

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

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

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

1. Check that your exam includes all 7 pages (cover, 6 problems). Additionally, there is a 2-sided formula sheet, and a 2-sided set of interest rate tables for 1.5%, 6%, 8% and 12%.
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. Answers without supporting calculations may be discounted.
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. No cellular telephones are permitted.
8. This exam lasts for 55 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.	(9 points possible)
_____	Problem 4.	(13 points possible)
_____	Problem 5.	(20 points possible)
_____	Problem 6.	(18 points possible)
_____	<b>TOTAL.</b>	(100 points possible)

**Manufacturing-Related Formulas**

$$C_p = (USL - LSL) / (6 \sigma) \quad C_{pk} = C_p (1 - k)$$

$$k = | \text{Actual Mean} - \text{Target Mean} | / ((USL - LSL) / 2)$$

$$\text{First-time yield, FTY} = e^{-dpu}$$

$$\text{Prob } \{ k \text{ defects} \} = (dpu^k / k!) e^{-dpu}$$

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**Problem 1. (20 points)**

A company is considering two different types of 125 horsepower motors to operate a large assembly line. The motors are scheduled to be in service for 5 years, and both will deliver the same operational characteristics for the assembly line. At the end of the fifth year, the equipment will be returned to the manufacturer, with a predetermined salvage value. An interest rate of 12% is to be used, except for the electricity, which is compounded monthly at a rate of 1.5% per month. Determine the equivalent 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 both motors are equal, so that does not need to be considered. Show all calculations and factors. Factor calculations may be shown in space to right.

**Motor #1**

Maintenance \$3,000 first year, increases \$500 per year.  
Electricity: \$200 per month  
Salvage value of \$600 at end of fifth year

**Motor #2**

Maintenance-Single payment contract, \$25,000, payable at end of fourth year.  
Electricity: \$300 per month  
Salvage value of \$800 at end of fifth year

**Motor #1**

(9) Lifetime Cost= \_\_\_\_\_

**Motor #2**

(9) Lifetime Cost= \_\_\_\_\_

(2) Cheapest Motor # \_\_\_\_\_

**Problem 2. (20 points)**

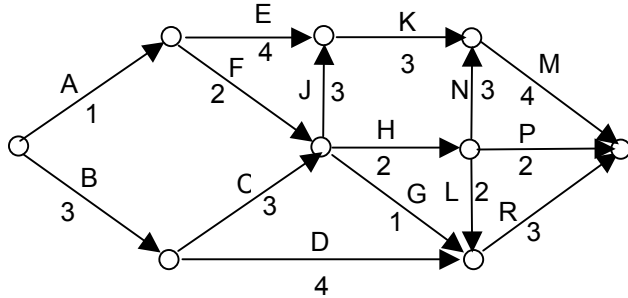
Answer the following multiple choice questions by circling the letter in front of the most appropriate response.

- 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 variation in time for each activity
  - (d) Gantt charts more clearly illustrate the design process
  - (e) Gantt 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 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 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.
- D. The fundamental economic trade-off discussed in Recitation # 3 with regard to choosing between the two synchronous machinery options was
- (a) output power of the motor versus power factor.
  - (b) efficiency of motor operation versus power rate.
  - (c) maintenance cost versus power rate.
  - (d) output power versus maintenance cost.



**Problem 4. (13 points)**

- A. (7 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: AEKM, duration=12



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

- B. (6 points) Determine the float for

(i) Activity K

Float K = \_\_\_\_\_

(ii) Activity H

Float H = \_\_\_\_\_

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**Problem 5. (20 points)**

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

- A. For the accelerated cost recovery method of depreciation, if the estimated salvage value doubles, the first year depreciation expense charged does not change. **TRUE** **FALSE**
- B. To construct a prototype, the design must be modular in nature. **TRUE** **FALSE**
- C. The book value of a piece of capital equipment is always less than the market value. **TRUE** **FALSE**
- D. The effective rate of interest is usually less than the nominal rate for a given calculation. **TRUE** **FALSE**
- E. In group decision-making, the number of possible communication interactions is linearly proportional to the number of group members. **TRUE** **FALSE**

**Problem 6. (18 points)**

A particular type of ceramic fastener used in final computer assembly must have a thermal characteristic specification of  $T$  greater than 2,000, with a target mean of 2,600. Two batches of 10,000 fasteners each are produced, with a mean and standard deviation of

Batch A: mean= 2,800  
Standard deviation =400

Batch B: mean=2,450  
Standard deviation=150

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

(4) Batch \_\_\_\_\_

(6) Number= \_\_\_\_\_

If we now specify an upper specification limit of 4,000, determine  $C_p$  and  $C_{pk}$  for Batch A.

(3)  $C_p$ = \_\_\_\_\_

(3)  $C_{pk}$ = \_\_\_\_\_

(2) Is the design for batch A tolerant? (Circle one) yes      no