

ME 579: Engineering Economics

End Semester Examination

1. Attempt all the questions.
2. Marks to all the questions are mentioned against them.
3. Single PDF file (no typed content is allowed) of the solution is also required to be uploaded. A separate assignment link will be created for this purpose.

1

Estimate the unit cost (UC) and selling price (SP) of manufacturing metal wire cutters in lots of 100 when following data have been obtained.

Factory (direct) Labour: 42 hours @ @11.15/hours

Factory overhead: 150% of factory labour

Outside manufacturing: \$79.87

Production Material: \$36.20

Packing Cost: 7% of factory labour

Desired profit: 12%

Choose the most appropriate out of the following choices...
(1 Point)

- (a) UC = \$960.30; SP = \$963.60
- (b) UC = \$860.30; SP = \$963.60
- (c) UC = \$860.30; SP = \$863.60
- (d) UC = \$960.30; SP = \$863.60

A lump-sum loan of \$5,000 is needed by Chandra to pay for college expenses. She has obtained small consumer loans with 12% interest per year in the past to help pay for college. But her father has advised Chandra to apply for a PLUS student loan charging only 8.5% interest per year. If the loan will be repaid in full in five years,

- I) what is the difference in total interest accumulated by these two types of student loans?
- II) what is the difference in EMI by these two types of student loans

choose the nearest one to reply above two questions.

(1 Point)

- (a) 1293.41; 8.43
- (b) 1234.91; 10.45
- (c) 1152.35; 6.63
- (d) 1200.12. 11.11

The winner of a multistate mega millions lottery jackpot worth \$175 million was given the option of taking payments of \$7 million per year for 25 years, beginning 1 year from now, or taking \$109.355 million now. The interest rate that renders the two options equivalent to each other is closest to:

(1 Point)

- (a) 4%
- (b) 5%
- (c) 6%
- (d) 7%

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A credit card company wants your business. If you accept their offer and use their card, they will deposit 1% of your monetary transactions into a savings account that will earn a guaranteed 5% per year. Your annual transactions total an average of \$20,000. The amount that you will have in this savings plan after 15 years is closest to:

(1 Point)

- (a) \$4655
- (b) \$4998
- (c) \$4315
- (d) \$4000

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Assume you borrow \$10,000 today and promise to repay the loan in two payments, one in year 2 and the other in year 4, with the one in year 4 being only half as large as the one in year 2. At an interest rate of 10% per year, the size of the payment in year 4 is closest to:

(1 Point)

- (a) \$4280
- (b) \$3975
- (c) \$3850
- (d) \$3690

6

It takes N1 years for a given sum of money to double at 5% per year simple interest and N2 years to double the same sum of money at 5% per year compounded annually. The difference of N1 and N2 is closest to:

(1 Point)

- (a) 20 years 0 days

- (b) 14 years 76 days
- (c) 5 years 289 days
- (d) 15 years 265 dyas

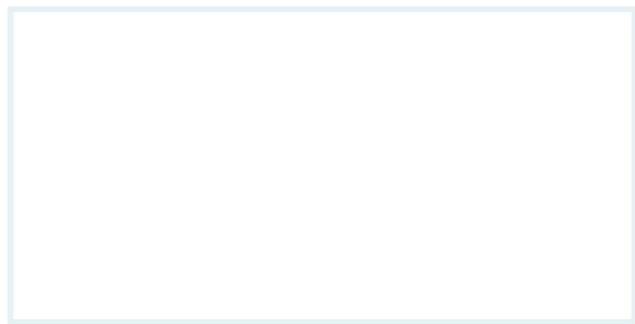
7

Maintenance expenses for a bridge on a local river are estimated to be \$30,000 per year for the first 10 years, followed by two separate \$80,000 expenditures in years 15 and 20. The expected life of the bridge is 30 years. If $i = 7\%$ per year, what is the equivalent uniform annual expense over the entire 30-year period?

(1 Point)

- (a) \$20986
- (b) \$21564
- (c) \$24,820
- (d) \$22,950

8



Consider the cash-flow diagrams of the Figure. Are these economically equivalent if the interest rate is 10% per year? If no, what is the difference in annual worth with respect to second one? Choose the nearest correct answer.

(2 Points)

- (a) These are economically equivalent with 8.13 percentage difference in AW
- (b) These are economically equivalent with zero percentage difference in AW
- (c) These are not economically equivalent with 8.13 percentage difference in AW

- (d) These are not economically equivalent with zero percentage difference in AW
- Insufficient data to find solution

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An alumnus of West Virginia University wishes to start an endowment that will provide scholarship money of \$40,000 per year beginning in year 5 and continuing indefinitely. The donor plans to give money now and for each of the next 2 years. If the size of each donation is exactly the same, the amount that must be donated each year at $i = 8\%$ per year is closest to:

(1 Point)

- (a) \$190,820
- (b) \$122,260
- (c) \$127,460
- (d) \$132,040

10

A bulk materials hauler purchased a used dump a truck for \$50,000 two years ago. The operating costs have been \$5000 per month and revenues have averaged \$7500 per month. The truck was just sold for \$11,000. The rate of return is closest to:

(1 Point)

- (a) 2.6% per month
- (b) 2.6% per year
- (c) 3.6% per month
- (d) 15.6% per year

A bond with a face value of \$6,000 pays interest of 7 per year. This bond will be redeemed at par value at the end of its 20-year life, and the first interest payment is due one year from now.

