Chapter 3 Understanding Money Management

3.1)

- Nominal interest rate:

$$r = 1.3\% \times 12 = 15.6\%$$

- Effective annual interest rate:

$$i_a = (1+0.013)^{12} - 1 = 16.77\%$$

3.2)

(a) Monthly interest rate: $i = 17.85\% \div 12 = 1.4875\%$
Annual effective rate: $i_a = (1+0.014875)^{12} - 1 = 19.385\%$

(b) $\$2,500(1+0.014875)^2 = \$2,574.93$

3.3) $r = \dfrac{10,000 - 8,800}{8,800} = 13.64\%$

3.4)

Assuming weekly compounding:

$$r = 6.89\%$$

$$i_a = (1+\frac{0.0689}{52})^{52} - 1 = 0.07128$$

3.5)

The effective annual interest rate :

$$i_a = e^{0.087} - 1 = 9.09\%$$

3.6)

Interest rate per week:

$$\$450 = \$400(1+i)$$
$$i = 12.5\% \text{ per week}$$

(a) Nominal interest rate:

$$r = 12.5\% \times 52 = 650\%$$

(b) Effective annual interest rate

$$i_a = (1+0.125)^{52} - 1 = 45{,}602\%$$

3.7)

$$\$20{,}000 = \$520(P/A, i, 48)$$
$$(P/A, i, 48) = 38.4615$$

Use Excel to calculate i:

$$i = 0.9431\% \text{ per month}$$
$$r = 0.9431 * 12 = 11.32\%$$

3.8)

$$\$16{,}000 = \$517.78(P/A, i, 36)$$
$$(P/A, i, 36) = 30.901155$$
$$i = 0.85\% \text{ per month}$$
$$r = 0.85 \times 12 = 10.2\%$$

3.9)

The three options :

a) $i_a = r = 6.12\%$

b) $i_a = \left(1 + \dfrac{0.06}{4}\right)^4 - 1 = 6.136\%$

c) $i_a = e^{0.059} - 1 = 6.078\%$

Bank B is the best option.

3.10)

a) $i = (1+\frac{0.06}{12})^1 - 1 = 0.5\%$

b) $i = (1+\frac{0.06}{12})^3 - 1 = 1.508\%$

c) $i = (1+\frac{0.06}{12})^6 - 1 = 3.038\%$

d) $i = (1+\frac{0.06}{12})^{12} - 1 = 6.168\%$

3.11)

$$i_{quarter} = e^{0.09/4} - 1$$
$$= 0.022755 \text{ (or 2.28\%)}$$

3.12)

a) $i = (1+\frac{0.06}{12})^1 - 1 = 0.5\%$

b) $i = (1+\frac{0.06}{12})^3 - 1 = 1.508\%$

c) $i = (1+\frac{0.06}{12})^6 - 1 = 3.038\%$

d) $i = (1+\frac{0.06}{12})^{12} - 1 = 6.168\%$

3.13)

$$\$25,000 = \$563.44(P/A, i, 48)$$
$$(P/A, i, 48) = 44.3703$$
$$i = 0.3256\% \text{ per month}$$

3.14)

a) $i = (1+\frac{0.11}{1})^1 - 1 = 11\%$

b) $i = (1+\frac{0.08}{2})^2 - 1 = 8.16\%$

c) $i = (1+\frac{0.095}{4})^4 - 1 = 9.844\%$

d) $i = (1+\frac{0.075}{365})^{365} - 1 = 7.788\%$

3.15)

(a)

$$F = \$9,545(1+\frac{0.082}{2})^{24} = \$9,545(F/P, 4.1\%, 24)$$
$$= \$25,037.64$$

(b)

$$F = \$6,500(1+\frac{0.06}{4})^{40} = \$6,500(F/P, 1.5\%, 40)$$
$$= \$11,791.12$$

(c)

$$F = \$42,800(1+\frac{0.09}{12})^{96} = \$42,000(F/P, 0.75\%, 96)$$
$$= \$87,693.83$$

3.16)

(a)

$$F = \$10,000(F/A, 4\%, 20) = \$297,781$$

(b)

$$F = \$9,000(F/A, 2\%, 24) = \$273,796.76$$

(c)

$$F = \$5,000(F/A, 0.75\%, 168) = \$1,672,590.40$$

3.17)

