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Continuing Education Course #484
What Every Engineer Should Know About
Engineering Economic Analysis, Part I

1. Which of the following about Engineering design and decision is correct.

○ a. Engineers look for the most economical and cost-effective ways to bring a project and idea to fruition in order to benefit mankind

○ b. Part of improving the human condition is the noble idea that systems and products that result from engineering invention and discoveries should be affordable.

○ c. Managing the engineering design process requires an understanding of the economic as well as the technical ramifications of a design decision.

○ d. Every Engineering decision has at least an alternative solution.

○ e. All of the above statements are correct

2. To "Do Nothing (DN)" is a decision.

○ a. True

○ b. False

3. Engineering Economic Analysis

○ a. is a specialized discipline of Engineering that is focused on the economic viability and efficacy of engineering projects

○ b. provides tools for systematic evaluation of the economic benefits of the alternative to the proposed solutions to engineering problems

○ c. quantifies the costs and benefits of a project and thus gives an objective estimate of various alternate future investments in the presence of limited resources

○ d. All of the above statements are correct

4. Which of the following is not supported by the idea of the time value of money (TVM)

○ a. TVM is based on the idea that people would rather have money now, today, than sometime in the future.

○ b. TVM implies that money is more valuable in the future rather than the present.

○ c. Capital Gain (CG) is made possible through TVM.

○ d. None of the above statements

5. Which of the following is not one of the major part or purpose of Engineering Economic Decisions

○ a. product and service expansion

○ b. cost minimization

○ c. product and service improvement

○ d. engineering design

6. The weighted value of a company's equity capital is 8% while the weighted value of its debt capital is 0.4%. If the Market value of the firm's equity (E)=$200million,and the market value of the firm's debt (D)=$90million, where V=E+D=$290 million, What is the estimate of WACC?

○ a. 69%
○ b. 31%
○ c. 8.4%
○ d. Not enough information

7. Which of the following is NOT true of WACC
○ a. WACC is the discount rate that a company uses to estimate its net present value
○ b. A higher WACC usually means lower risk for investors
○ c. WACC is one of the metrics used by a company to determine the cost to borrow funds.
○ d. None of the above

8. Economic utility may be defined as the amount of satisfaction experienced upon the consumption of a product or service
○ a. True
○ b. False

9. Which of the following statements is NOT TRUE about Utility
○ a. Utility cannot be expressed in dollars as can market value
○ b. The utility of a good or service does not change from one person to another
○ c. Utility is the capacity to be useful and provide satisfaction and must be present or required for something to have value
○ d. A good or service does not have to have utility for everyone, only utility for some.

10. The following statements about Market value is true
○ a. Market value is aggregated and impersonal
○ b. Market Value cannot change because of an individual or their preferences
○ c. Market value refers to a worth that can be expressed in dollars and cents
○ d. All of the above

11. Both marginal costs and incremental costs are concerned with the change in the production cost. Which of the following statement about marginal cost or incremental cost is true?
○ a. marginal cost is focused on the increase or decrease in costs that results from producing one additional unit of output
○ b. incremental cost refers to the total additional cost associated with the decision to expand output or to add a new product line
○ c. marginal cost refers to the change in total cost resulting from producing an additional unit of output,
○ d. All of the above

12. Which of the following about types of costs is NOT true
○ a. Variable costs are those costs that vary with the amount of activity
○ b. Normal costs are the type of costs that the organization incurs at the standard level of output under abnormal conditions
○ c. Fixed costs do not change with the amount of activity
○ d. Mixed costs contain elements of both variable and fixed costs

13. A bank can choose to compound its nominal interest rate (or the stated rate) periodically, that is daily, monthly , quarterly, semi-annually, or annually. The resulting effective interest rate will be,
○ a. higher if compounded monthly than if compounded quarterly
○ b. lower if compounded semi-annually than if compounded daily
○ c. will be the same as the nominal interest rate if the compounding is annual , that is, once a year
○ d. all of the above

14. If the nominal interest is compounded more than once, that is m >1, then
- a. the effective interest rate will always be higher than the nominal interest rate
- b. the effective interest will be lower than the nominal interest rate
- c. The interest rate compounded quarterly will be higher than if compounded daily
- d. none of the above

Question 15-18. A Bank charges a stated interest of 15% compounded monthly on a loan of $5,000.

