Econ 172A, Fall 2012: Quiz III

IMPORTANT

1. The quiz has 2 forms. You should answer the questions from only one form.
   - If your student identification number ends in an odd number (1, 3, 5, 7, 9) or if you have no student identification number, answer the questions from Form 1.
   - If your student identification number ends in even number (0, 2, 4, 6, or 8) answer the questions from Form 2.
2. Note: Both forms use the same data, but involve different questions.
3. Enter your answers on the next page. You will hand in only that page.
4. Pages 3 and 4 contain the information needed to answer the questions. (Both forms use the same information.)
5. Page 5 contains the questions for Form 1.
6. Page 6 contains the questions for Form 2.
7. You may not use calculators, books, or notes during this quiz.
8. If you do not know how to interpret a question, then ask me.
9. **Please remain in your seat until the exam is over.**
10. You will not receive credit unless you put your answers in the spaces on the next page.
11. I will collect the quizzes at 4:50.

HAND IN THIS PAGE ONLY

1. Fill in the information below:
   - NAME:
   - STUDENT IDENTIFICATION NUMBER:
   - I read the instructions and I am answering the questions corresponding to the appropriate form, which is FORM:
     Warning: Please make sure that you are answering the appropriate questions.

Please enter your answers here. (Circle the appropriate choice. There is one correct answer per question. Select "other" either if you have insufficient information or if none of the other choices is correct.)

1.	**NO**	**YES**	**OTHER**	
2.	**NO**	**YES**	**OTHER**	
3.	**INCREASE BY $80**	**INCREASE BY $160**	**OTHER**	
4.	**$9.00**	**$12.00**	**OTHER**	
5.	**NOTHING**	**$16.00**	**OTHER**	
6.	**INCREASE BY $42.667**	**INCREASE BY $77.333**	**OTHER**	
7.	**INCREASE BY $1.333**	**INCREASE BY $11**	**NO CHANGE**	**OTHER**
8.	**NO**	**YES**	**OTHER**	

A company can produce two products. The table below summarizes the production technology. Each week, up to 400 units of raw material can be purchased at a cost of \$1.50 per unit. The company employs four workers, who work 40 hours per week. The base salaries of the workers are considered a fixed cost and do not enter the computation. Workers are paid \$6 per hour to work overtime. Each week, 320 hours of machine time are available.

	Product 1	Product 2
Selling Price	\$15	\$8
Labor Required	.75 hour	.5 hour
Machine Time Required	1.5 hour	.8 hour
Raw Material Required	2 units	1 unit

If the firm does not advertise, 50 units of product 1 and 60 units of product 2 will be demanded each week. Advertising can be used to stimulate demand. Each dollar spent on advertising Product 1 increases the demand for Product 1 by 10 units. Each dollar spent on advertising Product 2 increases the demand for Product 2 by 15 units. At most \$100 can be spent on advertising.

To formulate the problem, I defined the following variables:

P_1 = the number of units of Product 1 produced each week.

P_2 = the number of units of Product 2 produced each week.

OT = the number of hours of overtime labor used each week.

RM = the number of units of raw material purchased each week.

A_1 = the amount (in dollars) spent each week advertising Product 1.

A_2 = the amount (in dollars) spent each week advertising Product 2.

The firm's optimization problem is then:

$$
\begin{array}{rrcrcrcrcrcrcr}
\max & 15P_1 & + & 8P_2 & - & 6OT & - & 1.5RM & - & A_1 & - & A_2 & & \\
\text{subject to} & P_1 & & & & & & & - & 10A_1 & & & \leq & 50 \\
 & & & P_2 & & & & & & & - & 15A_2 & \leq & 60 \\
 & .75P_1 & + & .5P_2 & - & OT & & & & & & & \leq & 160 \\
 & 2P_1 & + & P_2 & & & - & RM & & & & & \leq & 0 \\
 & & & & & & & RM & & & & & \leq & 400 \\
 & & & & & & & & & A_1 & + & A_2 & \leq & 100 \\
 & 1.5P_1 & + & .8P_2 & & & & & & & & & \leq & 320
\end{array}
$$

$$P_1, P_2, OT, RM, A_1, A_2 \geq 0.$$

I solved this problem using Excel. The output follows this problem. Use the output to answer the questions on your form. Answer the questions independently (so that a change described in one part applies only to that part). Answer as many questions below as you can using the available information.

Econ 172A Fall 2012
Quiz 3 Data

Adjustable Cells

Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
P_1	160	0	15	0.966667	0.533333
P_2	80	0	8	0.266667	0.483333
OT	0	-2.13333	-6	2.13333	1.00E+30
RM	400	0	-1.5	1.00E+30	4.5
A_1	11	0	-1	1	5.33333
A_2	1.333333333	0	-1	1	7.25

Constraints

Constraint	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
1	50	0.1	50	110	876.667
2	60	0.0666667	60	20	1315
3	160	3.86667	160	27.5	2.5
4	0	6	0	6.66667	55
5	400	4.5	400	6.66667	55
6	12.33333333	0	100	1.00E+30	87.6667
7	304	0	320	1.00E+30	16

Econ 172A, Fall 2012: Quiz III Form 1

(PID ENDS ODD)

1. If overtime costs $4 per hour, would the company use it?

2. If each unit of Product 1 sold for $15.50 would the current basis remain optimal?

3. How would the value change if Product 1 sold for $15.50?

4. What is the most that the company would be willing to pay for the opportunity to use up to 402 units of raw material (instead of 400 units)?

5. How much would the company lose if it had only 300 hours of machine time available?

6. If each worker were required (as part of the regular work week) to work 45 hours per week, what would the company's profit be? (That is, assume that the company gets 45 hours per week from a worker without paying overtime.)

7. How would the firm's profits change if advertising for Product 1 was free?

8. Suppose that a new product could be sold for $4.25 per unit using one hour of labor and one hour of machine time (but without any advertising or raw material). Would it be profitable to product the new product?

Econ 172A, Fall 2012: Quiz III Form 2

(PID ENDS EVEN)

1. If overtime costs $8 per hour, would the company use it?

2. If each unit of Product 1 sold for $16.00 would the current basis remain optimal?

3. How would the value change if Product 1 sold for $16.00?

4. What is the most that the company would be willing to pay for the opportunity to use up to 402 units of raw material (instead of 400 units)?

5. How much would the company lose if it had only 315 hours of machine time available?

6. If each worker were required (as part of the regular work week) to work 45 hours per week, what would the company's profit be? (That is, assume that the company gets 45 hours per week from a worker without paying overtime.)

7. How would the firm's profits change if advertising for Product 2 was free?

8. Suppose that a new product could be sold for $4 per unit using one hour of labor and one hour of machine time (but without any advertising or raw material). Would it be profitable to product the new product?