(a)

$$A = \$11,000(A/F, 4\%, 20) = \$369.60$$

(b)

$$A = \$3,000(A/F, 1.5\%, 60) = \$31.18$$

(c)

$$A = \$48,000(A/F, 0.6125\%, 60) = \$484.46$$

3.18)

(a) Quarterly effective interest rate = 2.25%

$$F = \$10,000(F/A, 2.25\%, 60) = \$1,244,504$$

(b) Quarterly effective interest rate = 2.267%

$$F = \$10,000(F/A, 2.267\%, 60) = \$1,251,976$$

3.19)

- Equivalent future worth of the receipts:

$$F_1 = \$1,500(F/P, 2\%, 4) + \$2,500$$
$$= \$4,123.65$$

- Equivalent future worth of deposits:

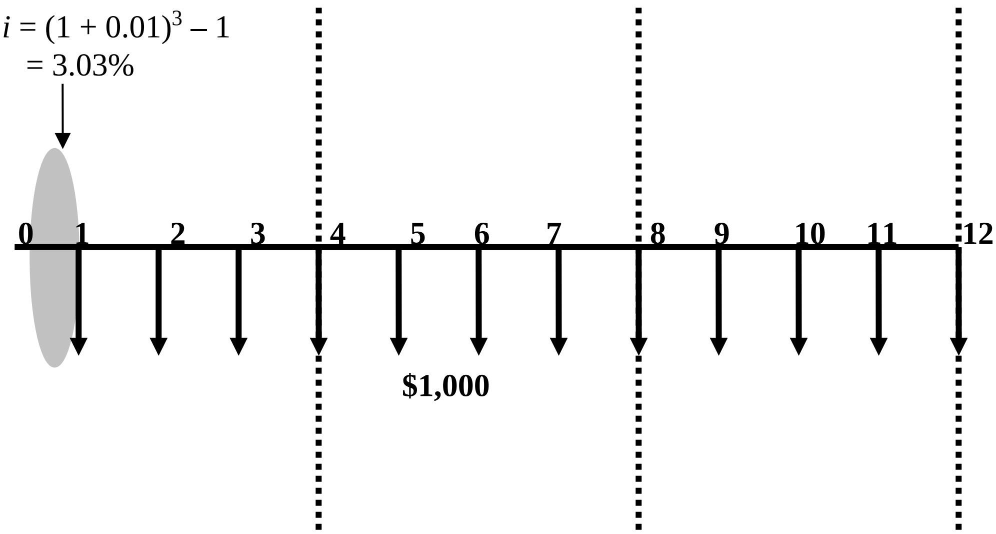
$$F_2 = A(F/A, 2\%, 8) + A(F/P, 2\%, 8)$$
$$= 9.7546A$$

$\therefore$ Letting $F_1 = F_2$ and solving for A yields $A = \$422.74$

3.20) (d)

Effective interest rate per
payment period

$i = (1 + 0.01)^3 - 1$
$= 3.03\%$



3.21)
(b)

3.22)

$$A = \$70{,}000(A / F, 0.5\%, 36)$$
$$= \$1{,}779.54$$

3.23)

- The balance just before the transfer:

$$F_9 = \$22{,}000(F / P, 0.5\%, 108) + \$16{,}000(F / P, 0.5\%, 72)$$
$$+ \$13{,}500(F / P, 0.5\%, 48)$$
$$= \$77{,}765.70$$

Therefore, the remaining balance after the transfer will be $38,882.85. This remaining balance will continue to grow at 6% interest compounded monthly. Then, the balance 6 years after the transfer will be:

$$F_{15} = \$38{,}882.85(F / P, 0.5\%, 72) = \$55{,}681.96$$

- The funds transferred to another account will earn 8% interest compounded quarterly. The resulting balance six years after the transfer will be:

$$F_{15} = \$38,882.85(F/P, 2\%, 24) = \$62,540.63$$

3.24)

