

Name: _____

Recitation Section: L _____

Student Number: _____

Graduating Spring 2004? _____ 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 55 minutes. Point values are listed for each problem to assist you in best using your time.

| | | |
|-------|---------------|-----------------------|
| _____ | Problem 1. | (26 points possible) |
| _____ | Problem 2. | (18 points possible) |
| _____ | Problem 3. | (12 points possible) |
| _____ | Problem 4. | (20 points possible) |
| _____ | Problem 5 | (9 points possible) |
| _____ | Problem 6 | (15 points possible) |
| _____ | TOTAL. | (100 points possible) |

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Problem 1. (26 points)

A company is considering three different types of 100 horsepower motors to operate a large assembly line. The motors are scheduled to be in service for 10 years, and all will deliver the same operational characteristics for the assembly line. 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. Determine the present value of the lifetime operating cost of each motor, including maintenance, electricity and salvage value, and then determine the cheapest motor. The purchase prices of all three motors are equal, so that does not need to be considered. Show all calculations. Factor calculations may be shown in space to right.

Motor #1

Maintenance \$3,000 per year.
Electricity: \$3,000 per year for years 1-5, \$4,000 per year for years 6-10
Salvage value of \$500 at end of tenth year

Motor #2

Maintenance \$2,000 first year, increases \$400 per year.
Electricity: \$4,000 per year.
Salvage value of \$500 at end of tenth year

Motor #3

Maintenance \$3,000 per year
Electricity: \$3,000 first year, increases 4% per year.
Salvage value of \$1,000 at end of tenth year

Motor #1

(8 pts.)Cost= _____

Motor #2

(8 pts.)Cost= _____

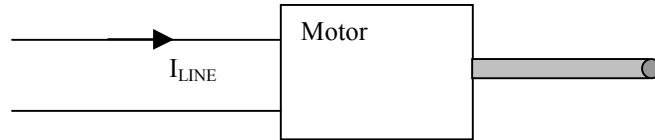
Motor #3

(8pts.)Cost= _____

(2 pts.)**Cheapest Motor #** _____

Problem 2. (18 points)

For this problem an interest rate of 8% is appropriate. The ac single phase motor operates at a rated line current of 200 amperes, and has an output 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 300 days per year, 12 hours per day, and at a cost of power of \$.04 per KW-hr.

Cost = _____

- B. (6 points) Determine the new value of line current, assuming the same motor terminal voltage and output power, but a power factor of .6 lagging and an efficiency of 80%.

New Line Current = _____

- C. (6 points) It is proposed that the purchase price of the motor be paid over 10 years with payments every 3 months. Assuming that the 8% is a nominal interest rate, determine the amount of each payment

Amount of each payment = _____

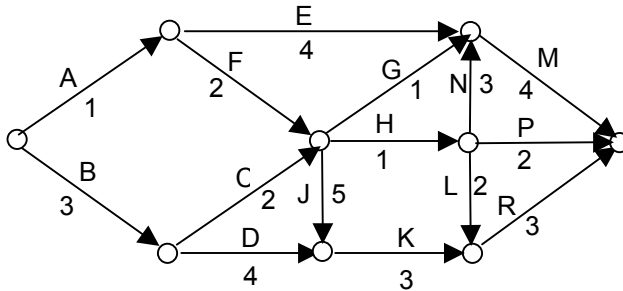
Problem 3. (12 points)

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

- A. The primary advantage of Gantt Charts over CPM diagrams for project scheduling is that
- (a) Gantt charts clearly show the chronological (time) relations among the various activities
 - (b) Gantt charts show the logical precedence relations more clearly than do CPM charts
 - (c) Gantt charts allow for a variations in time for each activity
 - (d) Gantt charts more clearly illustrate the design process
 - (e) Gantt charts allow for indication of reporting requirements
- B. Meritor Corporation manufactures doors, roofs, and suspensions for major automotive assemblers such as General Motors. These items are directly inserted into car bodies at the assembly line. This is an example of
- (a) hierarchy in design
 - (b) modularity in design
 - (c) partitioning in design
 - (d) prototyping in design
- C. A utility company sometimes adjust s the cost of power if a purchaser adjusts the load power factor because
- (a) The load power factor needs to match that of the line.
 - (b) Line losses can be reduced.
 - (c) It is desirable to have a large line current.
 - (d) A highly efficient motor is expensive to operate.
- D. A batch of 20,000 elastic bands is produced with a mean thermal characteristic of 1,200 (arbitrary units) and a standard deviation of 200. How many of the bands have a thermal characteristic greater than 800?
- (a) 2,275
 - (b) 4,550
 - (c) 9,773
 - (d) 14,323
 - (e) 19,545

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: AEM, duration=9



Path and Duration _____

- B. (6 points) Determine the float for

(i) Activity G

Float G = _____

(ii) Activity J

Float J = _____

- C. (6 points) Assume that, for a slightly different diagram, a PERT chart, the project duration is 18 months and the standard deviation is 6 months. Determine the probability that the project will require greater than 15 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 In the design process, one of the major advantages of partitioning is the ability to work on multiple tasks in parallel, leading to shorter calendar time to completion.
- #2 In the design process, one of the major advantages of partitioning is that, since there are more divisions, it is easier to develop a design that is globally optimized.
- B. #1 For a large group, the number of possible communication interactions is approximately proportional to the factorial of the number of group members.
- #2 For a large group, the number of possible communication interactions is approximately proportional to the square of the number of group members.
- C. #1 A biannual payment can mean a payment due approximately every two years.
- #2 A semiannual payment can mean a payment due approximately every two years.

Problem 6. (15 points)

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

- A. For the accelerated cost recovery method of depreciation, the first year expense charged to depreciation is usually more than it would be under the straight line method, assuming that the actual life is the same as the property life used in the accelerated method. **TRUE FALSE**
- B. The effective rate of interest is usually less than the nominal rate for a given calculation. **TRUE FALSE**
- C. To construct a prototype, the design must be modular in nature. **TRUE FALSE**
- D. The book value of a piece of capital equipment usually increases with time. **TRUE FALSE**
- E. For a series of 40 annual payments such that each payment is 9% greater than the previous payment, then the tenth payment is greater than twice the first payment of the series. **TRUE FALSE**