SOLUTIONS MANUAL

ENGINEERING ECONOMY

sixth edition

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Chapter 1

Foundations of Engineering Economy

Solutions to Problems

1.1 Time value of money means that there is a certain worth in having money and the worth changes as a function of time.

1.2 Morale, goodwill, friendship, convenience, aesthetics, etc.

1.3 (a) Evaluation criterion is the measure of value that is used to identify "best".
(b) The primary evaluation criterion used in economic analysis is cost.

1.4 Nearest, tastiest, quickest, classiest, most scenic, etc

1.5 If the alternative that is actually the best one *is not even recognized as an alternative*, it obviously will not be able to be selected using *any* economic analysis tools.

1.6 In simple interest, the interest rate applies only to the principal, while compound interest generates interest on the principal *and* all accumulated interest.

1.7 Minimum attractive rate of return is the lowest rate of return (interest rate) that a company or individual considers to be high enough to induce them to invest their money.

1.8 Equity financing involves the use of the corporation's or individual's own funds for making investments, while debt financing involves the use of borrowed funds. An example of equity financing is the use of a corporation's cash or an individual's savings for making an investment. An example of debt financing is a loan (secured or unsecured) or a mortgage.

1.9 Rate of return = (45/966)(100)
= 4.65%

1.10 Rate of increase = [(29 – 22)/22](100)
= 31.8%

1.11 Interest rate = (275,000/2,000,000)(100)
= 13.75%

1.12 Rate of return = (2.3/6)(100)
= 38.3%

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1.13 Profit = 8(0.28)
= $2,240,000

1.14 P + P(0.10) = 1,600,000
1.1P = 1,600,000
P = $1,454,545

1.15 Earnings = 50,000,000(0.35)
= $17,500,000

1.16 (a) Equivalent future amount = 10,000 + 10,000(0.08)
= 10,000(1 + 0.08)
= $10,800

(b) Equivalent past amount: P + 0.08P = 10,000
1.08P = 10,000
P = $9259.26

1.17 Equivalent cost now: P + 0.1P = 16,000
1.1P = 16,000
P = $14,545.45

1.18 40,000 + 40,000(i) = 50,000
i = 25%

1.19 80,000 + 80,000(i) = 100,000
i = 25%

1.20 F = 240,000 + 240,000(0.10)(3)
= $312,000

1.21 Compound amount in 5 years = $1{,}000{,}000(1 + 0.07)^5$
= $1,402,552
Simple amount in 5 years = 1,000,000 + 1,000,000(0.075)(5)
= $1,375,000

Compound interest is better by $27,552

1.22 Simple: 1,000,000 = 500,000 + 500,000(i)(5)
i = 20% per year simple

Compound: $1{,}000{,}000 = 500{,}000(1 + i)^5$
$(1 + i)^5 = 2.0000$
$(1 + i) = (2.0000)^{0.2}$
i = 14.87%

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1.23 Simple: $2P = P + P(0.05)(n)$
$P = P(0.05)(n)$
$n = 20$ years

Compound: $2P = P(1 + 0.05)^n$
$(1 + 0.05)^n = 2.0000$
$n = 14.2$ years

1.24 (a) Simple: $1{,}300{,}000 = P + P(0.15)(10)$
$2.5P = 1{,}300{,}000$
$P = \$520{,}000$

(b) Compound: $1{,}300{,}000 = P(1 + 0.15)^{10}$
$4.0456P = 1{,}300{,}000$
$P = \$321{,}340$

1.25 Plan 1: Interest paid each year = $400{,}000(0.10)$
$= \$40{,}000$

Total paid = $40{,}000(3) + 400{,}000$
$= \$520{,}000$

Plan 2: Total due after 3 years = $400{,}000(1 + 0.10)^3$
$= \$532{,}400$

Difference paid = $532{,}400 – 520{,}000$
$= \$12{,}400$

1.26 (a) Simple interest total amount = $1{,}750{,}000(0.075)(5)$
$= \$656{,}250$

Compound interest total = total amount due after 4 years – amount borrowed
$= 1{,}750{,}000(1 + 0.08)^4 – 1{,}750{,}000$
$= 2{,}380856 – 1{,}750{,}000$
$= \$630{,}856$

(b) The company should borrow 1 year from now for a savings of $656,250 – $630,856 = $25,394

