ECE 4000 RC

Quiz #1 Solution 6/7/02

1. A. $A = P(A/P, i\%, n)$

$A = 25{,}000(A/P, 6\%, 10)$

$(A/P, 6\%, 10) = \dfrac{i(1+i)^n}{(1+i)^n - 1} = \dfrac{.06(1.06)^{10}}{(1.06)^{10} - 1} = .13587$

$A = \$25{,}000(.13587) = \$3{,}397$

B. 10% per ANNUM, NOMINAL $= \frac{10\%}{2} = 5\%$ effective, semiannual

$A = F(A/F, i\%, n)$

$(A/F, 5\%, 16) = \dfrac{i}{(1+i)^n - 1} = \dfrac{.05}{(1.05)^{16} - 1} = .04227$

$A = \$30{,}000(.04227) = \$1{,}268$

Approximate solution:

$A/\text{year} = 30{,}000(A/F, 10\%, 8) = 30{,}000\left(\dfrac{.1}{(1.1)^8 - 1}\right)$

$A/\text{year} = 2623.3$

$A/\text{semiannual} = \dfrac{2623.3}{2} = \$1{,}312$ (Approx.)

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C. Let K_1 = 1st payment, 2nd payment

$2K_1$ = 3rd payment, 4th payment

Several solutions:

$$P = 4{,}000 = K_1(P/A, 8\%, 4) + K_1(P/A, 8\%, 2)(P/F, 8\%, 2)$$

or $$4{,}000 = K_1(P/A, 8\%, 2) + 2K_1(P/A, 8\%, 2)(P/F, 8\%, 2)$$

$$(P/A, 8\%, 4) = \frac{(1.08)^4 - 1}{.08(1.08)^4} = 3.3121$$

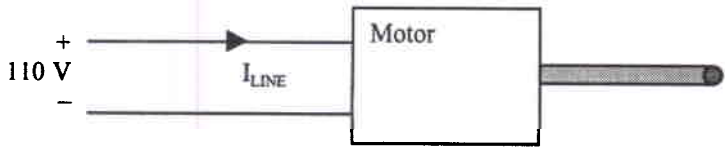
$$(P/A, 8\%, 2) = \frac{(1.08)^2 - 1}{.08(1.08)^2} = 1.7833$$

$$(P/F, 8\%, 2) = (1.08)^{-2} = .8573$$

$$K_1(3.3121) + K_1(1.7833)(.8573) = 4000$$

$$K_1 = \$826$$

2.



A. $$\text{COST} = \text{INPUT POWER IN KILOWATTS} \cdot \frac{\$.08}{\text{KW-hr}} \cdot \frac{300 \text{ days}}{\text{year}} \cdot \frac{12 \text{ hours}}{\text{day}}$$

$$\text{COST} = \frac{8 \text{ KW}}{.8} \times \frac{\$288}{\text{KW-year}}$$

$$\text{COST} = \$2{,}880/\text{year}$$

B.

$$P = 400(P/A, 5\%, 8) + 50(P/G, 5\%, 8)$$

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$$(P/A, 5\%, 8) = \frac{(1.05)^8 - 1}{.05\,(1.05)^8} = 6.4632$$

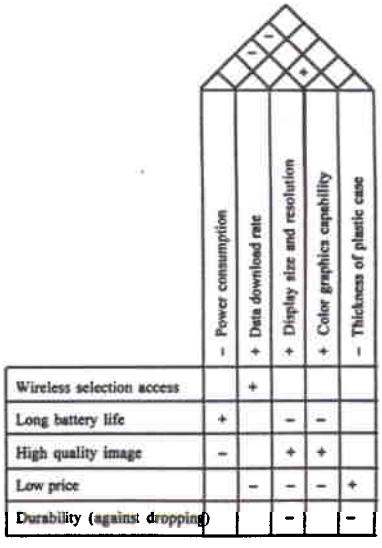
$$(P/G, 5\%, 8) = \frac{(1.05)^8 - (.05)(8) - 1}{(.05)^2\,(1.05)^8} = 20.9698$$

$$P = 400(6.4632) + 50(20.9698) = \$3,634$$

C(i) A less lagging power factor for the plant would mean lower current for the same real power to the plant. The lower current would produce less power loss in the line, so the power company would be willing to charge a reduced rate.

