Name:

IE 311.1 Mathematical Programming
Fall 2001
Quiz I

1[5 points]. You are given two integer linear programs below:

$$\max x_1 + x_2 + x_3 \tag{1}$$

$$\text{subject to} \tag{2}$$

$$x_1 + x_2 \leq 1 \tag{3}$$

$$x_1 + x_3 \leq 1 \tag{4}$$

$$x_2 + x_3 \leq 1 \tag{5}$$

$$x_1, x_2, x_3 \text{binary} \tag{6}$$

and

$$\max x_1 + x_2 + x_3 \tag{7}$$

$$\text{subject to} \tag{8}$$

$$x_1 + x_2 \leq 1 \tag{9}$$

$$x_1 + x_3 \leq 1 \tag{10}$$

$$x_2 + x_3 \leq 1 \tag{11}$$

$$x_1 + x_2 + x_3 \leq 1 \tag{12}$$

$$x_1, x_2, x_3 \text{binary} \tag{13}$$

a Do the two IP's above have the same feasible integer solutions or not? Show by inspecting the two IPs.

b Establish whether there is a difference between the LP relaxation optimal values of the two IPs? (In other words, is one superior to the other, or are they equal?)

2. [5 points] Consider the Integer Program

$$\max 3x_1 + 14x_2 + 18x_3 \tag{14}$$

$$\text{subject to} \tag{15}$$

$$3x_1 + 5x_2 + 6x_3 \leq 10 \tag{16}$$

$$x_1, x_2, x_3 \text{binary} \tag{17}$$

The LP relaxation optimum is $(0, 4/5, 1)$. Determine by inspection whether each of the following inequalities is valid for this model. In each case, determine whether adding the inequality in question to LP relaxation and resolving the model would improve the optimal value of the relaxation?

a $x_2 + x_3 \leq 1$

b $x_1 + x_2 + x_3 \leq 1$

c $3x_1 + 5x_2 \leq 10$