1.27 The symbols are F = ?; P = $50,000; i = 15%; n = 3

1.28 (a) FV(i%,n,A,P) finds the future value, F
(b) IRR(first_cell:last_cell) finds the compound interest rate, i
(c) PMT(i%,n,P,F) finds the equal periodic payment, A
(d) PV(i%,n,A,F) finds the present value, P

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1.29 (a) F = ?; i = 7%; n = 10; A = $2000; P = $9000
(b) A = ?; i = 11%; n = 20; P = $14,000; F = 0
(c) P = ?; i = 8%; n = 15; A = $1000; F = $800

1.30 (a) PV = P (b) PMT = A (c) NPER = n (d) IRR = i (e) FV = F

1.31 For built-in Excel functions, a parameter that does not apply can be left blank when it is not an interior one. For example, if there is no F involved when using the PMT function to solve a particular problem, it can be left blank because it is an end function. When the function involved is an interior one (like P in the PMT function), a comma must be put in its position.

1.32 (a) Risky
(b) Safe
(c) Safe
(d) Safe
(e) Risky

1.33 (a) Equity
(b) Equity
(c) Equity
(d) Debt
(e) Debt

1.34 Highest to lowest rate of return is as follows: Credit card, bank loan to new business, corporate bond, government bond, interest on checking account

1.35 Highest to lowest interest rate is as follows: rate of return on risky investment, minimum attractive rate of return, cost of capital, rate of return on safe investment, interest on savings account, interest on checking account.

1.36 WACC = (0.25)(0.18) + (0.75)(0.10) = 12%
Therefore, MARR = 12%

Select the last three projects: 12.4%, 14%, and 19%

1.37 End of period convention means that the cash flows are assumed to have occurred at the end of the period in which they took place.

1.38 The following items are inflows: salvage value, sales revenues, cost reductions
The following items are outflows: income taxes, loan interest, rebates to dealers, accounting services

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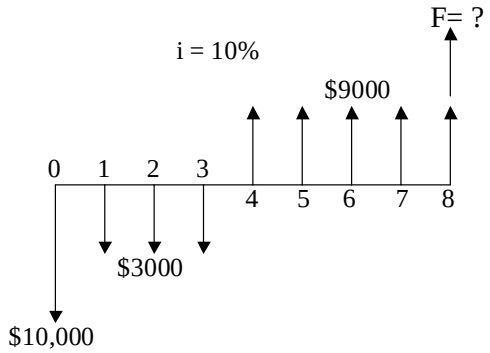
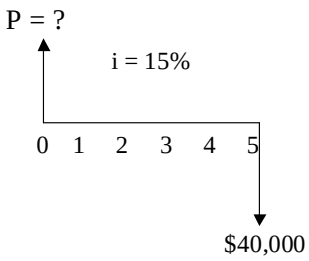
1.39 The cash flow diagram is:



1.40 The cash flow diagram is:



1.41 Time to double = 72/8
= 9 years

1.42 Time to double = 72/9
= 8 years

Time to quadruple = (8)(2)
= 16 years

1.43 4 = 72/i
i = 18% per year

1.44 Account must double in value five times to go from $62,500 to $2,000,000 in 20 years. Therefore, account must double every 20/5 = 4 years.

Required rate of return = 72/4
= 18% per year

FE Review Solutions

1.45 Answer is (c)

1.46 2P = P + P(0.05)(n)
n = 20
Answer is (d)

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1.47 Amount now = 10,000 + 10,000(0.10)
= $11,000

Answer is (c)

1.48 i = 72/9 = 8 %

Answer is (b)

1.49 Answer is (c)

1.50 Let i = compound rate of increase:

$$235 = 160(1 + i)^5$$
$$(1 + i)^5 = 235/160$$
$$(1 + i) = (1.469)^{0.2}$$
$$(1 + i) = 1.07995$$
$$i = 7.995\% = 8.0\%$$

Answer is (c)

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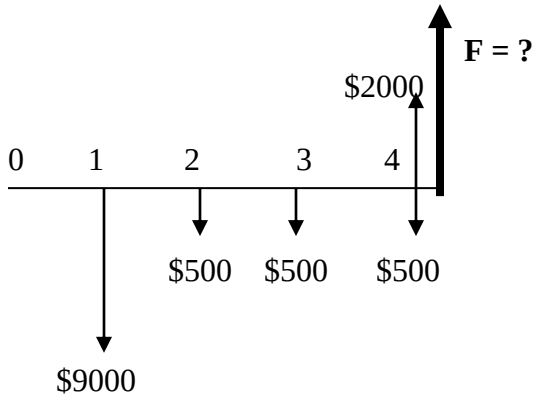
Extended Exercise Solution