Establish the cash flow equivalence at the end of 25 years. Let's define *A* as the required quarterly deposit amount. Then we obtain the following:

$$A(F/A, 1.5\%, 100) = \$80,000(P/A, 6.136\%, 15)$$
$$228.8030A = \$770,104$$
$$A = \$3,365.79$$

3.25)

$$C(F/A, 6.168\%, 7) + C(F/P, 0.5\%, 84)$$
$$= \$1,600 + \$1,400(F/P, 0.5\%, 12) + \$1,200(F/P, 0.5\%, 24)$$
$$+\$1,000(F/P, 0.5\%, 36)$$
$$= 8.437C + 1.52C = 1,600 + 1,486.35 + 1,352.59 + 1,196.68$$
$$9.957C = 5,635.62$$
$$\therefore C = \$566$$

3.26)

$$\$200,000 = \$2,000(P/A, 9\%/12, N)$$
$$N = 186 \text{ months}$$
$$N = 15.5 \text{ years}$$

3.27)

To find the amount of quarterly deposit (*A*), we establish the following equivalence relationship:

$$i_a = \left(1 + \frac{0.06}{4}\right)^4 - 1 = 0.06136$$

$$A(F/A, 1.5\%, 60) = \$60,000 + \$60,000(P/A, 6.136\%, 3)$$
$$A = \$219,978 / 96.2147$$
$$A = \$2,286.32$$

3.28)

Setting the equivalence relationship at the end of 20 years gives

$$i_{\text{semiannual}} = \left(1 + \frac{0.06}{4}\right)^2 - 1 = 3.0225\%$$

$$A(F/A, \frac{6\%}{4}, 80) = \$40,000(P/A, 3.0225\%, 20)$$
$$152.71A = \$593,862.93$$
$$A = \$3,888.81$$

3.29)

- Monthly installment amount:

$$A = \$22,000(A/P, 0.75\%, 60) = \$456.68$$

- The lump-sum amount for the remaining balance:

$$P_{24} = \$456.68(P/A, 0.75\%, 36) = \$14,361.13$$

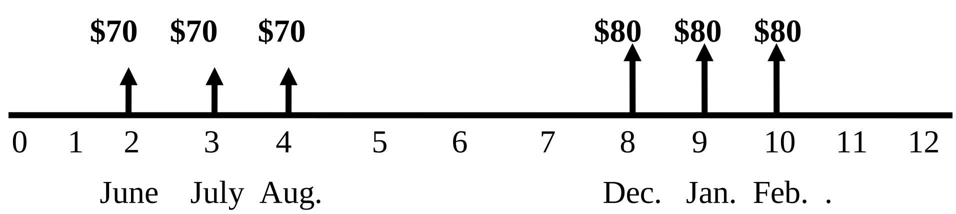
3.30)

Given $i = \frac{5\%}{12} = 0.417\%$ per month

$$A = \$500,000(A/P, 0.417\%, 120)$$
$$= \$5,303.26$$

3.31)

First compute the equivalent present worth of the energy cost savings during the first operating cycle:



$$P = \$70(P/A, 0.5\%, 3)(P/F, 0.5\%, 1) + \$80(P/A, 0.5\%, 3)(P/F, 0.5\%, 7)$$
$$= \$436.35$$

Then, compute the total present worth of the energy cost savings over 5 years.

$$P = \$436.35 + \$436.35(P/F, 0.5\%, 12) + \$436.35(P/F, 0.5\%, 24)$$
$$+\$436.35(P/F, 0.5\%, 36) + \$436.35(P/F, 0.5\%, 48)$$
$$= \$1,942.55$$

3.32)

- Option 1

$$i = (1 + \frac{.06}{4})^1 - 1 = 1.5\%$$
$$F = \$1,000(F/A, 1.5\%, 40)(F/P, 1.5\%, 60) = \$132,587$$

- Option 2

$$i = (1 + \frac{.06}{4})^4 - 1 = 6.136\%$$
$$F = \$6,000(F/A, 6.136\%, 15) = \$141,111$$

- Option 2 – Option 1 = \$141,110 – 132,587 = \$8,523
- Select (b)

3.33)

Given: r = 7% compounded daily, N = 25 years

- Since deposits are made at year end, find the effective annual interest rate:

$$i_a = (1 + 0.07/365)^{365} - 1 = 7.25\%$$

- Then, find the total amount accumulated at the end of 25 years:

$$F = \$3,250(F/A, 7.25\%, 25) + \$150(F/G, 7.25\%, 25)$$
$$= \$3,250(F/A, 7.25\%, 25) + \$150(P/G, 7.25\%, 25)(F/P, 7.25\%, 25)$$
$$= \$297,016.95$$

