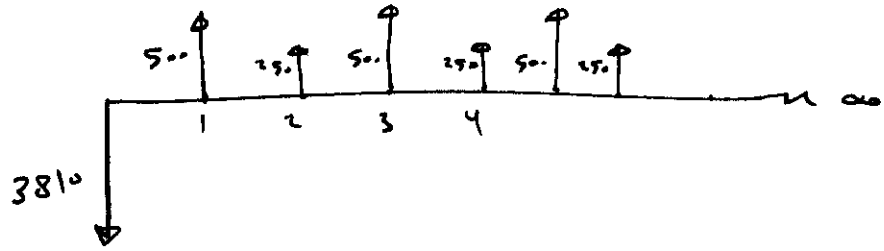
Chapter 7. Homework solution.

(4)



$$\left[\frac{500}{1+i} + \frac{500}{(1+i)^3} + \frac{500}{(1+i)^5} + \cdots\right] + \left[\frac{250}{(1+i)^2} + \frac{250}{(1+i)^4} + \cdots\right]$$

$$= pwB$$

$$pwc = 3810$$

$$\Rightarrow \frac{500}{1+i}\sum_{j=0}^{\infty}\left[\frac{1}{(1+i)^2}\right]^j + \frac{250}{(1+i)^2}\sum_{j=0}^{\infty}\left[\frac{1}{(1+i)^2}\right]^j = 3810$$

$$\Rightarrow \left(\frac{500}{1+i}\right)\left[\frac{1}{1-\frac{1}{(1+i)^2}}\right] + \frac{250}{(1+i)^2}\left[\frac{1}{1-\frac{1}{(1+i)^2}}\right] = 3810$$

$$= \frac{500}{1+i}\left[\frac{(1+i)^2}{(1+i)^2-1}\right] + \frac{250}{(1+i)^2}\left[\frac{(1+i)^2}{(1+i)^2-1}\right] = 3810$$

$$\Rightarrow \frac{500(1+i)}{(1+i)^2-1} + \frac{250}{(1+i)^2-1} = 3810$$

Let $(1+i) = x \Rightarrow \frac{500x}{x^2-1} + \frac{250}{x^2-1} = 3810$

$$\Rightarrow 500x + 250 = 3810(x^2-1)$$

$$\Rightarrow 50x + 25 = 381x^2 - 381$$

$$\Rightarrow 381x^2 - 50x - 405 = 0$$

$$\Delta = (-50)^2 + 4(405)(381) = 619{,}720$$

$$\sqrt{\Delta} = 787.22$$

$$\Rightarrow x_1 = \frac{50 + 787.22}{2(381)} = 1.0987$$

$$\Rightarrow i_1 = 0.0987 = 9.9\%$$

(1)

$$x_2 = \frac{50 - 787.22}{2(381)} = -0.967$$

$$\Rightarrow i_2 = -1.967 = -196\%$$ X rejected.

$\Rightarrow$ **IRR = 9.9%**

(14)

Let i be the monthly rate of return

$PWC = 119.67 (P|A, i\%, 30)$

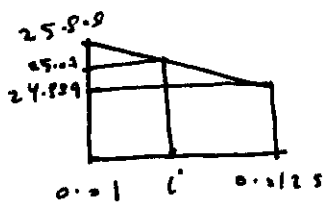
$PWB = 3000$

$(P|A, i\%, 30) = 25.07$

The factor $(P|A, 1\%, 30) = 25.808$

$(P|A, 1.25\%, 30) = 24.889$

By interpolation:



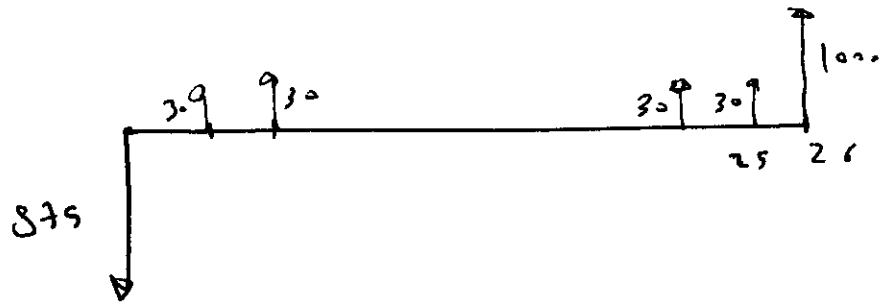
$$\frac{25.808 - 25.07}{25.808 - 24.889} = \frac{i - 0.01}{0.0125 - 0.01} \Rightarrow i = 0.012$$