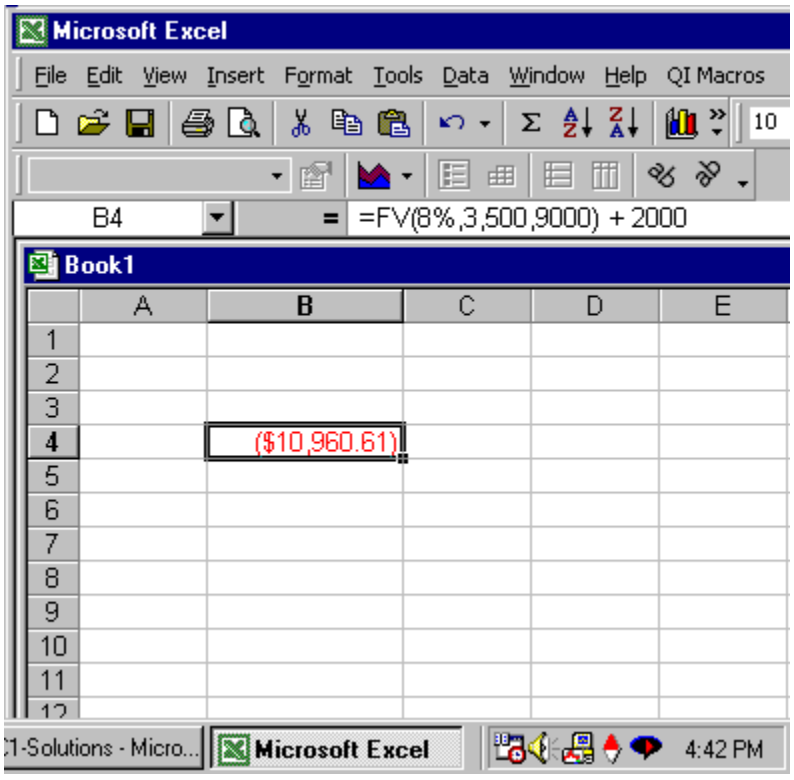
1.



F = [{[–9000(1.08) – 500] (1.08)} – 500] (1.08) + (2000–500)
= $–10,960.60

or F = –9000(F/P,8%,3) – 500(F/A,8%,3) + 2000

2. A spreadsheet uses the FV function as shown in the formula bar. F = $–10,960.61.



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3. F = [{[–9000(1.08) – 300] (1.08)} – 500] (1.08) + (2000 –1000)
   = $–11,227.33

   Change is 2.02%. Largest maintenance charge is in the last year and, therefore, no compound interest is accumulated by it.

4. The fastest method is to use the spreadsheet function:

   FV(12.32%,3,500,9000) + 2000

   It displays the answer:

   F = $–12,445.43

Case Study Solution

There is no definitive answer to the case study exercises. The following are examples only.

1. The first four steps are: Define objective, information collection, alternative definition and estimates, and criteria for decision-making.

   Objective: Select the most economic alternative that also meets requirements such as production rate, quality specifications, manufacturability for design specifications, etc.

   Information: Each alternative must have estimates for life (likely 10 years), AOC and other costs (e.g., training), first cost, any salvage value, and the MARR. The debt versus equity capital question must be addressed, especially if more than $5 million is needed.

   Alternatives: For both A and B, some of the required data to perform an analysis are:
   - P and S must be estimated.
   - AOC equal to about 8% of P must be verified.
   - Training and other cost estimates (annual, periodic, one-time) must be finalized.
   - Confirm n = 10 years for life of A and B.
   - MARR will probably be in the 15% to 18% per year range.

   Criteria: Can use either present worth or annual worth to select between A and B.

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2. Consider these and others like them:
   Debt capital availability and cost
   Competition and size of market share required
   Employee safety of plastics used in processing

3. With the addition of C, this is now a make/buy decision. Economic estimates needed are:
   - Cost of lease arrangement or unit cost, whatever is quoted.
   - Amount and length of time the arrangement is available.

   Some non-economic factors may be:
   - Guarantee of available time as needed.
   - Compatibility with current equipment and designs.
   - Readiness of the company to enter the market now versus later.

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