15. What is the annual nominal interest rate?
- a. 24%
- b. 6 %
- c. 15%
- d. Not enough information

16. What is the interest amount in the first month
- a. $50
- b. $500
- c. $506
- d. $62.50

17. What is the interest amount in the 3rd month
- a. $189.85
- b. $160.50
- c. $187.50
- d. $125

18. What is the effective interest rate per year
- a. 15%
- b. 30%
- c. 16.07%
- d. None of the above

19. If the nominal interest rate is 10% compounded semiannually, what the effective annual interest rate (EAR)
- a. 10.25%
- b. 21%
- c. 5%
- d. 10.38%

20. Assume the effective annual interest rate (EAR) is 9%, compounded monthly (m=12) what is the nominal interest rate, r.
- a. 9.5%
- b. 8.65%
- c. 10.1%
- d. 9%

Question 21-22. Assume you purchased the newest riding lawnmower with warranty from Home Depot on a 6-year payment plan. The first payment is $200 and increases by $50 each payment due to the warranty. This means that after the first year, payment is expected to increase by $50 each year until the 6th year. This is a uniform arithmetic series problem. The maintenance expense is as shown and assume the nominal rate is 10%.

Year	Maintenance cost
1	200

2 250
3 300
4 350
5 400
6 450

21. What is the Present value of the maintenance cost `P_T for the lawnmower if the nominal interest rate is 8%

- a. $P_T = \$450(P/A, 8\,\%, 10) + \$50(A/G, 8\,\%, 10)$
- b. $P_T = \$200(A/P, 8\,\%, 6) + \$450(A/G, 8\,\%, 6)$
- c. $P_T = \$450 + \$50(A/G, 8\,\%, 10)$
- d. $P_T = \$200(P/A, 8\,\%, 6) + \$50(A/G, 8\,\%, 6)$

22. What is the Equivalent Annual Cost of maintenance A_T for the lawnmower if the nominal interest rate is 10%

- a. $A_T = \$450 + \$50(A/G, 6\,\%, 10)$
- b. $A_T = \$200 + \$450(A/G, 10\,\%, 6)$
- c. $A_T = \$200 + \$50(A/G, 10\,\%, 6)$
- d. $A_T = \$450 + \$200(A/G, 6\,\%, 6)$

23. The internal rate of return IRR is defined as the interest rate for which

- a. net future worth of cash flows < $0.
- b. net present worth of cash flows > $0
- c. annual worth equivalents of cash flows or Net Present Value = $0
- d. a rate of interest that is always = MARR

24. For the purpose of Engineering Economic Analysis, a project is valid if its internal rate of return (IRR) is

- a. larger than MARR.
- b. equal to or larger than MARR
- c. less than MARR
- d. less than 0 percent

25. A project's internal rate of return (IRR) is the same whether calculated with the present worth, future worth, or annual equivalent worth methods

- a. The IRR is the same whether calculated with the payback method or the annual equivalent method.
- b. The IRR is the same whether calculated with the present worth, future, or annual equivalent methods.
- c. The IRR is more accurate when calculated with the present worth method than with the equivalent worth method.
- d. The IRR is less accurate when calculated with the future worth method than with the present worth method.

26. A four-year project has an initial cost of $20, 000, net annual cash inflows of $10, 000, and a salvage value of $5,000. Which of the following gives the project's internal rate of return (i*) using the Annual Worth method?