3.34)

(a) Quarterly interest rate = 2.25%

$$\begin{aligned}3P &= P(1+0.0225)^N\\ \log 3 &= N\log 1.0225\\ N &= 49.37\text{quarters} = 12.34 \text{ years}\end{aligned}$$

(b) Monthly interest rate = 0.75%

$$\begin{aligned}3P &= P(1+0.0075)^N\\ \log 3 &= N\log 1.0075\\ N &= 147.03 \text{ months} = 12.25 \text{ years}\end{aligned}$$

(c)

$$\begin{aligned}3 &= e^{0.09N}\\ \ln(3) &= 0.09N\\ N &= 12.20 \text{ years}\end{aligned}$$

3.35)

(a) Quarterly effective interest rate = 1.5%

$$F = \$10,000(F/A, 1.5\%, 60) = \$962,147$$

(b) Quarterly effective interest rate = 1.508%

$$F = \$10,000(F/A, 1.508\%, 60) = \$964,722$$

(c) Quarterly effective interest rate = 1.511%

$$F = \$10,000(F/A, 1.511\%, 60) = \$965,690$$

3.36)

$$\begin{aligned}F &= Pe^{rN} = \$5,000e^{(0.09\times 5)}\\ &= \$7,841.56\end{aligned}$$

3.37)

(a) Quarterly effective interest rate = 2.25%

$$F = \$4,000(F\ /\ A, 2.25\%, 40) = \$255,145$$

(b) Quarterly effective interest rate = 2.2669%

$$F = \$4,000(F\ /\ A, 2.2669\%, 40) = \$256,093$$

(c) Quarterly effective interest rate = 2.2755%

$$F = \$4,000(F\ /\ A, 2.2755\%, 40) = \$256,577$$

3.38)

$$i_a = e^{0.086/4} - 1 = 2.1733\%$$
$$A = \$10,000(A / P, 2.1733\%, 20)$$
$$= \$\ 621.84$$

3.39)

(a) Monthly effective interest rate = 0.74444%

$$F = \$1,500(F\ /\ A, 0.74444\%, 96) = \$209,170$$

(b) Monthly effective interest rate = 0.75%

$$F = \$1,500(F\ /\ A, 0.75\%, 96) = \$209,784$$

(c) Monthly effective interest rate = 0.75282%

$$F = \$1,500(F\ /\ A, 0.75282\%, 96) = \$210,097$$

3.40)

Effective interest rate per month = $e^{0.0975/12} - 1 = 0.8158\%$

$$A = \$48,000(A / P, 0.8158\%, 60) = \$1,014.90$$

3.41)

Effective interest rate per quarter = $e^{0.0688/4} - 1 = 1.7349\%$

$$P = \$2,500(P\ /\ A, 1.7349\%, 20) = \$41,944$$

3.42)

$$i = e^{0.0225} - 1 = 2.2755\%$$

$$F = \$5,000(F/A, 2.2755\%, 40) = \$320,721$$

$$F = \$320,721(F/P, 2.2755\%, 20) = \$502,990$$

3.43)

$$i = (1 + \frac{0.12}{12 \cdot 1})^1 - 1 = 1\% \text{ per month}$$
$$P = \$2,000(F/P, 1\%, 2) = \$2,040.20$$

3.44)

- Effective interest rate for Bank A

$$i = (1 + \frac{0.18}{4})^4 - 1 = 19.252\%$$

- Effective interest rate for Bank B

$$i = (1 + \frac{0.175}{365})^{365} - 1 = 19.119\%$$

- Select (c)

3.45)

$$i_m = 2.9\%/12 = 0.2417\%, 17\%/12 = 1.417\%$$
$$\$3,000(F/P, 0.2417\%, 6)(F/P, 1.417\%, 6)$$
$$-\$100[(F/A, 0.2417\%, 6)(F/P, 0.2417\%, 6) + (F/A, 1.417\%, 6)]$$
$$= \$2,077.79$$

3.46) (a)

- Bank A: $i_a = (1 + 0.0155)^{12} - 1 = 20.27\%$ per year
- Bank B: $i_a = (1 + 0.195/12)^{12} - 1 = 21.34\%$ per year

(b) Given $i = 6\%/365 = 0.01644\%$ per day, find the total cost of credit card usage for each bank over 24 months. We first need to find the effective interest rate per payment period (month—30 days per month):

$$i = (1 + 0.0001644)^{30} - 1 = 0.494\%$$

- Monthly interest payment:

Bank A: $\$300(0.0155) = \$4.65/\text{month}$

Bank B: $\$300(\frac{0.195}{12}) = \$4.875/\text{month}$

We also assume that the $300 remaining balance will be paid off at the end of 24 months.