(ii) If the motor (synchronous) were operated at a less lagging or leading power factor, the motor would probably be less efficient, requiring more input power for a given output power.

3. A. The display size and Resolution is directly related to four of the customer desires, positively for one and negatively for three, so it would be the Engineering characteristic likely to have the greatest effect on successful implementation.



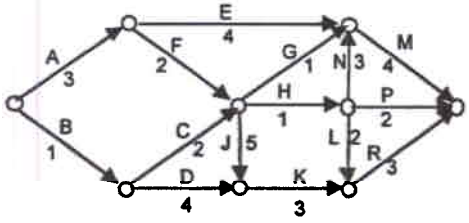
	− Power consumption	+ Data download rate	+ Display size and resolution	+ Color graphics capability	− Thickness of plastic case
Wireless selection access		+			
Long battery life	+		−	−	
High quality image	−		+	+	
Low price		−	−	−	+
Durability (against dropping)			−		−

B. The customer desires of high quality image and low price are in conflict. The high quality image requires high capability of Display Size and Resolution and color Graphics, which are in conflict with a low price. (d)

C. Power Consumption is negatively correlated with two engineering characteristics, Display Size and Resolution and color graphics capability. (a)

D. Long Battery Life is likely to be the most difficult customer Desire of the four listed to Achieve. It is negatively correlated with the two engineering characteristics that have a positive correlation with the customer Desive of high Quality image. (b)

4. A.



A. Critical Path = Longest Path

= AFJKR

B. Length of critical path = Project Duration

= 3+2+5+3+3

= 16

(i) LATEST START = PROJECT DURATION − LENGTH OF LONGEST BACKWARD PATH

LATEST START for ACTIVITY E = 16 − 8 = 8

EARLIEST START for ACTIVITY E = 3

FLOAT = LS − ES = 8 − 3 = 5

of ACTIVITY E

(ii) FLOAT for ACTIVITY F = 0, SINCE ALL ACTIVITIES ON the CRITICAL PATH have FLOAT = 0.

C. $t_{expected} = \frac{t_s + 4t_m + t_l}{6} = \frac{2.6 + 4(3.8) + 5.2}{6} = 3.83$

D. STANDARD DEVIATION = σ = 3 MONTHS

$Z = \frac{T - T_e}{\sigma} = \frac{21 - 17}{3} = 1.33$

FROM TAIL-END Z-DISTRIBUTION,

PROB($Z > 1.33$) = .0918 = 9.2%

5. A. Recycle MEANS TO EXTRACT AND REPROCESS MATERIALS, AS OPPOSED TO REUSE, which MEANS TO use DEVICE, or A MODULAR PART, over. A FUNDAMENTAL issue with recycling is the COST OF MATERIAL SEPARATION. #1

B. Less APPLIES TO MATTERS OF REDUCED DEGREE; fewer APPLIES TO ITEMS THAT ARE COUNTABLE. One would SAY "fewer STUDENTS," AS OPPOSED TO "LESS STUDENTS," which is INCORRECT.

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AN exception is that Less MAY Be used with Distance. "Less than 100 miles is correct." #1

C. ONe ADVANTage of Developing A prototype is THAT theoretically unforeseen component interactions MAY Be UNcovered. A Design that is hierArchical is one in which AN item AT one level of design ABSTRACTION is DECOMPOSED INTO multiple items AT the next lower level. this is somewhat inDepenDent of the CONCEPT of A prototype. #2

D. PARTITIONING is the separating of A Design INTO MULTIPLE PARTS AT The SAME level of ABSTRACTION. This SEPARATION Allows multiple items to Be TACKLED IN PARALLEL. the CALENDAR time to completion is Determined By the CALENDAR time of the longest PART. A DISADVANTage of extensive PARTITIONING is THAT eACh group tries (or MAY try) to OPTimize its PART, But this MAY NOT Necessarily lead to A global OPTimiZATION. #2

E. If the group has N members, each member can interact with N-1 others. By considering each member, there are $\frac{N(N-1)}{2}$ possible interactions, with the 2 in the denominator preventing double counting. For large N, the leading term is $\frac{N^2}{2} \propto N^2$. #1

F. Most development is design-standard based, for which it is easier to write and enforce regulations. Performance-standard based development allows for more design flexibility and creativity. #2