Department of Mathematical Sciences
Carnegie Mellon University

21-393 Operations Research II
Test 2

Name:____

Problem	Points	Score
1	25	
2	30	
3	20	
4	25	
Total	100	

Q1: (25pts)
(a) Write down the dual of

$$\begin{array}{llcllll}
\text{maximise} & x_1 & + & 6x_2 & & \\
\text{subject to} & & & & & \\
 & 2x_1 & + & 3x_2 & \leq & 12 \\
 & 6x_1 & + & x_2 & \leq & 8
\end{array}$$

$$x_1, x_2 \geq 0.$$

(b) You are now given that the optimal solution to the above program is $x_1 = 0, x_2 = 4$. Use complementary slackness to solve the dual.

Q2: (30pts)
Write down the Karush-Kuhn-Tucker conditions for the following problem:

$$\text{minimise } (x-1)^2 + (y-2)^2$$

subject to

$$2x + 3y_2 \geq 10$$

Solve the problem by finding a solution to the KKT conditions.

Q3: (20pts)
Set up the initial tableau for solving the problem of Q2 by the *restricted simplex algorithm*. List the pairs of variables that cannot simultaneously be basic. —**YOU DO NOT HAVE TO CONTINUE BEYOND THIS POINT IN THE SOLUTION OF THE PROBLEM**

Q4: (25pts)
Players A and B play the following game. A chooses a number $x_A \in \{0, 1, 2, 3\}$ and B chooses a number $x_B \in \{0, 1, 2\}$. If $x_A + x_B$ is odd, A wins a point, otherwise B wins a point.
Write down a linear program whose solution will produce an optimum strategy for A. **YOU DO NOT HAVE TO SOLVE THE PROGRAM**.