- Bank A:

$$P = \$20 + \$4.65(P/A, 0.494\%, 24) + \$20(P/F, 0.494\%, 12)$$
$$= \$143.85$$

- Bank B:

$$P = \$4.875(P/A, 0.494\%, 24) = \$93.25$$

Select Bank B

3.47)

(a) $i_m = (1 + \frac{0.12}{12 \cdot 1})^1 - 1 = 1\%$

(b) $\$10,000(A/P, 1\%, 48) = 10,000(0.0263) \quad = \$263/\text{month}$

(c) Remaining balance at the beginning of 20^{th} month is

$\$263(P/A, 1\%, 29) = \$263(25.0658) \quad = \$6,592.31$

So, the interest payment for the 20^{th} payment is $6,592.31*1% = $65.92.

(d) $263 x 48months = $12,624

So, the total interest paid over the life of the loan is $2,624.

3.48) Loan repayment schedule: $A = \$20,000(A/P, 0.5\%, 36) = \$608.44$

End of month	Interest Payment	Principal Payment	Remaining Balance
0	$0.00	$0.00	$20,000.00
1	$100.00	$508.44	$19,491.56
2	$97.46	$510.98	$18,980.58
13	$68.64	$539.80	$13,188.31
24	$38.20	$570.24	$7,069.38
36	$3.03	$605.41	$0

3.49)

Given: $P = \$120{,}000$, $N =$ 360 months, $i = 9\% / 12 = 0.75\%$ per month

(a)

$$A = \$120{,}000(A/P, 0.75\%, 360) = \$965.55$$

(b) If $r = 9.75\%$ APR after 5 years, then $i = 9.75\% / 12 = 0.8125\%$ per month.

- The remaining balance after the 60th payment:

$$B_{60} = \$965.55(P/A, 0.75\%, 300) = \$115{,}056.50$$

- Then, we determine the new monthly payments as

$$A = \$115{,}056.50(A/P, 0.8125\%, 300) = \$1{,}025.31$$

3.50)

(a)

(i) $\$10{,}000(A/P, 0.75\%, 24)$

(b)

(iii) $B_{12} = A(P/A, 0.75\%, 12)$

3.51)

Given information:

$i = 9.45\% / 365 = 0.0259\%$ per day, $N = 36$ months.

- Effective monthly interest rate, $i = (1 + 0.000259)^{30} - 1 = 0.78\%$ per month
- Monthly payment, $A = \$13{,}000(A/P, 0.78\%, 36) = \$415.58$ per month
- Total interest payment, $I = \$415.58 \times 36 - \$13{,}000 = \$1{,}960.88$

3.52)

Given Data: P = \$25,000, r = 9% compounded monthly, N = 36 month, and i = 0.75% per month.

- Required monthly payment:

$$A = \$25{,}000(A/P, 0.75\%, 36) = \$795$$

- The remaining balance immediately after the 20th payment:

$$B_{20} = \$795(P/A, 0.75\%, 16) = \$11,944.33$$

3.53)

Given Data: P = \$250,000 - \$50,000 = \$200,000.

- Option 1:
  N = 15 years × 12 = 180 months
  APR = 4.25%
  $\therefore\ A = \$200,000(A/P, 4.25\%/12, 180) = \$1,504.56$

- Option 2:
  N = 30 years × 12 = 360 months
  APR = 5%
  $\therefore\ A = \$200,000(A/P, 5\%/12, 360) = \$1,073.64$

$\therefore$ Difference = $\$1,504.56 - \$1,073.64 = \$430.92$

3.54)

$$A = \$400,000(A/P, \frac{9\%}{12}, 180) = \$4,057.07$$

- Total payments over the first 5 years (60 months)

$$\$4,057.07 \times 60 = \$243,424.20$$

- Remaining balance at the end of 5 years:

$$B_{60} = \$4,057.07(P/A, 0.75\%, 120) = \$320,271.97$$

- Reduction in principal = \$400,000 - $\$320,271.97 = \$79,728.03$
- Total interest payments = $\$243,424.20 - \$79,728.03 = \$163,696.17$

