Department of Mathematics
Carnegie Mellon University

21-393 Operatons Research II
Test 1

Name:______________________________________

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

Q1: (25pts)
Solve the following linear program by using the Upper Bounded Simplex Algorithm:

$$
\begin{array}{lrcrcr}
\text{maximise} & 2x_1 & - & 3x_2 & & \\
\text{subject to} & & & & & \\
& 23x_1 & + & 34x_2 & \leq & 837 \\
& 17x_1 & + & 19x_2 & \leq & 596
\end{array}
$$

$$0 \leq x_1 \leq 1, 0 \leq x_2.$$

Q2: (25pts)
Solve the following linear program for all values of λ:

$$\begin{array}{llcll}
\text{maximise} & (\lambda-2)x_1 & - & 3x_2 & & \\
\text{subject to} & & & & & \\
& x_1 & + & x_2 & \leq & 2 \\
& -x_1 & + & x_2 & \leq & 1
\end{array}$$

$$x_1, x_2 \geq 0.$$

Q3: (25pts)
Solve the following integer program:

$$\begin{array}{llllllll}
\text{maximise} & -3x_1 & - & \frac{1}{2}x_2 & & & & \\
\text{subject to} & & & & & & & \\
 & 2x_1 & + & \frac{1}{2}x_2 & + & x_3 & & = & 4\frac{1}{2} \\
 & -x_1 & + & \frac{1}{2}x_2 & & & + & x_4 & = & 2\frac{1}{2}
\end{array}$$

$$x_1, x_2, x_3, x_4 \geq 0 \text{ and integer.}$$

Q4: (25pts)

Formulate the following as an integer program:

The Financial Aids office at Carnegie Mellon University is preparing its awards for the coming year. It has selected n students to receive awards, and wants to grant at least m_i dollars to Student i, $i = 1, 2, \ldots, n$. The office has s different scholarships available; Scholarship j confers the amount a_j on its recipient. The office may have to award several scholarships to an individual in order to provide the minimum it has decided that he/she will receive. The office cannot however reduce the amount of a scholarship award. If the office does not award a particular scholarship then it becomes available for next year. The office wishes to maximise the amount of money not spent in this way.