

HW#4

4-2, 4-4, 4-6, 4-8, 4-14, 4-18

$$\begin{aligned} 4-2 \quad (a) \quad PW(15\%) &= -\$640,000 + \$180,000(P/A, 15\%, 8) - \$44,000(P/A, 15\%, 8) \\ &\quad + \$4,000(P/G, 15\%, 7)(P/F, 15\%, 1) \\ &= -\$640,000 + \$180,000(4.4873) - \$44,000(4.4873) \\ &\quad + \$4,000(10.192)(0.8696) \\ &= \underline{\$5,717.70} \end{aligned}$$

$$(b) \quad PW(i\%) = -\$640,000 + \$136,000(P/A, i\%, 8) + \$4,000(P/G, i\%, 7)(P/F, i\%, 1)$$

Linear interpolation will be needed to solve for $i\%$. We need two trial interest rates, one resulting in a positive PW and the another producing a negative present worth. The IRR will then be bracketed between these two interest rates. Since PW is not linear, the two interest rates should be 10% or less apart to minimize error of linear interpolation.

For this problem, the two trial interest rates chosen were 15% and 20%.

	<u>$i\%$</u>	<u>PW</u>	
(a)	15%	\$5717.70	(f)
(b)	$i\%$	0.00	(g)
(c)	20%	-\$90,625.53	(h)

The standard approach to determining $i\%$ with linear interpolation is:

$$\frac{c - a}{f - h} = \frac{b - a}{f - g}$$
$$\frac{20\% - 15\%}{\$5717.70 - (-\$90,625.23)} = \frac{i\% - 15\%}{\$5717.70 - 0}$$

Thus $i\% = \underline{15.3\%}$

$$\begin{aligned}
 4-4 \quad (a) \quad PW(15\%) &= -\$10,000 + (\$8,000 - \$4,000)(P/A, 15\%, 5) - \$1,000 (P/F, 15\%, 5) \\
 &= -\$10,000 + \$4,000(3.3522) - \$1,000 (0.4972) \\
 &= \underline{\$2,911.60}
 \end{aligned}$$

$$\begin{aligned}
 FW(15\%) &= -\$10,000 (F/P, 15\%, 5) + (\$8,000 - \$4,000)(F/A, 15\%, 5) - \$1,000 \\
 &= -\$10,000 (2.0114) + \$4,000(6.7424) - \$1,000 \\
 &= \underline{\$5,855.60}
 \end{aligned}$$

$$\begin{aligned}
 AW(15\%) &= \$8,000 - \$4,000 - [\$10,000(A/P, 15\%, 5) - (-\$1,000)(A/F, 15\%, 5)] \\
 &= \$4,000 - [\$10,000(0.2983) + \$1,000(0.1483)] \\
 &= \underline{\$868.70}
 \end{aligned}$$

$$(b) \quad PW(i\%) = 0 = -\$10,000 + (\$8,000 - \$4,000)(P/A, i\%, 5) - \$1,000(P/F, i\%, 5)$$

$$PW(15\%) = \$2,911.60 > 0, \therefore i\% > 15\%$$

$$PW(25\%) = \$429.50 > 0, \therefore i\% > 25\%$$

$$PW(30\%) = -\$526.90 < 0, \therefore i\% < 30\%$$

Linear interpolation between 25% and 30% yields: $i\% = \underline{27.2\%}$

Since the IRR > MARR, the project is acceptable.

$$(c) \quad |-\$10,000| (F/P, i\%, 5) = \$4,000 (F/A, 15\%, 4) (F/P, 15\%, 1) + \$3,000$$

$$\$10,000 (1+i)^5 = \$25,969.60$$

$$i^5 = (2.59696)^{0.2} = 0.21 \text{ or } \underline{21\%}$$

REMINDER: The ERR method requires the use of the net cash flow (NCF) amount at the end of each time period in its calculations. The time period in this problem is "year".

$$4-6 \quad \text{Capital Investment} = -\$300,000 - \$600,000 - \$250,000 - \$100,000 = -\$1,250,000$$

Revenue = \$750,000 per year

Market Value = \$400,000 + \$350,000 + \$50,000 + \$100,000 = \$900,000

Expenses = -\$475,000 per year

$$\begin{aligned}
 PW(25\%) &= -\$1,250,000 + (\$750,000 - \$475,000)(P/A, 25\%, 10) \\
 &\quad + \$900,000(P/F, 25\%, 10) \\
 &= -\$1,250,000 + \$275,000(3.5705) + \$900,000(0.1074) \\
 &= \underline{-\$171,452.50} < 0
 \end{aligned}$$

Therefore, they should not invest in the new product line.

$$4-8 \quad rZ = \left(\frac{0.10}{2}\right) \$5,000 = \$250 \text{ per semiannual period}$$

$i = 8\% / 2 = 4.0\%$ per semiannual period

$P_0 = \$250 (P/A, 4\%, 24) + \$5,000(P/F, 4\%, 24)$

$= \$250 (15.2470) + \$5,000(0.3901)$

$= \underline{\$5,762}$

The purchaser can pay up to \$5,762 and still earn 8% nominal interest, compounded semiannually.

4-14 $i\% / \text{month} = 13.8\%/\text{yr} \text{ divided by } (12 \text{ mo}/\text{yr}) = 1.15\% / \text{month}$

Monthly payment (A) = $(\$8,200 - \$1,500) (A/P, 1.15\%, 36)$
 $= \$6,700 (0.0341) = \228.47

Assuming the September 1 payment has been made as part of the lump - sum settlement, the present worth of the remaining 28 payments, plus the September 1 payment is:

$PW(1.15\%) = A + A (P/A, 1.15\%, 28) = \$228.47 + \$228.47 (23.8234) = \underline{\$5,671.40}$

4-18 Opportunity Cost = Investment at BOY x (P/F, 15%, 1) = BOY (0.15)

Capital Recovery Amount = Opportunity Cost + Loss in Value During Year

Year	Investment at Beginning of Year	Opportunity Cost of Interest (i = 15%)	Loss in Value During Year	Capital Recovery Amount
1	\$10,000	\$10,000 (0.15) = 1,500	\$3,000	1,500 + 3,000 = 4,500
2	10,000 - 3,000 = 7,000	7,000 (0.15) = 1,050	2,000	1,050 + 2,000 = 3,050
3	7,000 - 2,000 = 5,000	5,000 (0.15) = 750	2,000	750 + 2,000 = 2,750
4	5,000 - 2,000 = 3,000	3,000 (0.15) = 450	1,000	450 + 1,000 = 1,450

$P_0 = \$4,500 (P/F, 15\%, 1) + \$3,050 (P/F, 15\%, 2) + \$2,750 (P/F, 15\%, 3)$
 $+ \$1,450 (P/F, 15\%, 4)$
 $= \$4,500 (0.8696) + \$3,050 (0.7561) + \$2,750 (0.6575) + \$1,450 (0.5718)$
 $= \$ 8,856.54$

$A = \$8,856.54 (A/P, 15\%, 4) = \$8,856.49 (0.3503) = \underline{\$3,102.45}$

This same value can be obtained and confirmed with Equation 4-5:

$CR(i\%) = I (A/P, i\%, N) - S (A/F, i\%, N)$
 $= \$10,000 (A/P, 15\%, 4) - \$2,000 (A/F, 15\%, 4)$
 $= \$10,000 (0.3503) - \$2,000 (0.2003)$
 $= \underline{\$3,102.12}$

Note: The Annual Worth from the table and the CR amount from Equation 4-5 are the same.