AGEC 622 LP Practice Exam

- Total of 100 points

Part I Multiple Choices (30 points)

1. (6 pts.) The units in the same row must have the same denominator

A. True B. False C. I don't know.

2. (6 pts.) Suppose in a transportation problem, the number of supply locations is *m* and the number of demand locations is *n*. The movement from supply locations to demand locations are all allowed. How many decision variables are there in this problem?

A.$m + n$ B.$m * n$ C.m D.n

3. (6 pts.) In the optimal solution, the decision variable level times the shadow price should be zero.

A. True B. False C. I don't know

4. (6 pts.) Does the mixed integer problem belong to the linear programming category?

A. Yes, it does. B. No, it doesn't. C. I don't know.

5. (6 pts.) Sam has a firm to assemble tables using tabletop and 4 legs. He can buy tops and legs from the market at $10/top and $2/leg. He sells the tables for $20 each. He could only make no more than 20 tables. Which tableau is correct for this simple question?

(A)	Table	Table Tops	Table Legs		
Obj	20	-10	-2		
Table balance	1	-1	-4	<=	0
Table max	1			<=	20
(B)	Table	Table Tops	Table Legs		
Obj	20	-10	-2	max	
Table tops balance	1	-1		<=	0
Table legs balance	4		-1	<=	0
Table max	1			<=	20

(C)	Table	Table Tops	Table Legs		
Obj	20	-10	-2	max	
Table tops balance	1	-1		<=	0
Table legs balance	1		-4	<=	0
Table max	1			<=	20
(D)	Table	Table Tops	Table Legs		
Obj	20	-10	-2	max	
Table tops balance	1	-1		<=	0
Table legs balance	-4		1	<=	0
Table max	1			<=	20

Part II Interpretation (30 points)

Donald's sawmill computer has generated a solution to a model that shows how to deal with today's delivery of logs. The solution deals with sales of four products (2x4's, 1x2's, plywood, and sawdust) three processes can be used (Proc1, Proc2, Proc3) that produce combinations of 2x4's, 1x2's, plywood, and saw dust. The mill uses energy, storage space, logs, saw time, and bundling time. Energy and extra storage space can be purchased from the market. The units of all variables in this problem are units. The model tableau is as follows:

	2x4's	1x2's	Plywood	Saw dust	Proc1	Prco2	Proc3	Energy	Rent Storage	sum		
amount of each x												
objective	200	300	70	10				-0.06	-1		MAX	
2x4's	1				-5		-6				<=	0
1x2's		1			-3		-2.5				<=	0
Plywood			1			-6					<=	0
Saw dust				1	-1	-2	-0.7				<=	0
Energy					4	3.9	3.5	-1			<=	0
Storage	30	25	72	1					-1		<=	100
Logs					1	1	1				<=	500
Saw Time					4	12	8				<=	2400
Bundling Time					3	1	6				<=	2400
Non-negative	1,	1,	1,	1,	1,	1,	1,	1,	1,		>=	0

Sensitivity report is given below:

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
C3	amount of each x 2x4's	2600	0	200	1E+30	29.83
D3	amount of each x 1x2's	1450	0	300	59.66	275
E3	amount of each x Plywood	0	-2	70	2	1E+30
F3	amount of each x Saw dust	470	0	10	99.43333333	9
G3	amount of each x Proc1	400	0	0	29.83	826.965
H3	amount of each x Prco2	0	-1725.654	0	1725.654	1E+30
I3	amount of each x Proc3	100	0	0	1653.93	29.83
J3	amount of each x Energy	1950	0	-0.06	0.06	367.54
K3	amount of each x Rent Storage	114620	0	-1	0.027777778	1.734302326

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
L5	2x4's sum	1.13687E-13	170	0	1E+30	2600
L6	1x2's sum	-8.52651E-14	275	0	1E+30	1450
L7	Plywood sum	0	0	0	1E+30	0
L8	Saw dust sum	4.26326E-14	9	0	1E+30	470
L9	Energy sum	0	0.06	0	1950	1E+30
L10	Storage sum	100	1	100	114620	1E+30
L11	Logs sum	500	1653.93	500	100	200
L12	Saw Time sum	2400	7.4575	2400	800	400
L13	Bundling Time sum	1800	0	2400	1E+30	600

Please answer the following questions using the parameter numbers and the solution values:

1. (4 pts.) Decision variables: 2x4's and Energy

2. (4 pts.) Shadow prices on Saw Time constraint and shadow prices on Energy constraint

3. (2 pts.) Reduced costs of Decision Variable Proc2

4. (4 pts.) Which constraint(s) is(are) not binding? Why? Make your best guess.

5. (4 pts.) List the names of all supply-demand balance constraints (for both the input side and output side).

6. (6 pts) Explain the economic meaning of Storage constraint. Please use the parameter numbers in the problem.

7. (6 pts) Explain the economic meaning of the parameters in the column of Proc1, in terms of yield and resource usage. Please use the parameter numbers in the problem.

Part III Tableau (40 points)

Suppose John has a farm with 1000 acres of cropland, 500 acres of pastureland and one corn barn. He can plant corn and soybeans on the cropland and feed beef cattle on pastureland. One head of cattle will occupy 15 acres of pastureland. John starts feeding cattle in the first quarter of the year (Q1) and sells cattle in Q4. The cost of planting crops and feeding beef cattle is listed below.

	Corn	Soybean	Cattle
Cost ($)	80	100	300
Yield	180 bu/acre	70 bu/acre	600 (lb/head)
Price		7 ($/bu)	1 ($/lb)
Corn Q1(bu/head)			5
Corn Q2(bu/head)			5
Corn Q3(bu/head)			5
Corn Q4 (bu/head)			5
Harvest time	Q3	Q3	

One head of cattle eats 5 bushels of corn per quarter. The following information is given.

- The storage cost is $0.1 per bushel per quarter.
- John can **purchase** corn in Q1 and Q2 at $3.2 and $3.4 per bushel respectively.
- He can **sell** corn in Q3 and Q4 at $3 and $3.3 per bushel respectively.
- 1% of the corn in the barn spoils per quarter
- No purchase option available in Q3 and Q4
- No initial storage in the corn barn in Q1.
- The corn barn must be cleaned out at the end of Q4.
- The corn barn can only store corn not soybeans.
- The barn can store up to 150 thousand bushels of corn.

Please set up the tableau for this problem. (Do not need to solve).