Be sure to sign the following pledge. Consider the statement to be the rules for the exam. Any infraction relating to these rules will be considered a breach of SU’s Academic Integrity policy, and will be dealt with accordingly.

Due Date: Friday, 10/24/14
On my honor, I have not:
a. sought nor received assistance from any person other than Dr. Hetzler, nor
b. provided assistance to any other student, nor

c. copied the solution or any portion of the solution from any reference source.

Signature: __________________________

1. Mike is trying to decide what to have for dinner tonight. He has the ingredients to make an entire serving of each of two different meals. From one serving of the first, he’ll obtain 30% of the Vitamin A and 25% of the protein he needs in a day. From one serving of the second, he’ll obtain 15% of the Vitamin A and 15% of the protein he needs in a day. Suppose that he needs 20% of the Vitamin A for the day, and 20% of the protein. It takes him 30 minutes to prepare one serving of the first type of meal, and 20 minutes for the second, but he’s in a rush, so he wants to minimize the amount of time required to make his meal. A fraction of a serving will require the same fraction of the total time for one whole serving, and will provide the same fraction of nutrients. He wants to know what fraction of a serving of each type of meal he should prepare. Formulate a linear programming problem, assuming that the two fractions should total one.

2. Brady Corporation produces cabinets. Each week, they require 90,000 cu. ft. of processed lumber. They may obtain lumber in two ways. First, they may purchase lumber from an outside supplier and then dry it at their kiln. Second, they may chop down logs on their land, cut them into lumber at their sawmill, and finally dry the lumber at their kiln. Brady can purchase grade 1 or grade 2 lumber. Grade 1 lumber costs $3 per cu. ft. and when dried produces 0.7 cu. ft. of useful lumber. Grade 2 lumber costs $7 per cu. ft. and when dried produces 0.9 cu. ft. of useful lumber. It costs the company $3 to chop down a log. After being cut and dried, a log yields 0.8 cu. ft. of lumber. Brady incurs costs of $4 per cu. ft. of lumber dried. It costs $2.50 per cu. ft. of logs sent through the sawmill. Each week, the sawmill can process up to 35,000 cu. ft. of lumber. Each week, up to 40,000 cu. ft. of grade 1 lumber and up to 60,000 cu. ft. of grade 2 lumber can be purchased. Each week, 40 hours of time are available for drying lumber. The time it takes to dry 1 cu. ft. of grade 1 lumber is 2 seconds; of grade 2 lumber is 0.8 second; a log is 1.3 seconds. Formulate an LP problem to help Brady minimize the cost of meeting the weekly demand for processed lumber.

3. Use the simplex algorithm to solve the following problem:

Maximize $Z = 2x_1 - x_2 + x_3$ subject to:

$3x_1 + x_2 + x_3 \leq 60$

$x_1 - x_2 + 2x_3 \leq 10$

$x_1 + x_2 - x_3 \leq 20$

$x_i \geq 0.$

4. Based on your final table for #3, if we wanted to produce another item under the following conditions, what would be the new optimal solution and optimal value?

Each unit of the new product is worth 2 units of the objective, $Z$.

Each unit of the new product consumes 1 unit each of the first two resources, but none of the 3rd resource.
5. A refinery manufactures two grades of jet fuel, F1 and F2, by blending four types of gasoline, A, B, C, and D. Fuel F1 uses the gasolines in the ratio 1:1:2:4, and fuel F2 uses the gasolines in the ratio 2:2:1:3. The supply of the gasolines is limited to 1000, 1200, 900, and 1500 bbl/day respectively. The costs of each are $120, $90, $100, and $150 per bbl. Fuels F1 and F2 sell for $200 and $250 per bbl.

a. Determine the optimal production mix for F1 and F2.

b. What is the allowable range for your objective coefficient corresponding to F1? Interpret what this means for the company’s fuel production.

c. What is the allowable range for the right-hand side of your first constraint? Interpret what this means for the company’s fuel production.