Linear Optimization Midterm # 1 6:30pm 3/13/2013

March 13, 2013

(1) (10 pts) What is the recession cone of P (be careful!)? Prove it!

$$P = \{x \in \mathbb{R}^n | Ax \le b, x \le 0\}$$

(2) (20 pts) Consider the following system if inequalities:

• Find its extreme points using the intersection of tight halfspaces.

• Extend it to a standard system and find its basic feasible solutions.

(3) (25 pts) Solve the following LP using Simplex method. Identify the inverse of Basis at every iteration.

(4) (15 pts) Solve the following LP using Geometric method:

(5) (25 pts) [C:/limbo/LPfolder]\$ Error code 80080005 – server execution failed

- Joe: &%\$#!! THE SERVER FAILED!
- Jack: Oh no.. we are \$#%\$#*@! how do we get the solution? NOW WHAT?!
- Joe: Wait... look! we have some part of the table intact, maybe we can generate the rest!
- Jack: *sigh-of-relief*, but.. dude... HOW CAN WE DO IT?

The simplex table at the end (well, the readable part :)) and their original LP are as follows:

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		x_1	x_2	x_3	x_4	x_5		_	
		1	:(0	0	2	@\$	-	
	%	1	*	0	1	#		_	
	x_2	!	:D	0	0	1	3		
	&	\$?	0	1	0	%	!!		
			0					=	
max	-x	$;_{1} +$	$-2x_2$						
s.t.	x	1	$+x_2$	$-x_3$				_	2
	-x	1	$+x_2$		-x	4		=	1
			$+x_2$			+	x_5	=	3
	x_{1}	1,	x_2 ,	$x_3,$	x_{z}	4, 4	$x_{5},$	\geq	0

Fill in the missing numbers! or you can do two-phase simplex method from scratch for 1/2 points.

Hints:

- The reduced cost of basic variables are...
- Remember, ORDER OF BASIS IS IMPORTANT!
- When we multiply with the inverse of basis we will get our favorite matrix (guesses :)) somewhere in some order within the table.

(6) (20 pts) Assume the polyhedron $\{x \in \mathbb{R}^n | Ax = b, x \ge 0\}$ is bounded. Consider the following two problems, where x_n is the *n*th component of x:

Let the optimal objective values of these two problems be x'_n and x''_n , respectively. Let x_n be any number in the interval $[x'_n, x''_n]$. Show that there exists a feasible point whose *n*th component is equal to x_n .