- (a) How much should be paid now for this bond in order to receive a yield of 10% per year on the investment?
- (b) If this bond is purchased now for \$4,800, what annual yield would the buyer receive?

Choose the correct choice to reply

(1 Point)

- (a) 4467.31, 10.4%
- (b) 4067.31, 9.24%
- (c) 4467.31, 9.24%
- (d) 4067.31, 10.4%

An interest rate of 18% per year, compounded continuously, is closest to an effective:

(1 Point)

- (a) 1.51% per quarter
- (b) 4.5% per quarter
- (c) 4.6% per quarter
- (d) 9% per 6 months

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A bulk materials hauler purchased a used dump truck for \$50,000 two years ago. The operating costs have been \$5000 per month and revenues have averaged \$7500 per month. The truck was just sold for \$11,000. The rate of return is closest to

(1 Point)

(a) 2.6% per month

(b) 2.6% per year

(c) 3.6% per month

(d) 15.6% per year

14

Konica Minolta plans to sell a copier that prints documents on both sides simultaneously, cutting in half the time it takes to complete big commercial jobs. The faster copier is expected to increase profit by \$2,500,000 per year, regardless of which of the following rollers the company uses in its copiers. The estimated costs associated with chemically treated vinyl rollers and fiber-impregnated rubber rollers are shown below. Determine which of the roller types should be selected on the basis of an ROR analysis assuming the company's MARR is 25% per year.

Roller Type	Treated	Impregnated
First cost, (\$1000)	-5000	-6500
Annual cost, (\$1000/year)	-1000	-650
Salvage value, (\$1000)	100	200
Life, years	5	5

(1 Point)

(A) Do nothing

(B) Select "Treated"

(C) Select "Impregnated"

(D) Insufficient data

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A metal plating company is considering four different methods for recovering by-product heavy metals from a manufacturing site's liquid waste. The investment costs and annual net incomes associated with each method have been estimated. All methods have an 8-year life; the MARR is 11% per year; and an AW-based ROR analysis is required. (i) If the methods are independent (because they can be implemented at different plants), which ones are acceptable? (ii) If the methods are mutually exclusive, determine which one should be selected.

Method	First Cost, \$	Salvage Value, \$	Annual Net Income, \$/Year
P	-30,000	+1,000	+4,000
Q	-36,000	+2,000	+5,000
R	-41,000	+500	+8,000
S	-53,000	-2000	+10,500

Select the correct option for above two questions.
(2 Points)

(a) (i) select S; (ii) select R

(b) (i) select P; (ii) select Q

(c) (i) select S; (ii) select S

(d) (i) select R; (ii) select R

Several alternatives are under consideration to enhance security at a county jail. Since the alternatives { **Extra Cameras (EC)**; **New Sensors (NS)**; **Steel Tubing (ST)** and **Access Control (AC)** } serve different areas of the facility, all that are economically attractive will be implemented. Determine which one(s) should be selected, based on a B/C analysis using an interest rate of 7% per year and a 10-year study period.

	(EC)	(NS)	(ST)	(AC)
First cost,	\$ 38,000	87,000	99,000	61,000
M&O, \$/year	49,000	64,000	42,000	38,000
Benefits, \$/year	110,000	160,000	74,000	52,000
Disbenefits, \$/year (2 Points)	26,000	21,000	32,000	14,000

- (a) Select EC only
- (b) Select EC and NS
- (c) Select EC and ST
- (d) Select all
- (e) Select none

Huntington Medical Center purchased a used lowfield MRI scanner 2 years ago for \$445,000. Its operating cost is \$272,000 per year and it can be sold for \$150,000 anytime in the next 3 years. The Center's director is considering replacing the presently owned MRI scanner with a state-of-the-art 3 Tesla machine that will cost \$2.2 million. The operating cost of the new machine will be \$340,000 per year, but it will generate *extra revenue* that is expected to amount to \$595,000 per year. The new unit can probably be sold for \$800,000 three years from now. You have been asked to determine how much the presently owned scanner would have to be worth on the open market for the AW values of the two machines to be the same over a 3-year planning period. The Center's MARR is 20% per year. Select the best choice.

