

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

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

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

Graduating Fall 2003?    \_\_\_\_\_ YES                      \_\_\_\_\_ NO

1. Check that your exam includes all 7 pages (cover, 7 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 55 minutes. Point values are listed for each problem to assist you in best using your time.

_____	Problem 1.	(21 points possible)
_____	Problem 2.	(18 points possible)
_____	Problem 3.	(8 points possible)
_____	Problem 4.	(20 points possible)
_____	Problem 5.	(9 points possible)
_____	Problem 6.	(15 points possible)
_____	Problem 7.	(9 points possible)
_____	<b>TOTAL.</b>	(100 points possible)

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**Problem 1. (21 points)**

There are three different 10-year payment plans for the purchase of a large piece of machinery (dollar amounts are in thousands). At the end of the tenth year, the equipment will be returned to the manufacturer, with a predetermined salvage value. An interest rate of 6% is to be used.

Plan #1

Initial payment=\$500

Payments for years 1-10: \$50 increase per year, starting with \$300 for year 1.

Salvage value of \$200 at end of tenth year

Plan #2

Initial payment=\$500

Payments for years 1-10: 10% increase per year, starting with \$400 for year 1.

Salvage value of \$800 at end of tenth year

Plan #3

Initial payment=\$500

No payments for years 1-5.

Payments for years 6-10: \$1000 per year.

Salvage value of \$200 at end of tenth year

Determine the present value of the cost of each plan. Show all calculations. Factor calculations may be shown in space to right, above.

Plan #1

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

Plan #2

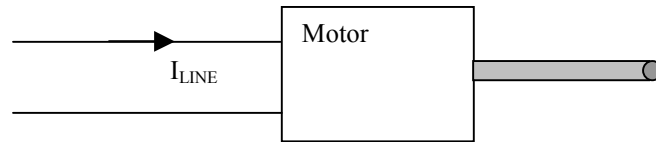
Cost=\_\_\_\_\_

Plan #3

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

**Problem 2. (18 points)**

For this problem an interest rate of 8% is appropriate. The ac single phase motor operates at a rated line voltage of 200 volts, and has an input power of 40 KW, a power factor of .8 lagging and an efficiency of 90%. The purchase cost of the motor is \$20,000.



- A. (6 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 \$.05 per KW-hr.

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

- B. (6 points) Determine the rms line current to the motor, and the power lost in the line, assuming a line resistance of .003 ohms. Show units.

Line Current = \_\_\_\_\_

Power Lost = \_\_\_\_\_

- C. (6 points) In recitation #3, the engineering economy problem posed involved a trade-off offered by the power company of rate charged versus power factor.

(i) Why might the power company want to offer this trade-off? Give a specific reason.

(ii) Why might the manufacturing plant operator might not want to change the power factor of the motor? Give a specific reason.

(i) \_\_\_\_\_

(ii) \_\_\_\_\_

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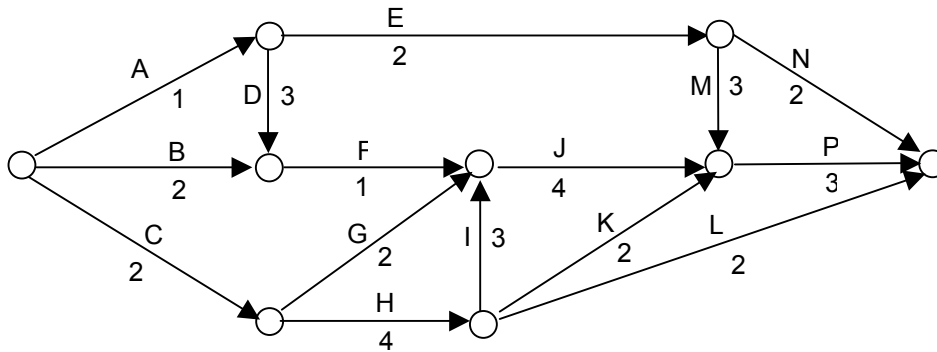
**Problem 3. (8 points)**

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 an optimistic and a pessimistic 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. The design methodology discussed in Recitation #2 (PowerPC computer design case study) was primarily discussed as an example of
- (a) modularity of design.
  - (b) decomposition of design.
  - (c) staggered parallelism of design.
  - (d) development of a prototype.
  - (e) hierarchy of design.

**Problem 4. (20 points)**

A. (8 points) Determine the critical path and its duration for the following CPM chart. State the path in terms of activity letters in order from start to finish. Example: AEN, duration=5



Path and Duration \_\_\_\_\_

B. (6 points) Determine the float for

(i) Activity G

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

(ii) Activity I

Float I = \_\_\_\_\_

C. (6 points) Assume that, for a slightly different diagram, a PERT chart, the project duration is 15 months and the standard deviation is 6 months. Determine the probability that the project will require greater than 9 months to complete.

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

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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 A fundamental problem with design for recyclability is that technology changes may render the modular components obsolete.  
#2 A fundamental problem with design for recyclability is the expense in separating mixed materials.
- B. #1 The university was unable to settle the dispute between the two students.  
#2 The affect of the storm in Oregon was dramatic.
- C. #1 There were less students registered for the afternoon laboratory section.  
#2 Birmingham is less than 500 kilometers from Atlanta.

**Problem 6. (15 points)**

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

- A. For the accelerated cost recovery method of depreciation, if the actual working life doubles, the first year depreciation expense charged decreases. **TRUE FALSE**
- B. The uncertainty principle applies to elementary particles, but does not yield measurable predictions that apply to ordinary physical objects. **TRUE FALSE**
- C. To construct a prototype, the design must be modular in nature. **TRUE FALSE**
- D. Regular semiannual payments occur four times more often than do regular biennial payments. **TRUE FALSE**
- E. When the Payback Period method of project comparison is used, future investment returns are related to the initial cost using the P/F factor. **TRUE FALSE**

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**Problem 7. (9 points)**

A particular type of ceramic fastener used in final computer assembly must have a thermal characteristic specification of  $T$  less than 1,800. Two batches of 10,000 fasteners each are produced, with a mean and standard deviation of

Batch A: mean= 1,200

Standard deviation =400

Batch B: mean=1,600

Standard deviation=300

Which batch has the least number of expected defects, and what is that expected number? Justify your answer.

Batch \_\_\_\_\_

Number= \_\_\_\_\_