Chapter 1 Engineering Economic Decisions

1.1

- Lease
    - Deposit (typically one month worth of deposit) refundable when lease expires.
    - Monthly lease payment
    - Monthly maintenance fees
    - Monthly utility expenses
- Buy
    - Closing fees
    - Down payment
    - Monthly mortgage payments
    - Property taxes
    - Monthly utility fees
    - Monthly maintenance fees
    - Repair expenses
    - Homeowners' association fee (if applicable)

1.2

- Option 1:

    - Total amount at the end of two years: **$1,150**

- Option 2:
    - Loan $500 to a friend for one year and receive $600
    - Deposit $500 (left over) in a back at 3% for two years:

        $500(1.03)(1.03) = $530.45

    - Deposit $600 received from your friend at 3% per year for a year:

        $600(1.03) = $618
        Total amount at the end of two years:

        $530.45 + $618 = **$1,148.45**
    These two options are about the same. But considering the trustworthiness, you could go with Option 2.

Chapter 2 Accounting Information for Engineering Economic Decisions

2.1

(2) Income statement; (1) balance sheet; (3) cash flow statement; (4) operating activities; (5) investing activities, and (6) financing activities; (7) capital account (paid-in capital)

2.2

(7), (8), (1), (11), (3), (9)

2.3

(a)

- Current assets = $150,000 + $200,000 + $150,000 + $50,000 + $30,000 = $580,000
- Current liabilities = $50,000 + $100,000 + $80,000 = $230,000
- Working capital = $580,000 - $230,000 = $350,000
- Shareholder's equity = $100,000 + $150,000 + $150,000 + $70,000 = $470,000

(b) EPS = $500,000/10,000 = $50 per share

(c) Par value = $15; capital surplus = $150,000/10,000 = $15

Market price = $15 + $15 = $30 per share

2.4

(a) Shareholder's equity in 2021 = $700 - $510 = $190(M)
Shareholder's equity in 2022 = $900 - $640 = $260(M)

(b) Net working capital in 2021 = $100 - $60 = $40(M)
Net working capital in 2022 = $200 - $90 = $110(M)

(c) The income taxes in year 2022:

($2,350 - $1,130-$420-$210) *0.35 = $206.5(M)

(d) $383.50 + $420=$803.50 (M)
(Cash from Operating activities = Net income + Depreciation)

2.5 (a)

	Company A	Company B
ROE (= Net income/Equity)	26.03%	22.29%
ROA (= Net income + interest expense (1-tax rate)/Average total assets)	17.34%	12.59%

(b) Company A has performed better in terms of profitability.

(c) If two companies were merged, the impact on the results of ROE could be positive under the situation where the Company A leads the acquisition using a stock swap instead of issuing new stocks for M&A cost. If Company A uses a stock swap, the stock value wouldn't be decreased in terms of scarcity.

2.6

Inventory turnover ratio (2021) = Sales/Average inventory balance
$$= \$3,776,395 / (\$202,794 + \$231,313) \times 0.5$$
$$= 17.4 \text{ times}$$

Inventory turnover ratio (2022) = 15.6 times

This ratio shows how many times the inventory of a firm is sold and replaced over a specific period. From the data, Metronix was holding more stocks of inventory than last year; having more inventories on stock is unproductive.

2.7 (b)

2.8 (b)

2.9 (d)

2.10

Given Olson's EPS = $8 per share; Cash dividend = $4 per share; Book value per share = $80; Changes in the retained earnings = $24 million; Total debt = $240 million; Find debt ratio = total debt/total assets

- $EPS = \dfrac{\text{Net Income}}{X} = \$8$

  Where X = the number of outstanding shares

- $\text{Book value} = \dfrac{\text{Total shareholders' equity}}{X} = \$80$

- Retained earnings = Net income – Cash dividend; Net income = 8X from EPS relationship and the total cash dividend = 4X, so we rewrite 8X – 4X = $24 million, or X = 6 million shares

- From the book value per share, we know that the total shareholders' equity = 80X, or $480 million; Total assets = Total liabilities + Total shareholders' equity = $240 million + $480 million = $720 million

