Due March 18 No class Mar 10-14 (spring break).

Exam Mar 27

1. Solve the following problem by adding cutting planes. Prove that at least one of your cutting planes is a facet-defining inequality. (Similar questions will be on both exams.)

max x1+x2

s.t. x1+4x2≤10

3x1+x2≤9

x1,x2∈Z+

2. Create a two dimensional IP that has no facets.

3. Given the following knapsack constraint.

35x1+27x2 +23x3+19x4+15x5+15x6+12x7+8x8+6x9+3x10≤39.

x∈B10

a. Draw the conflict graph for the above problem find a clique inequality that induces a facet. (prove that it is a facet)

b. Find a hyperclique (edges must be of at least size 3). Find the largest lower bound on the dimension of the face induced by the hyperclique inequality. If you can find one that is facet defining, that would be better, but it may not be possible.

4. I like science fiction. So assume that the fourth dimension is time. Suppose I have a polyhedron that has length, width, depth and time as the dimensions. Furthermore, you may assume that the only constraints are bound constraints with each variable being restricted between 0 and 1. (The four dimensional hypercube.) You can view this as a die that stays in one position from time 0 to 1. Please describe in words at least two classes of facets for this polyhedron.

5. A wheel Wm, is a graph with m+1 nodes where the nodes 2, 3,..., m+1 form a hole and the there exist edges {1,2}, {1,3}, ..., {1,m+1}. A picture of a W5 is below. Derive conditions where an induced Wm creates a facet defining inequality for the node packing polyhedron. Prove that the conditions you come up with do generate a facet-defining inequality. The more broad the condition, the more points given.

