

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 bank 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:

$$\$530.45 + \$618 = \mathbf{\$1,148.45}$$

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 = $\$700 - \$510 = \$190(\text{M})$
Shareholder's equity in 2022 = $\$900 - \$640 = \$260(\text{M})$

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

(c) The income taxes in year 2022:

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

(d) $\$383.50 + \$420 = \$803.50 (\text{M})$
(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

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

$$\text{Inventory turnover ratio (2022)} = 15.6 \text{ times}$$

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

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

Where X = the number of outstanding shares

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

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- 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)

$$= 61,494,000 / ((1,301,000 + 1,051,000) \times 0.5) = 52.29$$

(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)

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

(j) Return on common equity (= (Net income available to common stockholders)/Avg. common equity)

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

(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:

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

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

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

- From Quick ratio

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$$\text{Inventory} = \$600,000 - (1.12 \times \$250,000) = \$320,000 \text{ -----} \textcircled{2}$$

- From Inventory Turnover

$$\text{Net Revenue} = ((\$320,000 + \$280,000)/2) \times 6.0 = \$1,800,000$$

$$\text{Cost of goods sold} = \$1,800,000 - \$900,000 = \$900,000 \text{ ----- A}$$

- From DSO

$$\text{Accounts receivable} = 24.3333 \times (\$1,800,000 \div 365) = \$120,000 \text{ -----} \textcircled{1}$$

$$\text{Cash} = \textcircled{3} - (\textcircled{2} + \textcircled{1}) = \$160,000 \text{ -----} \textcircled{0}$$

- From interest expense of income statement

$$\text{Bond} = \$450,000 \text{ -----} \textcircled{6}$$

$$250,000 + \textcircled{6} = \$700,000 \text{ -----} \textcircled{7}$$

- From Debt-to-Equity ratio

$$\text{Total Equity} \textcircled{10} = \$700,000 \div 0.875 = \$800,000 \text{ -----} \textcircled{10}$$

$$\text{Total assets or Total liabilities and equity} = \textcircled{7} + \textcircled{10} = \$1,500,000 \text{ -----} \textcircled{5}$$

- From Return on total assets

$$\text{Net income F} = 14\% \times (\$1,350,000) - (\$45,000) (0.6) = \$162,000$$

- From F, $D = F \div 0.6 = \$270,000$,

$$E = D \times (0.4) = \$108,000$$

$$C = D + 45,000 = \$315,000$$

$$B = \$900,000 - C = \$585,000$$

- From EPS

$$\text{Stock Outstanding} = F \div 4.05 = 40,000 \text{ shares}$$

$$\text{Common stock} = \$2.50 \times 40,000 = \$100,000 \text{ -----} \textcircled{8}$$

$$\text{Retained Earnings} = \textcircled{10} - \textcircled{8} = \$700,000 \text{ -----} \textcircled{9}$$

2.13

- Accounts receivable = $\text{DSO} \times \text{Sales}/365 = 45 \text{ days} \times (\$1,200)/365 \text{ 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 - (\text{current assets}/\text{current ratio}) - \500 = $(\$207.945) - (427.945/3.2)$ = \$74.212
- Total assets turnover = $\text{Sales}/\text{Total assets} = \$1,200/ (\$427.945 + \$280) = 1.695 \text{ times}$

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.

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

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

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

(f) Calculate the profit margin.

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

(g) Calculate the Return on Common Equity

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

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:

$$WC \text{ req.} = (+\$100,000 - \$20,000) - (+\$30,000 - \$40,000) = \$90,000,$$

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):

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

- Compound interest (Susan):

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

- 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%:

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

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

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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

$$F = 2P = P(1 + 0.06)^N$$

- $\log 2 = N \log(1.06)$
 $N = 11.90 \text{ years} \approx 12 \text{ years}$
- Rule of 72: $72 / 6 = 12 \text{ years}$

3.23

$$(\$16.50)(100)(F/P, i, 44) = \$77.50(204,800)$$

$$(F/P, i, 44) = \frac{\$15,872,000}{\$1,650} = 9,619.39$$

$$i = 23.18\%$$