3.55)

The amount to finance = \$300,000 - \$45,000 = \$255,000

$$A = \$255,000(A/P, 0.5\%, 360) = \$1,528.85$$

Then, the minimum acceptable monthly salary (S) should be

$$S = \frac{A}{0.25} = \frac{\$1,528.85}{0.25} = \$6,115.42$$

3.56)

Given Data: purchase price = \$150,000, down payment (sunk equity) = \$30,000, interest rate = 0.75% per month, N = 360 months,

- Monthly payment:

$$A = \$120,000(A/P, 0.75\%, 360) = \$965.55$$

- Balance at the end of 5 years (60 months):

$$B_{60} = \$965.55(P/A, 0.75\%, 300) = \$115,056.50$$

- Realized equity = sales price – balance remaining – sunk equity:

\$185,000 - \$115,056.60 - \$30,000 = \$39,943.50

Note: For tax purpose, we do not consider the time value of money on \$30,000 down payment made five years ago.

3.57)

Given Data: interest rate = 0.75% per month, each individual has the identical remaining balance prior to their 20th payment, that is,\$80,000. With equal remaining balances, all will pay the same interest for the 20th mortgage payment.

\$80,000(0.0075) = \$600

3.58)

Given Data: loan amount = \$130,000, point charged = 3%, N = 360 months, interest rate = 0.75% per month, actual amount loaned = \$126,100:

- Monthly repayment:

$$A = \$130,000(A/P, 0.75\%, 360) = \$1,046$$

- Effective interest rate on this loan

$$\$126,100 = \$1,046(P/A, i, 360)$$
$$i = 0.7787\% \text{ per month}$$

$$\therefore\ i_a = (1+0.007787)^{12} - 1 = 9.755\% \text{ per year}$$

3.59)

(a)

$$\$50,000 = \$7,500(P/A,i,5) + \$2,500(P/G,i,5)$$
$$i = 6.914\%$$

(b)

P = \$50,000

Total payments = \$7,500 + \$10,000 + ... + \$17,500 = \$62,500

Interest payments = \$3,456.87 + ... + \$1,131.66 = \$12,500

End of month	Interest Payment	Principal Payment	Remaining Balance
0	\$0.00	\$0.00	\$50,000.00
1	\$3,456.87	\$4,043.13	\$45,956.87
2	\$3,177.34	\$6,822.66	\$39,134.21
3	\$2,705.64	\$9,794.36	\$29,339.85
4	\$2,028.48	\$12,971.52	\$16,368.34
5	\$1,131.66	\$16,368.34	\$0

3.60)

(a) Amount of dealer financing = \$15,458(0.90) = \$13,912

$$A = \$13,912(A/P, 11.5\%/12, 60) = \$305.96$$

(b) Assuming that the remaining balance will be financed over 56 months,

$$B_4 = \$305.96(P/A, 11.5\%/12, 56) = \$13,211.54$$
$$A = \$13,211.54(A/P, 10.5\%/12, 56) = \$299.43$$

(c) Interest payments to the dealer:

$$I_{\text{dealer}} = \$305.96 \times 4 + \$13,211.54 - \$13,912 = \$523.38$$

Interest payments to the credit union:

$$I_{\text{union}} = \$299.43 \times 56 - \$13,211.54 = \$3,556.54$$

3.61)

- The monthly payment to the bank: Deferring the loan payment for 6 months is equivalent to borrowing

$$\$16,000(F/P, 0.75\%, 6) = \$16,733.64$$

To pay off the bank loan over 36 months, the required monthly payment is

$$A = \$16,733.64(A/P, 0.75\%, 36) = \$532.13 \text{ per month}$$

- The remaining balance after making the 16th payment:

$$\$532.13(P/A, 0.75\%, 20) = \$9,848.67$$

- The loan company will pay off this remaining balance and will charge \$308.29 per month for 36 months. The effective interest rate for this new arrangement is:

$$\begin{aligned} \$9,848.67 &= \$308.29(P/A, i, 36) \\ (P/A, i, 36) &= 31.95 \\ i &= 0.66\% \text{ per month} \end{aligned}$$

$$\therefore\ r = 0.66\% \times 12 = 7.92\% \text{ per year}$$

3.62)

$$\begin{aligned} \$18,000 &= A(P/A, 0.667\%, 12) + A(P/A, 0.75\%, 12)(P/F, 0.667\%, 12) \\ &= A(11.4958) + A(11.4349)(0.9234) \\ &= 22.05479A \\ A &= \$816.15 \end{aligned}$$