- Debt ratio = $240 million/$720 million = 0.33

2.11

(a) Debt ratio (= Total debt/Total assets)

= $19,483,000/$38,599,000 = 50.48%

(b) Times-interest-earned ratio (= EBIT/Interest expense)

= Not defined

(c) Current ratio (= Current assets/Current liabilities)

= 29,021,000/19,483,000 = 1.49

(d) Quick (acid test) ratio (= (Current assets - Inventories)/Current liabilities))

= (29,021,000-1,301,000)/19,483,000 = 1.42

(d) Inventory-turnover ratio (= Sales/Avg. inventory balance)

= 61,494,000/ ((1,301,000+1,051,000)×0.5) = 52.29

(f) Days-sales-outstanding ratio (= Receivables/ (Annual sales/365))

=10,136,000/ (61,494,000/365) = 60.16

(g) Total-assets-turnover ratio (= Sales/Total assets)

= 61,494,000/38,599,000 = 1.59

(h) Profit margin on sales (= Net income available to common stockholders/Sales)

= 2,635,000/61,494,000 = 4.28%

(i) Return on total assets (= (Net income + interest expense (1-tax rate))/Avg.

total assets)

$= 2,635,000/ ((38,599,000 + 33,652,000)×0.5) = 7.29\%$

(j) Return on common equity (= (Net income available to common

stockholders)/Avg. common equity)

$= 2,635,000/ ((7,766,000 + 5,641,000)×0.5) = 39.31\%$

(k) Price/earnings ratio (= Price per share/Earnings per share)

$=13.47/ (3,350,000/1,944,000) = 7.82$

(l) Book value per share (= (Total stockholders' equity-Preferred stock)/Shares

outstanding)

$= 7,766,000/1,944,000 = \$3.99$

To make an informed analysis of the firm's financial health, we need to calculate the various financial ratios of the firm's competitors along with the S&P 500.

2.12

Income Statement:

A	B	C	D	E	F
$900,000	$585,000	$315,000	$270,000	$108,000	$162,000

Balance Sheet:

⓪	①	②	③	④	⑤
$160,000	$120,000	$320,000	$600,000	$900,000	$1,500,000

⑥	⑦	⑧	⑨	⑩
$450,000	$700,000	$100,000	$700,000	$800,000

- From Current ratio
  Total current assets = 2.4 × $250,000 = $600,000 ---------------------------------- ③
  Plant and equipment, net = $1,500,000-$600,000=$900,000---------------------- ④

- From Quick ratio

Inventory = $600,000 - (1.12 × $250,000) = $320,000 ---------------------------②

- From Inventory Turnover
  Net Revenue = (($320,000 +$280,000)/2) × 6.0 =$1,800,000
  Cost of goods sold = $1,800,000- $900,000= $900,000 ------- A

- From DSO
  Accounts receivable = 24.3333 × ($1,800,000 ÷365) = $120,000 ----------------- ①
  Cash = ③-(②+①) = $160,000 --○

- From interest expense of income statement
  Bond = $450,000 ---------------------------------- ⑥
  250,000 + ⑥ = $700,000 ------------------------⑦

- From Debt-to-Equity ratio
  Total Equity ⑩ = $700,000 ÷ 0.875 =$ 800,000 ------------- ⑩
  Total assets or Total liabilities and equity = ⑦ + ⑩ = $1,500,000 ------⑤

- From Return on total assets

  Net income F = 14%× ($1,350,000) - ($45,000) (0.6) = $162,000

- From F, D =F ÷ 0.6 = $270,000,
          E = D× (0.4) =$108,000
          C = D+45,000 = $315,000
          B=$900,000-C = $585,000

- From EPS
  Stock Outstanding = F ÷ 4.05 = 40,000 shares
  Common stock = $2.50 × 40,000 = $100,000 -----------------------------⑧

