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**Name: (please print)** \_\_\_\_\_ **Solution**

**Quiz 2**  
**LP Sensitivity Analysis and Forecasting**  
**BUAD311 – Operations Management**  
**Spring 2012**

Time: 25 minutes

There are 4 pages, including this page. All together the quiz has a maximum of 50 points.

This is a closed-book closed-notes quiz.

You are allowed to use one crib sheet (8.5x11).

You may use a simple calculator.

No laptops. No PDAs. No cell phones.

You may receive partial credits unless otherwise noted. Show your work and write legibly.

Do not be tempted to seek “inspiration” from a neighbor’s quiz. Poor scores can be overcome, but cheating will be dealt with harshly!

Please sign here to indicate that you have adhered to university policies regarding ethical behavior in preparing for and completing this quiz.

“I hereby certify that I have adhered to the university policies regarding ethical behavior in preparing for and completing this quiz.”

1. (30 points) Trojan Pottery is a supplier of mugs and plates featuring the USC logo and scenes from the university. There are two steps involved in making mugs/plates--Forming and Finishing. It takes 0.6 hour of labor-time to form a mug and 0.4 hour of labor-time to form a plate, at the firm's production facility. "Forming" involves molding the clay and applying the glaze. "Finishing" involves firing the formed mugs/plates in a kiln (a type of oven). Each mug uses 0.75 lb. of clay and 0.25 gallon of glaze for forming, and 0.50 hours of kiln time for finishing. Each plate uses one lb. of clay and 0.20 gallon of glaze for forming, 0.40 hour of kiln time for finishing. For making the mugs and plates, the firm has 150 labor-hours available, 300 lbs. of clay on hand, and 100 gallons of glaze, and has access to 175 hours of kiln time. It sells each mug for \$20 and each plate for \$25. Trojan Pottery wants to find the optimal product-mix it should produce so as to maximize revenue. It has formulated and solved the following linear program and obtained the Sensitivity report shown below.

$x$  = number of mugs produced  
 $y$  = number of plates produced

Maximize  $\$20x + \$25y$   
 Subject to

$0.60x + 0.40y \leq 150$  (Labor-hours constraint)  
 $0.75x + y \leq 300$  (Clay constraint)  
 $0.25x + 0.2y \leq 100$  (Glaze constraint)  
 $0.5x + 0.4y \leq 175$  (Kiln hours constraint)  
 $x \geq 0, y \geq 0$

**Microsoft Excel 14.0 Sensitivity Report**

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$D\$3	x	150	0	20	11.25	1.25
\$D\$4	y	187.5	0	25	1.666666667	9

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
\$C\$10	Labor: $0.6x + 0.40y \leq 150$	150	6.25	150	25	30
\$C\$11	Clay: $0.75x + y \leq 300$	300	22.5	300	75	75
\$C\$12	Glaze: $0.25x + 0.2y \leq 100$	75	0	100	1E+30	25
\$C\$13	Kiln Hours: $0.5x + 0.4y \leq 175$	150	0	175	1E+30	25

Answer the following questions. (5 points each)

a) What is the optimal product-mix?

# of mugs=150, # of plates=187.5

b) What is the value of the objective function at the optimal solution?

$150(\$20) + 187.5(25) = \$7687.5$

c) Suppose Trojan Pottery procures 10 additional pounds of clay. How much will their objective function value change?

10 lbs is within the Allowable Increase of 75 lbs → the objection function will increase by  $10 * (\text{Shadow price on clay constraint}) = 10 (22.5) = \$225$ .

d) What is the maximum that Trojan Pottery can pay for an additional hour of labor?

The shadow price on the Labor-hours constraint = \$6.25

e) Suppose Trojan Pottery increased the price of plates to \$28 per plate. What is the new optimal solution? Explain.

The increase of \$3 is beyond the "Allowable Increase" of \$1.6667 in the price of plates → we need to resolve to find the new optimal solution

f) Suppose Trojan Pottery acquired 10 more hours of kiln time. How much will their objective function value change?

The shadow price on the Kiln Hours constraint is zero → objective function will remain unchanged.