3.63)

Given: $i = 9\%/12 = 0.75\%$ per month, deferred period = 6 months, N = 36 monthly payments, first payment due at the end of 7th month, the amount of initial loan = \$15,000

(a) First, find the loan adjustment required for the 6-month grace period.

$$\$15{,}000(F/P, 0.75\%, 6) = \$15{,}687.78$$

Then, the new monthly payments should be

$$A = \$15{,}687.78(A/P, 0.75\%, 36) = \$498.87$$

(b) Since there are 10 payments outstanding, the loan balance after the 26th payment is

$$B_{26} = \$498.87(P/A, 0.75\%, 10) = \$4{,}788.95$$

(c) The effective interest rate on this new financing is

$$\begin{aligned} \$4{,}788.95 &= \$186(P/A, i, 30) \\ i &= 1.0161\% \text{ per month} \\ r &= 1.0161\% \times 12 = 12.1932\% \\ i_a &= (1 + 0.010161)^{12} - 1 = 12.90\% \end{aligned}$$

3.64)

(a) Using the bank loan at 9.2% compound monthly
Purchase price = \$22,000, Down payment = \$1,800

$$A = \$20{,}200(A/P, (9.2/12)\%, 48) = \$504.59$$

(b)
Using the dealer's financing,
Purchase price = \$22,000, Down payment = \$2,000, Monthly payment = \$505.33, N = 48 end of month payments.
Find the effective interest rate:

$$\begin{aligned} \$505.33 &= \$20{,}000(A/P, i, 48) \\ i &= 0.8166\% \text{ per month} \\ \text{APR}(r) &= 0.8166\% \times 12 = 9.80\% \end{aligned}$$

3.65)

- 24-month lease plan:

$$\begin{aligned} P &= (\$2{,}500 + \$520) + \$500 + \$520(P/A, 0.5\%, 23) \\ &- \$500(P/F, 0.5\%, 24) \\ &= \$13{,}884.13 \end{aligned}$$

- Up-front lease plan:

$$P = \$12,780 + \$500 - \$500(P/F, 0.5\%, 24)$$
$$= \$12,836.4$$

Select the single up-front lease plan.

3.66)

Given: purchase price = $155,000, down payment = $25,000

- Option 1: $i = 7.5\%/12 = 0.625\%$ per month, $N = 360$ months
- Option 2: For the assumed mortgage, $P_1 = \$97,218$, $i_1 = 5.5\%/12 = 0.458\%$ per month, $N_1 = 300$ months, $A_1 = \$597$ per month; For the 2nd mortgage $P_2 = \$32,782$, $i_2 = 9\%/12 = 0.75\%$ per month, $N_2 = 120$ months

(a) For the second mortgage, the monthly payment will be

$$A_2 = P_2(A/P, i_2, N_2) = \$32,782(A/P, 0.75\%, 120) = \$415.27$$

$$\$130,000 = \$597(P/A, i, 300) + \$415.27(P/A, i, 120)$$
$$i = 0.5005\% \text{ per month}$$
$$r = 0.5005\% \times 12 = 6.006\% \text{ per year}$$
$$i_a = 6.1741\%$$

(b) Monthly payment

- Option 1: $A = \$130,000(A/P, 0.625\%, 360) = \$908.97$
- Option 2: $1,012.27 (= $597 + $415.27) for 120 months, then $597 for remaining 180 months.