- a. -$20,000(A/P, i*, 4) + $10,000 + $5,000(A/F, i*, 4) = 0
- b. -$20,000(P/F, i*, 4) + $10,000 + $5,000(A/F, i*, 4) = 0
- c. -$20,000(F/P, i*, 4) + $10,000 + $5,000 = 0
- d. -$20,000(A/F, i*, 4) + $10,000 + $5,000(A/P, i*, 4) = 0

27. A project has an initial cost of $50,000, net annual cash inflows of $20,000 in the first year subsequently increasing (uniform gradient) of $1,000 each year. If the project's salvage value is $0 after five years, which of the following gives the project's internal rate of return (i*) using the Present worth (PW) OR the Future worth (FW) method?

- a. -$50,000 + $20,000(P/A, i*, 5) + $1,000(A/P, i*, 5) +0 = 0
- b. -$50,000 + $20,000(F/A, i*, 5) + $0(P/F, i*, 5) +0 = 0

○ c. -$50,000 + $20,000(P/A, i*, 5) - $1,000(P/G, i*, 5) +0 = 0
○ d. -$50,000 + $20,000(P/A, i*, 5) + $1,000(P/G, i*, 5)+0 = 0

28. A project has an initial cost of $200,000, net annual cash inflows of $25,000 in the first year subsequently increasing (uniform gradient) by $2,000 each year. If the project's salvage value is $10,000 after five years, which of the following gives the project's internal rate of return (i*) using the Annual worth (AW) or future (FW) method?
○ a. -$200,000(A/P, i*, 5) + $25,000+ $2,000(A/G, i*, 5) +$10,000(A/F, i*, 5) = 0
○ b. -$200,000 + $25,000(F/A, i*, 5) + $2, 000(F/P, i*, 5) +$10,000= 0
○ c. -$200,000 + $25,000(P/A, i*, 5) + $2,000(P/G, i*, 5)+$10,000(A/F, i*, 5) = 0
○ d. -$200,000 + $25,000(P/A, i*, 5) + $2,000(P/G, i*, 5)+$10,000 = 0

29. The IRR method and the present worth method
○ a. give the same investment decision only when the projects are independent
○ b. give the same investment decision whether the projects are independent or mutually exclusive
○ c. give the same investment decision when there are only two projects to consider
○ d. give the same investment decision only when the projects are mutually exclusive.

30. If a project's cumulative cash flow has two or more sign changes (- to +, + to - , -to+)
○ a. the project will likely have more than one internal rate of return-IRR.
○ b. the project's internal rates of return-IRR are all negative.
○ c. the project definitely has more than one internal rate of return-IRR.
○ d. the project's internal rate(s) of return is(are) greater than MARR.

31. If all net project receipts (inflows) are taken forward at the MARR to the time of the last cash flow at FT and all net project disbursements(outflows) PT are taken forward at an unknown interest rate to equal the future worth, the unknown interest rate that would provide the equality is called the
○ a. approximate IRR.
○ b. precise ERR.
○ c. precise IRR
○ d. approximate ERR

32. If MARR > 0 percent, then the time required to recover a project's initial cost will be
○ a. the same recovery period regardless of the payback method.
○ b. shorter with the simple payback method than with the discounted payback method
○ c. longer with the simple payback method than with the discounted payback method.
○ d. Need more information.

33. Benefit Cost Analysis BCR is defined as:
(Present Worth of Benefits BCR=(Present Worth Benefits / (Present Worth Costs).
Which of the following is true about Breakeven Investment?
○ a. BCR ≥ 1, Breakeven Investment
○ b. BCR =1, Breakeven Investment
○ c. BCR <1, Breakeven Investment
○ d. None of the above

34. Which of the following about Capitalized Worth/Capitalized Cost is true?
○ a. Capitalized Worth (CW) is defined as the present worth (PW) equivalent of an infinitely long series of cashflows.
○ b. It is the present worth (PW) of an alternative that would last forever.
○ c. In certain cases, if only expenses are considered, then the result of the approach is referred to as capitalized cost (CC) analysis
○ d. All of the above

35. $PW = \text{CC} = \dfrac{A}{i}$, when

- a. $n \to \infty$
- b. n is finite
- c. $i = \text{IRR}$
- d. all of the above