Math 414 Hw 15 Name________________________________Score____/10

Exam 2, week from today.

1(2). Suppose a canonical problem is being solved by the two phase method. Suppose r, s are the extra variables and u is the slack variable. Suppose the objective is:
max $z = 2x - y$

Suppose the last tableau of the first phase is

	x	y	u	r	s	b
x	1	8	0	1	2	3
u	0	-3	1	1	3	4
z	0	7	0	2	4	0

What is the initial matrix of the second phase?

What is the first tableau obtained from the initial matrix by pivoting?

2(5). Write the canonical and dual problems for the given primal problem.
Let r, s, t be the slack variables in the canonical problem and also the variables of the the dual problem.
Solve both problems.

PRIMAL PROBLEM　　CANONICAL PROBLEM　　DUAL PROBLEM

Max $z = 2x + y$

r: $x + y \le 4$

s: $x - y \le 2$

t: $-x + y \le 2$

$x, y \ge 0$

Optimal solutions:

PRIMAL PROBLEM	CANONICAL PROBLEM	DUAL PROBLEM
$z =$	$z =$	$z =$
$x =$	$x =$	
$y =$	$y =$	
	Slacks $r =$	Duals $r =$
	$s =$	$s =$
	$t =$	$t =$

Note: The optimal values are all the same.
Note: Either a slack variable is 0 or the corresponding dual variable is 0. This is the COMPLEMENTARY SLACKNESS PRINCIPLE. For any constraint, the slack and dual variable can't both be nonzero.

3(3). Find the optimal solutions (you may use the geometric method since there are only two variables) for the following primal problem and for its dual problem. Now run LinSolve on the primal problem. In the LinSolve column, write down the values LinSolve gives for the dual variables which it calls "shadow prices".
LinSolve changes the sign of negative constraint constants (it doesn't handle negatives). It gives you a warning since this changes the sign of the corresponding dual variable. You must take care of reversing this sign change. See the example below.
To run LinSolve on a negative variable $s \le 0$, replace s by $-s$ (thus $s \ge 0$), run LinSolve, then negate the answer to get back s.

PRIMAL PROBLEM	DUAL PROBLEM
max $z = x + y$	min $z = 2r - 2s$
with	with
r: $2x + y \le 2$	x: $2r - s \ge 1$
s: $-x - 2y \ge -2$	y: $r - 2s \ge 1$
$x, y \ge 0$	$r \ge 0, s \le 0$

OPTIMAL PRIMAL SOLUTION.	DUAL SOLUTION.	LINSOLVE SHADOW PRICES Note sign change.
$z =$	$z =$	
$x =$	$r =$	$r =$
$y =$	$s =$	$s =$