(c) Total interest payment

- Option 1: $I = \$908.97 \times 360 - \$130,000 = \$197,229.20$
- Option 2: $I = \$228,932.4 - \$130,000 = \$98,932.4$

(d) Equivalent interest rate:

$$
\begin{aligned}
\$908.97(P/A,i,360) &= \$597(P/A,i,300)+\$415.27(P/A,i,120)\\
i &= 1.2016\% \text{ per month}\\
r &= 1.2016\% \times 12 = 14.419\% \text{ per year}\\
i_a &= 15.4114\%
\end{aligned}
$$

3.67) No answers given

3.68)

$$
\begin{aligned}
P &= \$50(P/A,3\%,14)+\$1,000(P/F,3\%,14)\\
&= \$1,225.92
\end{aligned}
$$

3.69)

If you left the \$15,000 in your savings account, the total balance at the end of 48 months at 8% interest compounded monthly would be

$$F_I = \$15,000(F/P,8\%/12,48) = \$20,635$$

The earned interest during this period is then

$$I = \$20,635 - \$15,000 = \$5,635$$

Now if you borrowed \$15,000 from the dealer at interest 11% compounded monthly over 48 months, the monthly payment would be

$$A = \$15,000(A/P,11\%/12,48) = \$388$$

You can easily find the total interest payment over 48 months under this financing by

$$I = (\$388 \times 48) - \$15,000 = \$3,624$$

It appears that you save about \$2,011 in interest (\$5,635 - \$3,624). However, reasoning this line neglects the time value of money for the portion of principal payments. Since your money is worth 8%/12 interest per month, you may calculate the total equivalent loan payment over the 48-month period. This is done by calculating the equivalent future worth of the loan payment series.

$$F_{II} = \$388(F/A,8\%/12,48) = \$21,863.77$$

Now compare F_I with F_{II}. The dealer financing would cost \$1,229 more in future dollars at the end of the loan period.

3.70) (a) $A = \$60,000(A/P, 13\%/12, 360) = \$664$

(b)

$$
\begin{aligned}
\$60,000 = {} & \$522.95(P/A, i, 12) \\
& + \$548.21(P/A, i, 12)(P/F, i, 12) \\
& + \$574.62(P/A, i, 12)(P/F, i, 24) \\
& + \$602.23(P/A, i, 12)(P/F, i, 36) \\
& + \$631.09(P/A, i, 12)(P/F, i, 48) \\
& + \$661.24(P/A, i, 300)(P/F, i, 60)
\end{aligned}
$$

Solving for i by trial and error yields

$$
\begin{aligned}
i &= 1.0028\% \\
i_a &= (1 + 0.010028)^{12} - 1 = 12.72\%
\end{aligned}
$$

Comments: With Excel, you may enter the loan payment series and use the IRR(range, guess) function to find the effective interest rate. Assuming that the loan amount (-$60,000) is entered in cell A1 and the following loan repayment series in cells A2 through A361, the effective interest rate is found with a guessed value of 11.5/12%:

$$= \text{IRR}(A1:A361, 0.95833\%) = 0.010028$$

(c) Compute the mortgage balance at the end of 5 years:

- Conventional mortgage:

$$B_{60} = \$664(P/A, 13\%/12, 300) = \$58,873.84$$

- FHA mortgage (not including the mortgage insurance):

$$B_{60} = \$635.28(P/A, 11.5\%/12, 300) = \$62,498.71$$

(d) Compute the total interest payment for each option:

- Conventional mortgage(using either Excel or Loan Analysis Program at the book's website—http://www.prenhall.com/park):

$$I = \$178,937.97$$

- FHA mortgage:

$$I = \$163,583.28$$

(e) Compute the equivalent present worth cost for each option at $i = 6\%/12 = 0.5\%$ per month:

- Conventional mortgage:

$$P = \$664(P/A, 0.5\%, 360) = \$110,749.63$$

- FHA mortgage including mortgage insurance:

$$\begin{aligned} P &= \$522.95(P/A, 0.5\%, 12) \\ &\quad + \$548.21(P/A, 0.5\%, 12)(P/F, 0.5\%, 12) \\ &\quad + \$574.62(P/A, 0.5\%, 12)(P/F, 0.5\%, 24) \\ &\quad + \$602.23(P/A, 0.5\%, 12)(P/F, 0.5\%, 36) \\ &\quad + \$631.09(P/A, 0.5\%, 12)(P/F, 0.5\%, 48) \\ &\quad + \$661.24(P/A, 0.5\%, 300)(P/F, 0.5\%, 60) \\ &= \$105,703.95 \end{aligned}$$

The FHA option is more desirable (least cost).