

Name: _____

Recitation Section: **L** _____

Student Number: _____

1. Check that your exam includes all 6 pages (cover, 5 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.	(22 points possible)
_____	Problem 3.	(18 points possible)
_____	Problem 4.	(24 points possible)
_____	Problem 5	(16 points possible)
_____	TOTAL.	(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) A company purchases a piece of equipment by agreeing to make a
single payment of \$6,000, 4 years from the present. Determine the equivalent
present cost of the equipment, assuming that a compound rate of interest (a) _____
of 8% is appropriate. (b) _____

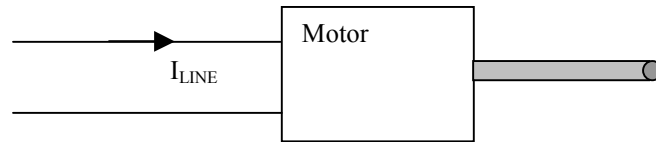
B. (5 points) An individual deposits \$10,000 every four months into a
savings account. How much does the individual have at the end of 4
years, assuming that she is able to invest her funds at a nominal rate of 9%
per year? (a) _____
(b) _____

C. (10 points) A new piece of machinery with a 6-year useful lifetime is
expected to have maintenance costs of \$8,000 per year for the first
four years of use and then have maintenance costs of \$12,000 per year
for the last two 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. (22 points)

For this problem an interest rate of 6% is appropriate. The motor operates at a constant efficiency of 80%, and the rms value of line voltage is 120 volts. The motor operates initially at a power factor of .7 lagging, with an output power of 30 KW. The purchase cost of the motor is \$25,000.



- A. (7 points) Determine the cost of electrical power for one year for the motor, assuming that it operates 300 days per year, 8 hours per day, and at a cost of power of \$.07 per KW-hr.

Cost = _____

- B. (7 points) Assume that the first year cost of maintenance for the motor is \$800 and that the maintenance cost increases by 8% per year. Determine the present value of the cost of maintenance for the motor, assuming a 6 year operation.

Cost = _____

- C. (8 points)

(i) In recitation #3, the engineering economy problem relating to electrical machinery and power factor was discussed. Why would it probably be to the advantage of the power company for the motor operator to change the power factor to have a value closer to one? Give a specific reason.

(ii) The lowest cost solution required the use of 3 synchronous motors and 1 induction motor. Why might that solution not be the best one in a practical industrial situation, or should one always pick the lowest cost (as calculationaly determined)? Give a specific reason related to this case.

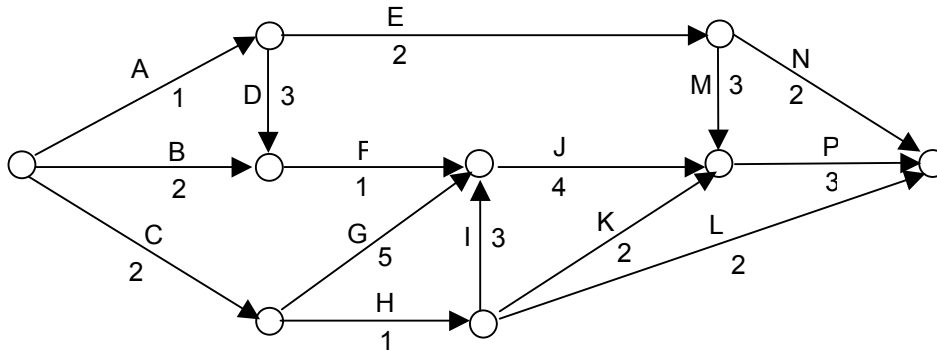
Problem 3. (18 points)

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

- A. The primary advantage of PERT Charts over CPM diagrams for project scheduling is that
- (a) PERT charts clearly show the chronological (time) relations among the various activities.
 - (b) PERT charts show the logical precedence relations more clearly than do CPM charts.
 - (c) PERT charts allow for a variations in time for each activity, and allow for a probabilistic estimate of a given delay.
 - (d) PERT charts more clearly illustrate the design process.
 - (e) PERT charts allow for indication of reporting requirements.
- B. Which one of the following statements is most nearly correct?
- (a) A fundamental disadvantage associated with reuse is that the mixed material components are difficult to separate.
 - (b) A fundamental disadvantage associated with reuse is that the technology can change, rendering the process uneconomical.
 - (c) A fundamental disadvantage associated with reuse is that the material constituents are 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 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. (24 points)

A. (8 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: AEN



Path _____

B. (8 points) Determine the float for

(i) Activity I

Float I = _____

(ii) Activity J

Float J = _____

C. (8 points) Assume that, for a slightly different diagram, a PERT chart, the project duration is 18 months and the standard deviation is 3 months. Determine the probability that the project can be completed in less than 14 months.

Probability = _____

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Problem 5. (16 points)

An electronic production process requires a specific circuit element to have a resistance greater than 4×10^6 ohms. Three batches of 100,000 devices, each device containing exactly one of these joints, are produced, with a mean and standard deviation of

Batch A: mean = 5.2×10^6 ohms

Standard deviation = 10^6 ohms

Batch B: mean = 6.5×10^6 ohms

Standard deviation = 2.5×10^6 ohms

Batch C: mean = 4.5×10^6 ohms

Standard deviation = 1.5×10^6 ohms

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

Batch _____

Number = _____