  Retained Earnings = ⑩ - ⑧ = $700,000 ----------------------------------⑨

2.13

- Accounts receivable = DSO × Sales/365 = 45 days × ($1,200)/365 days = $147.945
- Current assets = (Cash and marketable securities) + (Accounts receivable) + Inventory = $427.945
- Long-term debt = (Total assets) – (Current liabilities) – (Common equities)
  = $427.945 + $280 – (current assets/current ratio) - $500
  = ($207.945) – (427.945/3.2)
  = $74.212
- Total assets turnover = Sales/Total assets = $1,200/ ($427.945 + $280) = 1.695 times

2.14

(a) Find Tiger's accounts receivable.

$$DSO = 91.25 = \frac{AR}{200,000/365} \Rightarrow AR = \$50,000$$

(b) Determine the amount of current liabilities.

$$CA = Cash + Inventory + AR = \$10,000 + \$150,000 + \$50,000 = \$210,000$$

$$Current\ Ratio = 4.2 = \frac{\$210,000}{Current\ Liabilities} \Rightarrow Current\ Liabilities = \$50,000$$

(c) Calculate the amount of the long-term debt.

$$Total\ Asset = Current\ Asset + Fixed\ Asset = \$210,000 + \$90,000 = \$300,000$$
$$\$300,000 = (\$50,000 + Long\ term\ debt) + \$200,000$$
$$\Rightarrow Long\ term\ debt = \$50,000$$

(d) Calculate the Return on Common Equity.

$$ROE = \frac{net\ income}{equity} = \frac{\$15,000}{\$200,000} = 0.075 \Rightarrow 7.5\%$$

2.15

(a) Find Fisher's accounts receivable.
$$DSO = \frac{AR}{1,200/365} \rightarrow AR = \mathbf{147.95M}$$

(b) Calculate the amount of current assets.

$$CA = cash + Inv. + AR = 100 + 180 + 147.95 = \mathbf{427.95M}$$

(c) Determine the amount of current liabilities.
$$CR = 3.2 = \frac{CA}{CL} = \frac{427.95}{CL} \rightarrow CL = \mathbf{133.73M}$$

(d) Determine the amount of total assets.

$$TA = CA + FA = 427.95 + 280 = \mathbf{707.95M}$$

(e) Calculate the amount of the long-term debt.

$$707.95 = (133.73 + LB) + 500 \rightarrow LB = \mathbf{74.22M}$$

(f) Calculate the profit margin.

$$profit\ margin = \frac{net\ income}{sales} = \frac{358}{1,200} = \mathbf{29.83\%}$$

(g) Calculate the Return on Common Equity

$$ROE = \frac{net\ income}{equity} = \frac{358}{500} = \mathbf{71.6\%}$$

Short Case Studies with Excel

ST2.1

Not provided

ST2.2

(a) Working capital = Current assets – Current liabilities

Working capital requirements = Changes in current assets – Changes in current liabilities:

WC req. = (+$100,000 - $20,000) – (+$30,000 - $40,000) = $90,000,

indicating that additional financing is needed to fund the increase in current assets.

(b) Taxable income = $1,500,000 - $650,000 - $150,000 - $20,000 = $680,000

(c) Net income = $680,000 - $272,000 = $408,000

(d) Net cash flow:
- Operating activities = net income + depreciation – WC = $408,000 + $200,000 - $90,000 = $518,000
- Investing activities = equipment purchase = ($400,000)
- Financing activities = borrowed fund = $200,000
- Net cash flow = $518,000 - $400,000 + $200,000 = $318,000

ST2.3

Not provided

(Visit the websites and get the most recent financial statements available)

Chapter 3: Interest Rate and Economic Equivalence

Types of Interest

3.1 $I = (iP)N = (0.06)(\$2,000)(5) = \$600$

3.2

- Simple interest:

$$\$20,000 = \$10,000(1+0.075N)$$
$$(1+0.075N) = 2$$
$$N = \frac{1}{0.075} = 13.33 \approx 14 \text{ years}$$

- Compound interest:

$$\$20,000 = \$10,000(1+0.07)^N$$
$$(1+0.07)^N = 2$$
$$N = 10.24 \approx 11 \text{ years}$$

3.3

- Compound interest:

$$F = \$1,000(1+0.065)^5$$
$$= \$1,370.09$$

- Simple interest:

$$F = \$1,000(1+0.068(5))$$
$$= \$1,340$$

The compound interest option is better.

