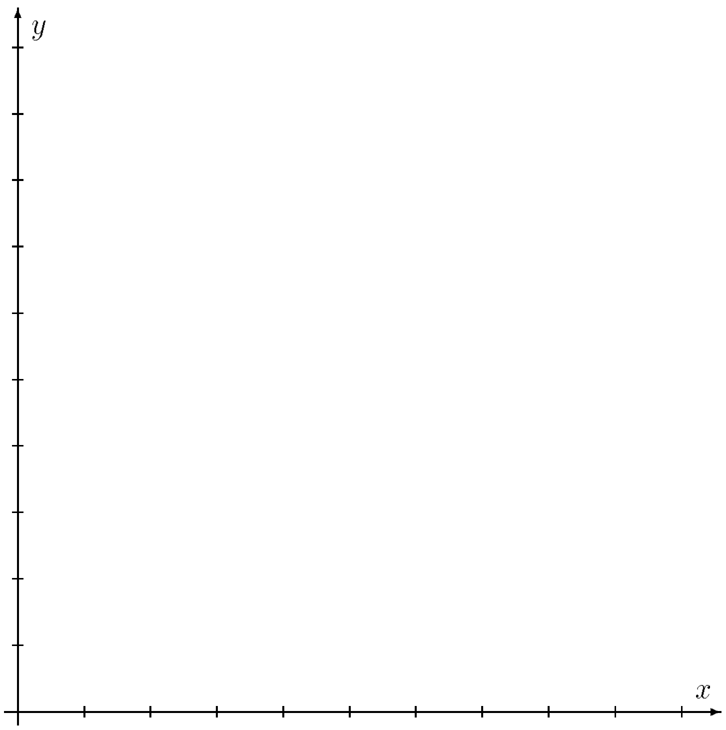
5. Consider the linear program

$$\min\ 2x + y$$

$$\text{subject to :}$$

$$\begin{aligned} x &\leq 4 \\ x + y &\geq 4 \\ x - y &\geq 0 \end{aligned}$$

a) Sketch the feasible set.



b) Give the optimal feasible point and the optimal objective function value.

c) Draw the level line of the objective function which passes through the optimal feasible point.

6. A candy company packages bubble gum, Hershey's Kisses and mints into mixed packages of candy. They have 10 lbs of each type of candy. They sell two mixes. Mix I contains 2 oz. of bubble gum, 3 oz. of Hershey's kisses and 4 oz. of mints. Mix II contains 4 oz. of bubble gum, 1 oz. of Hershey's kisses and 2 oz. of mints. Mix I produces a profit of \$0.50 per package and Mix II produces a profit \$0.75 per packages. Write down a linear program whose solution will give the most profitable way of packaging the available ingredients.

7. Use the Lindo printout to answer the questions below.

a) What is the objective function?

b) What is the optimal feasible point?

c) Suppose that the resource in Row 2 is increased by 10 units. What will be the new optimal objective function value?

d) Suppose that the coefficient of x is changed from 3 to 4. What will be the new optimal objective function value?

e) Suppose that the coefficient of y is changed from 5 to 8. What will the new optimal objective function value be?

8. a) A child has 7 teddy bears and 4 stuffed dragons. How many ways can he pick one of each to put in his bed?

b) How many ways can a family of five stand in one row for a photograph?

c) How many different 3 member groups can we form from a class of 31?

9. On the third exam, 100 students took the exam, 82 came to class to collect their test paper and 82 passed the exam. Seventy-six students passed the exam and collected their test paper.

   a) How many students failed the exam and did not collect their test?

   b) Are the events C of collecting the exam and P of passing the exam independent? Justify your answer.

10. a) Suppose that you have 7 coins in your pocket. Two quarters, 2 nickels and 3 dimes. What is the expected value of picking a coin at random? Assume that each coin is equally likely to be drawn.

b) Bill makes 75% of his free throws. Assuming that consecutive shots are independent, what is the probability of Bill making exactly 3 shots in 4 attempts?