

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

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

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

Graduating Fall 2002?    \_\_\_\_\_ YES                      \_\_\_\_\_ NO

1. Check that your exam includes all 6 pages (cover, 6 problems). Additionally, there is a 2-sided formula sheet.
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. **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. For all multiple choice questions, select the closest, or most appropriate, answer.
6. You are permitted one sheet (8 1/2 x 11, double-sided) of **handwritten** notes. Use of any other notes, books, or other resources is prohibited.
7. Calculators are permitted; however, you are not allowed to use the calculator memory to store notes, etc.
8. This exam lasts for 50 minutes. Point values are listed for each problem to assist you in best using your time.

_____	Problem 1.	(20 points possible)
_____	Problem 2.	(20 points possible)
_____	Problem 3.	(18 points possible)
_____	Problem 4.	(24 points possible)
_____	Problem 5	(9 points possible)
_____	Problem 6	(9 points possible)
_____	<b>TOTAL.</b>	(100 points possible)

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**Problem 1. (20 points)**

For each of the following economic computations, (a) list the conversion factor(s) 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)

(b) \$ 137.01

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

A. (5 points) Determine the equivalent present value of a guaranteed annual  
payment of \$8,000 per year for 10 years, assuming that a compound rate  
of interest of 6% is appropriate. (a) \_\_\_\_\_  
(b) \_\_\_\_\_

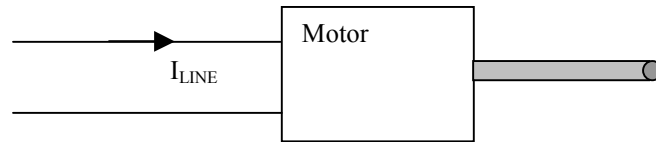
B. (5 points) An individual deposits \$8,000 quarterly (every three months)  
into a savings account. How much does the individual have at the end of 5  
years, assuming that she is able to invest her funds at a nominal rate of 8%  
per year? (a) \_\_\_\_\_  
(b) \_\_\_\_\_

C. (10 points) A new piece of machinery with a 6-year useful lifetime is  
expected to have maintenance costs of \$6,000 per year for the first  
two years of use and then have maintenance costs of \$12,000 per year  
for the last four years. Determine the present value of the maintenance  
costs, assuming an interest rate of 8%. (a) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**NOTE:** This problem may require the use of more than one  
conversion factor. List all factors used. (b) \_\_\_\_\_

**Problem 2. (20 points)**

For this problem an interest rate of 6% is appropriate. The motor operates at a rated line voltage of 120 volts, and has an input power of 20 KW, a power factor of .8 lagging and an efficiency of 90%. The purchase cost of the motor is \$20,000.



- A. (7 points) Determine the cost of power for one year for the motor, assuming that it operates 360 days per year, 12 hours per day, and at a cost of power of \$.08 per KW-hr.

Cost = \_\_\_\_\_

- B. (7 points) Assume that the first year cost of maintenance for the motor is \$600 and that the maintenance cost increases by 5% per year. Determine the present value of the cost of maintenance for the motor, assuming an 8 year operation.

Cost = \_\_\_\_\_

- C. (6 points) Keeping **all** other specifications the same, which of the following would be the primary effect of an increase in the power factor to .9 lagging?

- (a) an increase in output power to 22.5 KW, line current unchanged.
- (b) a decrease in output power to 17.8 KW, line current unchanged.
- (c) an increase in line current by 12.5%, output power unchanged.
- (d) a decrease in line current by 11.1%, output power unchanged
- (e) an increase in output power to 22.5 KW, and an increase in line current by 12.5%.

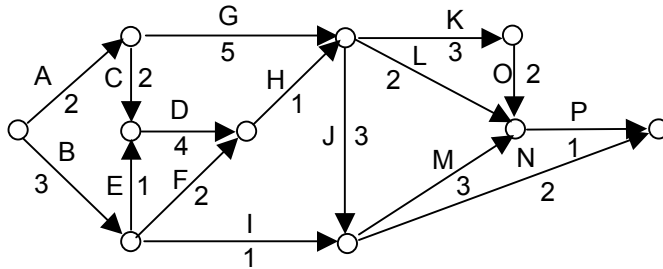
**Problem 3. (18 points)**

Answer the following multiple choice questions by circling the letter in front of the most appropriate response.

- A. The project completion time for a PERT Chart is assumed to be a normally distributed random variable. This assumption is most closely related to the concept that
- (a) each activity is assumed to have both a shortest and a longest time for completion.
  - (b) the individual activity times are uncorrelated random variables, and the central limit theorem applies to the sum.
  - (c) the float is zero along a critical path.
  - (d) the earliest and latest starts are uncorrelated random variables.
  - (e) the critical path is the longest path from start to finish.
- B. Which one of the following statements is most nearly correct?
- (a) A fundamental disadvantage associated with reuse is that the technology can change, rendering the process uneconomical.
  - (b) A fundamental disadvantage associated with reuse is that the mixed material components are difficult to separate.
  - (c) A fundamental advantage associated with reuse is that the material constituents are not a significant portion of the cost.
  - (d) A fundamental disadvantage associated with recycling is that it is frequently becomes uneconomical due to technological change
- C. The technical purpose of the development of a family of microprocessors by the multi-company alliance discussed in Recitation #2 was
- (a) the development of increasingly cheaper machines over time;
  - (b) the development of a prototype for an ultra-high performance supercomputer;
  - (c) the development of progressively high performance machines;
  - (d) The development of a totally recyclable desk-top computer.

**Problem 4. (24 points)**

- A. (6 points) Determine the critical path for the following CPM chart. State the path in terms of activity letters in order from start to finish. Example: CHM



Path \_\_\_\_\_

- B. (6 points) Determine the float for

(i) Activity D

Float D = \_\_\_\_\_

(ii) Activity G

Float G = \_\_\_\_\_

- C. (6 points) Assume that for a given PERT chart (different from the diagram above), the project duration is 16 months and the variance is 4 months<sup>2</sup>. Determine the probability that the project will require greater than 14 months to complete.

Probability = \_\_\_\_\_

- D. (6 points) The PERT chart described in Part C has a set of logical precedence relations described by the following:

Activity A must be done before activity D

Activities A and B must be done before activity E

Activities B and C must be done before activity F

In the space to the right, sketch the portion of the chart that describes the above conditions. Represent all dummy activities with a dashed line (-----)

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**Problem 5. (9 points)**

For each of the sentence pairs below, select the sentence (#1 or #2) that is **incorrect**, by either word usage, spelling, or content (do not consider punctuation).

- A. #1 The university was unable to settle the dispute between the three students.  
#2 The university was unable to effect a solution to the budgetary difficulty.
- B. #1 There were less children in line for tickets than usual .  
#2 Fewer than six hours had passed before it was time to depart.
- C. #1 A biennial payment is due twice a year  
#2 A semimonthly payment is due approximately every two weeks

**Problem 6. (9 points)**

For each of the following statements, circle either TRUE or FALSE.

- A. To construct a prototype, the design must first be simulated. **TRUE FALSE**
- B. In the design process, one of the major advantages of partitioning is the ability to utilize fewer people, even at the expense of a longer calendar time to completion. **TRUE FALSE**
- C. In group decision-making, the number of possible communication interactions is linearly proportional to the number of group members. **TRUE FALSE**