Name: _Chris Notter_   CWID: _893272518_   Date: ~~Wednesday, March 11, 2020~~ Sunday, March 13, 2021

CALIFORNIA STATE UNIVERSITY, FULLERTON
Computer Engineering

EGCP 401 – Engineering Economics & Professionalism
(Spring 2021)

Midterm Exam 1(Total Points = 60)

Submit your answer on Canvas by March 14ᵗʰ midnight.

Academic Dishonesty Policy

In line with University policies, the Computer Engineering program supports a strict and well-defined policy against academic dishonesty. Thus, to assure a fair and equitable testing environment for all students, there will be zero tolerance during exam for any of the following:

•   Cheating of any type (looking at or copying another student's answers) or helping another student with answers.

•   Use of notes, phones, or other aids (other than that allowed by instructor)

•   Talking or texting during exams

•   Leaving the classroom during the exam (without permission)

Consequences for violating these policies will be a "zero" on the exam at a minimum, with the possibility of an F in the course.

Normally, full credit is given only if work is shown when appropriate.

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1. **(10 Points) True or False**

I. In an economic decision making, when the inputs and outputs are fixed, the criterion to use is minimize the input. (**False**)

II. An example for fixed input in economic decision making is that the project manager has a budget of one million dollars for this project. (**True**)

III. Sunk costs must be ignored in engineering economic decision making as sunk costs are money already spent and do not have any consequence on decision making. (**True**)

IV. An opportunity cost is associated with using a resource in one activity instead of another.
(**True**)

V. The breakeven volume is the quantity for which the unit cost is minimized. (**False**)

VI. If Sonja invested $10,000 in a good mutual fund that pays an average return of 10%, the investment will be worth $16,110 five years from now. (**True**)

$$F = 10000\left[1+.1\right]^5$$

VII. One thousand dollars invested grew to be $3,000 six years hence. If the interest was compounded yearly, the interest rate on this investment was 20%.(**True**)

$$3000 = 1000(1+r)^6$$
$$\boxed{r = .2}$$

VIII. In developing cash flow diagrams the convention is to use a negative cash flow for receipts.
(**False**)

IX. Interest compounding daily than continuous compounding for a known interest rate will provide a larger yield. (**False**)

X. In order to use the gradient series factors to solve a set of given cash flows, the cash flows must increase or decrease gradually by the same amount every year, starting year 2 and must have zero cash flow in year 1. (**True**)

2. (20 Points) ESTIMATING ENGINEERING COSTS AND BENEFITS

Reference: Table 1
Tech Engineering in TN is making a product for the overseas market.
The following cost data for the product has been compiled.

Item	Cost
Selling price	$167
Materials and purchased parts	$25/unit
Direct Labor	2 hrs at $20 per hour
Fixed Cost	$1,400,000

2.1. If the overhead expenses are charged at 80 % of labor cost, determine the manufacturing cost per unit.

A) $72

B) $97

C) $65

D) None of these

$$\text{Direct Labor} = 2(20) = 40$$
$$25 + 40 \longrightarrow 0.8(40) = 32$$
$$25 + 40 + 32 = \boxed{\$97}$$

2.2. The breakeven volume for this product is _____.

A) 14,433

B) 8,383

C) 20,000

D) None of these

$$\frac{1400000}{(167-97)} = 20000 \text{ units}$$

2.3. What is the profit per unit if 30,000 units are sold?

A) $23.33

B) $20.81

C) $24.35

D) None of these

$$\frac{30000(70) - 1400000}{30000} = \boxed{\$23.33}$$

2.4. To reduce the breakeven volume to 15,000 units, what should be the selling price?

A) $210.33

B) $190.33

$$(s-97)\ 15\ 600 = \frac{1400000}{s-97}\ (s-97)$$

$$\frac{15000(s-97)}{15000} = \frac{1400000}{15000}$$

$$3/5 \quad \begin{cases} s - 97 = \frac{280}{3} \\ s = \frac{571}{3} \end{cases}$$

$$\$190.33$$

C) $241.35
D) None of these

2.5. A 2000-gallon metal tank to store hazardous materials was bought 15 years ago at cost of $100,000. What will a 5,000-gallon tank cost today if the power–sizing exponent is 0.57 and the construction cost index for such facilities has increased from 180 to 600 over the last 15 years? Choose the closest value.