(2 Points)

- (A) Replacement value i.e \$1,49,000 is less than Market value of lowfield MRI, so replace
- (B) Replacement Value i.e. \$7,13,735 is higher than market value of lowfield MRI, so retain it.
- (C) Replacement Value i.e. \$1,50,000 is higher than market value of lowfield MRI, so replace it.
- (D) None of the above

Freeport McMoRan engineers estimated that the capital investment necessary for recovering valuable metals (nickel, silver, gold, etc.) from a copper refinery's wastewater would be \$150 million. The equipment is expected to have a useful life of 10 years with no salvage value. The amount of metal currently discharged in the wastewater is 12,500 pounds per year. The recovered metals are expected to have a selling price of \$250 per pound. The efficiency relation of the recovery operation is represented by X 0.5, where X represents the efficiency in percentage. What value of X is necessary for the company to break even? Assume $i = 10\%$ per year.

(1 Point)

- (a) 71%

(b) 69%

(c) 61%

(d) 59%

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Find the present worth of earthmoving equipment that has a first cost today of \$150,000, an annual operating cost of \$60,000, and a salvage value of 20% of the first cost after 5 years; these estimates being in future dollars. Assume the interest rate is 10% per year and that inflation has averaged 7% per year.
(1 Point)

(a) \$-3,10,111

(b) \$-3,25,630

(c) \$-3,32,111

(d) \$-3,30,620

20

When WTA, Inc. purchased rights to extract silver from a mine for a total price of \$2.1 million 3 years ago, the estimated 350,000 ounces of silver was to be removed over the next 10 years. A total of 175,000 ounces has been removed and sold thus far. (a) What is the Total Cost Depletion (TCD) allowed over the 3 years? (b) New exploratory tests indicate that only an estimated 100,000 ounces remain in the veins of the mine. What is the Cost Depletion Factor (CFD) applicable for the next year?
(1 Point)

(a) TCD = \$10,50,000; CFD = \$12.50 per ounce

(b) TCD = \$12,50,000; CFD = \$10.50 per ounce

(c) TCD = \$12,50,000; CFD = \$12.50 per ounce

(d) TCD = \$10,50,000; CFD = \$10.50 per ounce

young couple planning ahead for their retirement has decided that \$3 million is the amount they will need in order to retire comfortably 20 years from now. For the past 5 years, they have been able to invest one of their salaries (\$50,000 per year, which includes employer contributions) while living off the other salary. They plan to start a family sometime in the next 10 years and when they will have their first child, one of the parents will quit working, causing the savings to decrease to \$10,000 per year thereafter. If they have realized an average ROR of 10% per year on their investments, and expect to continue at this ROR, is reaching their goal of \$3 million in 20 years sensitive to when they have their first child (i.e., between now and 10 years from now)? If so, how many years from now will they have to wait before they have their first child? Use a future worth analysis.

(2 Points)

- (a) It is insensitive and so a family can be started at any point of time in the next 10 years
- (b) It is sensitive and so they should wait for at least one year from now to meet the goal
- (c) It is sensitive and so they should wait for at least two years from now to meet the goal
- (d) It is sensitive and so they should their first child in year 1 to meet the goal

Five thousand new smart camera systems are needed annually to expand the security surveillance of roads, buildings, airports, parks, etc. in a large metropolitan area. The system components can be obtained in one of three ways: (1) *Make* them in one of three plants partially owned by the government; (2) *Buy* them off the shelf from the one and only manufacturer; or (3) *Contract* to have them made to specifications by a vendor. The estimated annual cost for each alternative is dependent upon specifics of the plant, the producer, or the vendor. The information shown in the figure details the alternative, a probability of occurrence, and the estimated annual cost. Construct and solve a decision tree to determine the least-cost alternative to provide the components. Choose the correct option.

(2 Points)

- (A) Subcontract a vendor
- (B) Make in one of the three plants
- (C) Buy them from the only one current manufacturer
- (D) all of the above

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The shipping costs for fresh fruit items have been estimated and assigned the probabilities shown below. The expected value of the shipping costs is closest to:

Shipping Cost, \$ 34 38 55

Probability 0.22 0.31 0.47
(1 Point)

- (a) \$36.33
- (b) \$39.21
- (c) \$41.28
- (d) \$45.11

Over a 1-week period, an officer of the state lottery commission sampled ticket purchasers at a single high-traffic location. The amounts labelled W for winnings, distributed back to the purchasers/winners, and the associated probabilities for 5000 tickets are shown below.

Winnings W, \$	0	2	5	10	100
Probability	0.95	0.025	0.015	0.0093	0.0007

- (i) Calculate the expected value (EVW) of W per ticket.
(ii) If tickets cost \$2, what is the expected long-term income (LC) to the state per ticket, based upon this sample?

Choose the correct answer.

(1 Point)

- (A) EVW = 0.288; LC = \$1.72
- (B) EVW = 0.208; LC = \$1.82
- (C) EVW = 0.200; LC = \$5.72
- (D) EVW = 0.388; LC = \$2.72

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