3.4

- Simple interest (John):

$$I = iPN = (0.1)(\$1,000)(5) = \$500$$

- Compound interest (Susan):

$$I = P\left[(1+i)^N - 1\right] = \$1,000\left[(1+.095)^5 - 1\right]$$
$$= \$574.24$$

- Susan's balance will be greater by $74 (or $74.24 to be exact)

3.5

- Simple interest:

$$I = iPN = (0.10)(\$10,000)(5) = \$5,000$$

- Compound interest:

$$I = P[(1+i)^N - 1] = \$10,000(1.6105 - 1) = \$6,105$$

3.6

- Option 1: Compound interest with 8%:

$$F = \$4,500(1+0.085)^5 = \$5,000(1.4693) = \$6,766.45$$

- Option 2: Simple interest with 9.5%:

$$\$4,500(1+0.095 \times 5) = \$5,000(1.475) = \$6,637.50$$

$\therefore$ Option 1 is still better.

3.7

End of Year	Principal Repayment	Interest payment	Remaining Balance
0			$15,000.00
1	$4,620.50	$1,200.00	$10,379.50
2	$4,990.14	$830.36	$5,389.36
3	$5,389.35	$431.15	$0

Equivalence Concept

3.8
$$P = \$22,000(P/F, 5\%, 5) = \$22,000(0.7835) = \$17,237.58$$

3.9
$$F = \$30,000(F/P, 9\%, 3) = \$30,000(1.295) = \$38,850.87$$

3.10

$$F = \$100(F/P,10\%,10) + \$200(F/P,10\%,8) = \$688$$

3.11

$$\$1,000(F/P,i,2) = \$1,200$$
$$\$1,000(1+i)^2 = \$1,200$$
$$i = \sqrt{1.2} - 1$$
$$i = 9.54\%$$

Single Payments (Use of *F/P* or *P/F* Factors)

3.12

$$i = 10.5\%, \text{ two-year discount rate is } (1+0.105)^2 = 1.221 \text{ (or 22.1\%)}$$

3.13

$$F = 2P = P(1+0.06)^N$$
$$\log 2 = N \log 1.06$$
$$N = 11.896 \text{ years (or 12 years)}$$

3.14

$$F = \$1(1.08)^{394} = \$14,755,694,730,611$$

3.15

$$P = \$450,000(P/F,5\%,5) = 450,000(0.7835) = \$352,575$$

3.16

$$F = \$250,000(F/P,6\%,10) = \$447,712$$

3.17
(a) $F = \$5,000(F/P,7\%,5) = \$7,013$

(b) $F = \$7,250(F/P,9\%,15) = \$26,408$

(c) $F = \$9,000(F/P,6\%,33) = \$61,565$

(d) $F = \$12,000(F/P,5.5\%,8) = \$18,416$

3.18

$$P = \$300,000(P/F,8\%,10) = \$138,958$$

3.19

(a) $P = \$25,500(P/F,12\%,8) = \$10,299$

(b) $P = \$58,000(P/F,4\%,12) = \$36,227$

(c) $P = \$25,000(P/F,6\%,9) = \$14,797$

(d) $P = \$35,000(P/F,9\%,4) = \$24,795$

3.20

(a) $P = \$12,000(P/F,13\%,4) = \$7,360$

(b) $F = \$30,000(F/P,13\%,5) = \$55,273$

3.21

$$F = 3P = P(1+0.08)^N$$
$$\log 3 = N \log(1.08)$$
$$N = 14.27 \rightarrow 15 \text{ years}$$

3.22

$$F = 2P = P(1+0.06)^N$$
- $\log 2 = N \log(1.06)$
  $N = 11.90 \text{ years} \simeq 12 \text{ years}$

- Rule of 72: $72/6 = 12 \text{ years}$

3.23

$$(\$16.50)(100)(F/P,i,44) = \$77.50(204,800)$$
$$(F/P,i,44) = \frac{\$15,872,000}{\$1,650} = 9,619.39$$
$$i = 23.18\%$$