A) $337,175
B) $666,667
C) $561,960
D) None of these.

$$100000\left(\frac{600}{180}\right)\left(\frac{5000}{2000}\right)^{0.57}$$

$$= 100000(3.33)(2.5)^{0.57}$$

$$= \boxed{561958.89}$$

3. (10 Points) INTEREST AND EQUIVALENCE

3.1. Sam, made an investment of $20,000 at a much later date when he turned 35. Now that he is also 50, what is his investment worth if his investment also an earned an interest rate of 6.5% compounded semi-annually.

A) $52,207.37
B) $44,491.96
C) $32,500
D) None of these

$(.065/2) = .0325$

$$F = 20000\left(1 + .0325\right)^{2(50-35)}$$

$$F = 20000(1.0325)^{30}$$

$$\boxed{F = 52207.37}$$

3.2. Don Krump wants to triple his investment in 6 years. An investment firm offers him an attractive interest rate. If the interest is compounded monthly, determine the nominal interest for this investment.

A) 20.09%
B) 15.76%
C) 18.45%
D) 16.67%

$F = 3 \times \text{investment}$ $12(6) = 72 \text{ years}$

$$3F = F\left(1 + \frac{i}{12}\right)^{72}$$

$$3 = \left(1 + \frac{i}{12}\right)^{72}$$

$$r = \frac{(1.015326 - 1)}{12} \text{ (6 years)}$$

$$\boxed{r = 14.45\%}$$

4. (20 Points) EQUIVALENCE FOR REPEATED CASH FLOWS

4.1. For an interest rate of 10% compounded annually, evaluate the value of "X" from the cash flows given in table below.

Year	0	1	2	3	4	5
Cash flows	-10,000 + X	1,600	1,700	1,800	1,900	3,500

A) $2,316.85
B) $3,295.43
C) $1,064.74
D) $1,102.75

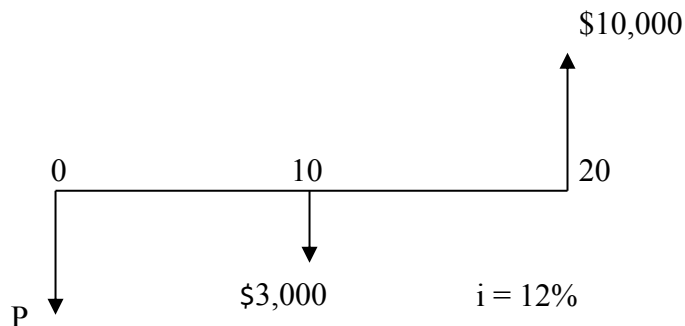$$10000 = X + 1600\left(P/A, 10\%, 5\right) + 100(P/G, 10\%, 5)$$

$$= X + 1600(3.791) + 100(6.862) + 1500(0.6209)$$

$$= X + 6056.6 + 686.2 + 931.35$$

$$10000.00 = X + 7683.15$$
$$-7683.15 \qquad -7683.15$$

$$\boxed{\$2316.85} = X$$

4.2. For the cash flow diagram below, determine the value of P

$10,000

0   10   20

$3,000   i = 12%

P

A) $119.26
B) $195.49
C) $71
D) $147.20

$$\frac{10000}{(1+.12)^{20}} - \frac{3000}{(1+.12)^{10}}$$

$$1036.67 - 965.919 = \boxed{\$70.751}$$

4.3. A set of cash flows are given in table below, using the principles of equivalence, determine the value "Y" for an interest rate of 8% compounded annually.

Year	0	1	2	3	4	5	5-10
Cash flow in $	-5,000	0	0	0	-1,000	-1,000	Y

A) $1,402.34
B) $1,887.50
C) $1,107.78
D) $2,328.25

$$-1000\left((P/F, 8\%, 4) + (P/F, 8\%, 5)\right) + Y\left((P/A, 8\%, 4)\right) - 5000 = 0$$

$$-1000\left(1.415613\right) + Y\left(6.710081 - 3.312127\right) - 5000 = 0$$

$$-1415.613 + Y\left(3.397954\right) = 5000$$

$$Y\left(3.397954\right) = 6415.613$$

$$\frac{3.397954 \, Y}{3.397954} = \frac{6415.613}{3.397954}$$

$$\boxed{Y = 1888}$$