Math 414   Lecture 27

For integer problems duality theory fails. Omit dual variable calculations.

Linsolve doesn't do integer problems. Use it or MatLab to get the final simplex tableau. Run the Cutting Plane Agorithm with MatLab.
Recall the MatLab instructions for inserting rows (see Hw 22).
First load the program 'insert':   load('insert')

2.5	-0.5	0.5
2	2	2
9	9	9

The floor of the nonintegral row $\langle 2.5, -0.5, 0.5\rangle$ is $\langle 2, -1, 0\rangle$.
We wish to add row $\langle 2, -1, 0\rangle$ just above the objective row and then add a slack column $\langle 0; 0; 1; 0\rangle$ before the final constant column.
Enter: row = $\langle 2\ {-1}\ 0\rangle$; >insert<
Result:

2.5	-0.5	0	0.5
2	2	0	2
2	-1	1	0
9	9	0	9

Note: enter "row = $\langle 2\ {-1}\ 0\rangle$", not "row = $\langle 2\ {-1}\ 1\ 0\rangle$" ; The insert program automatically adds the "1".

RECALL:

THE CUTTING PLANE ALGORITHM FOR INTEGER PROBLEMS

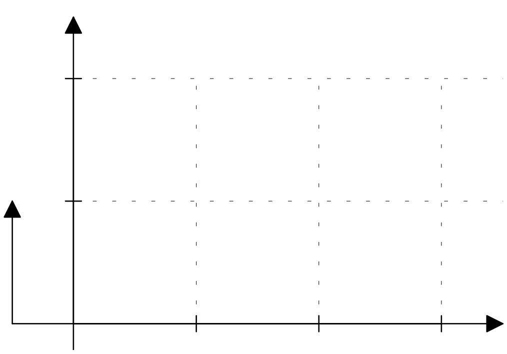
- Run the simplex method as usual and get a solution.

Loop:

- If the primal variables are integral, stop. We're done.
- If not pick the constraint for the <u>primal</u> variable (don't try to make slacks integral) with the largest decimal part. Choose one if there are two or more with the same largest decimal part.
- Take the floor of its coefficients and its constant, and add a slack variable.
- Add this new constraint, pivot to make a tableau whose basic variables have identity matrix columns.
- Apply the dual method to restore feasiblity and get a new solution.

Repeat the loop.

■ max $z = y$
with
a: $2x + 2y \le 3$,
$x, y \in N$



Initial tableau.

x	y	r	b

Final tableau. Select y to enter and pivot.

x	y	r	b

The solution is not integral. Cut it off by adding a new floor constraint: taking the floor of the coefficients and constant.
The new constraint is: ____________________

Adding a slack gives: ____________________

New matrix.

	x	y	r	s	b
z					

New tableau. Pivot to make y and s identity columns.

	x	y	r	s	b
z					

The solution is not feasible. Restore feasibility using the dual method. In the row with the negative constant, pivot on the entry whose objective/(negative-coefficient) ratio is closest to 0.

Final tableau.

	x	y	r	s	b
z					

Answer. max $z = 1$ at $y = 1$, $x = 0$.

Trees

A tree consists of *nodes* connected by *edges*.
There is a *root* node at the top.
If two nodes are connected by an edge, the higher node is the *parent* and the lower one is the *child*.
Nodes with no children are *terminal* nodes.
In a *binary tree* every nonterminal node has exactly two children.
From each node, there is a unique *path* up to the root.