

Name: \_\_\_\_\_

Recitation Section: L \_\_\_\_\_

Student Number: \_\_\_\_\_

Graduating Fall 2000?      \_\_\_\_\_ YES                      \_\_\_\_\_ NO

1. Check that your exam includes all 5 pages.
2. Read all instructions and problems carefully. Points will be deducted for failure to follow instructions.
3. Complete the information requested in the spaces above.
4. PRINT your name and student number in the spaces at the top of all remaining pages of this exam.
5. The back of this cover page contains a table of engineering economics formulas.
6. **Show ALL of your work on these pages.** The pages in this exam may be separated for grading; therefore, if you need extra space for a particular problem, write on the back of the page for that problem. The instructions for a specific question may limit the amount of space allowed for an answer.
7. You are permitted one sheet (8½ x 11, double-sided) of **handwritten** notes. Use of any other notes, books, or other resources is prohibited.
8. Calculators are permitted; however, you are not allowed to use the calculator memory to store notes, etc.
9. This exam lasts for 45 minutes. Point values are listed for each problem to assist you in best using your time.
10. Institute policy prohibits the posting of student grades using an identifiable key (name, student number, PO Box, etc.). If you wish to have your scores posted so that you can check them, please sign on the line below and remember (or write down) the random identification code written in the box below.

\_\_\_\_\_  
SIGNATURE

|       |               |                      |
|-------|---------------|----------------------|
| _____ | Problem 1.    | (20 points possible) |
| _____ | Problem 2.    | (10 points possible) |
| _____ | Problem 3.    | (10 points possible) |
| _____ | Problem 4.    | (10 points possible) |
| _____ | <b>TOTAL.</b> | (50 points possible) |

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Problem 1. (20 points)

For each of the following economic computations, (a) list the conversion factor to be used, specifying the parameter values, and (b) compute the result, showing your work. Write your answers on the blank lines on the right edge of this page; correct answers in other locations may not receive full credit. An example is provided.

**EXAMPLE:**

If you invest \$100 in a bank account today, at an interest rate of 6.5%,  
how much will you have after five years? (a) (F/P, 6.5%, 5)

$$100 * (F/P, 6.5%, 5) = 100 * (1 + 0.065)^5 = 100 * 1.3701 = 137.01$$

(b) \$ 137.01

A. (5 points) Your company currently leases a piece of machinery for  
\$650/month. Assuming the owner increases the lease rate 4.5% each  
year, what will be the monthly lease price 10 years from now? (a) \_\_\_\_\_  
(b) \_\_\_\_\_

B. (5 points) New manufacturing equipment will cost \$475,000.  
Assuming a desired rate of return of 15% and a lifetime of 20 years,  
what is the minimum annual savings needed to justify this investment? (a) \_\_\_\_\_  
(b) \_\_\_\_\_

C. (5 points) You will need \$30,000 five years from now for a  
down payment on a house. Assuming your investments earn 7.3%,  
how much do you need to invest annually to achieve this goal? (a) \_\_\_\_\_  
(b) \_\_\_\_\_

D. (5 points) A bond with a discount (interest) rate of 8.5% costs \$18,785  
today. What is the term (in years) required for this bond to reach its  
face value of \$50,000? (a) \_\_\_\_\_  
(b) \_\_\_\_\_

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Problem 2. (10 points)

Your company is considering the purchase of a piece of machinery, which it will use for four years and then sell to someone else. Compute each of values requested below. Show your work, including equations, and enter the results in the table below. If you need more space, use the back of **this sheet**.

Throughout this problem assume an interest rate of 6%. A table of conversion factors is provided below.

**Table of Conversion Factors**

- (F/P, 6%, 4) = 1.2625
- (P/F, 6%, 4) = 0.7921
- (A/F, 6%, 4) = 0.2286
- (F/A, 6%, 4) = 4.3746
- (A/P, 6%, 4) = 0.2886
- (P/A, 6%, 4) = 3.4651
- (P/G, 6%, 4) = 4.9455

|                                    |              | <b>Present Value</b> |
|------------------------------------|--------------|----------------------|
| <b>Initial Purchase Price</b>      | \$135,000    | \$135,000            |
| <b>Salvage Value</b>               | Part A below |                      |
| <b>Operating/Maintenance Costs</b> | Part B below |                      |
| <b>NET COST</b>                    |              |                      |
| <b>Expected Mfg Cost Savings</b>   | Part D below |                      |

- A. (2 points) After using this equipment for four years, your company expects to sell it for \$82,000. What is the present value of the salvage price?
  
- B. (3 points) Operating and maintenance costs are estimated at \$9500 in the first year, with an increase of \$1800 in each subsequent year. What is the present value of operating and maintenance costs for the four-year period?
  
- C. (2 points) Taking into account all of these factors (purchase price, salvage value, operating and maintenance costs), what is the net cost (present value) of this machinery over the entire four years of use?
  
- D. (2 points) This equipment is expected to yield \$40,000 savings in manufacturing costs each year. What is the present value of the expected savings for the four years of use?
  
- E. (1 point) Do you consider purchasing this equipment to be a good investment? Briefly justify your answer.



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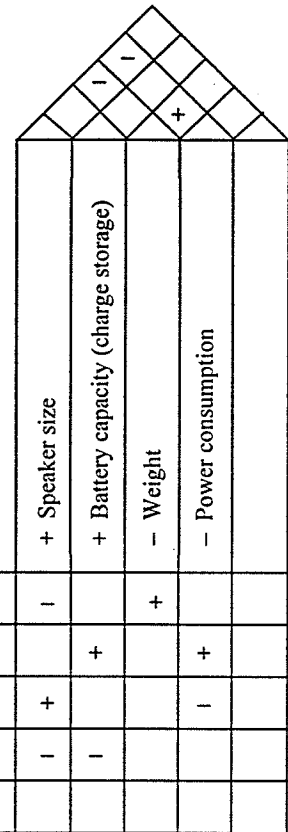
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**Problem 4. (10 points)**

This QFD diagram maps customer desires into engineering characteristics for a portable CD player. It is being developed to assist in establishing requirements and specifications for a new product.

Complete this QFD diagram by doing the following:

- (1) Add one customer desire and one engineering characteristic, selecting those attributes that you believe are the most important ones not already included in the diagram.
- (2) Fill in the rectangular and triangular matrices for the row and column you added, using "+" and "-" symbols to indicate relationships, as defined in the course handout.



In the space below, or on the back of *this page*, answer the following questions.

- A. (4 points) Briefly explain your choice of customer desire and engineering characteristic, as well as your placement of "+" and "-" symbols.
  
- B. (2 points) Identify two customer desires that are in conflict. Explain how this conflict is revealed in the QFD diagram. If there are no conflicting customer needs/desires, state so.
  
- C. (4 points) Based on this QFD diagram, which engineering characteristic is probably the most important in determining overall success in satisfying customer desires? Why? How will determining the value for this characteristic affect other aspects of the design?