$= 1.2\%$ is the monthly IRR

$\Rightarrow$ nominal IRR $= 1.2 \times 12 = 14.4\%$

effective $= (1.012)^{12} - 1 = 0.153$ or **15.3 %**

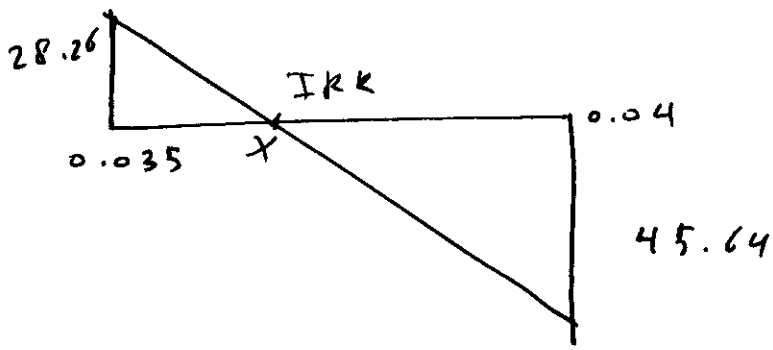
(27)



$$Npw(i\%) = 1000\,(p|f, i\%, 26) + 30\,(p|A, i\%, 25) - 875$$

$$Npw(3.5\%) = 28.26$$

$$Npw(4\%) = -45.64$$



$$\frac{X}{28.26} = \frac{0.005 - X}{45.64} \Rightarrow X = 0.0019$$

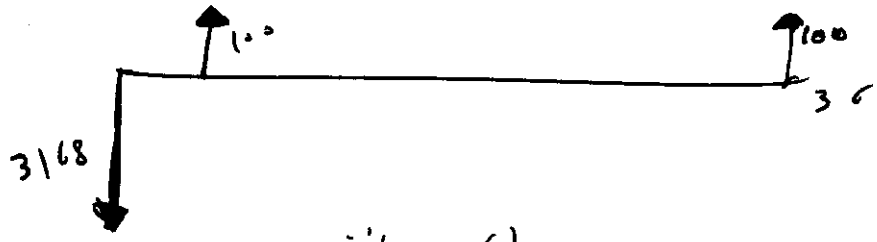
$$\Rightarrow IRR = 0.035 + X = 0.0369$$

This is the biannual interest $\Rightarrow$

effective annual interest is $(1+0.0369)^2 - 1 = 0.07516$

$\Rightarrow$ annual Rate of return = 7.9 %

(24)



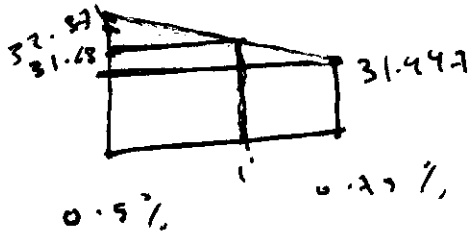
$pw_B = 100(p|A, i\%, 36)$

$pw_C = 3168$

$NPW(i) = 100(p|A, i\%, 36) - 3168$

$NPW(0.5\%) = 32.871(100) - 3168 > 0$

$NPW(0.75\%) = 100(31.447) - 3168 < 0$



$$\frac{32.871 - 31.68}{32.871 - 31.447} = \frac{i' - 0.005}{0.0075 - 0.005}$$

$i' = 0.005 + 0.8363(0.0025)$

$= 0.00709$

Monthly interest $\simeq 0.71\%$

Nominal or annual interest $\simeq 8.52\%$

(48)

Period	X	Y
0	-$100	-$50
1	35	16.5
2	35	16.5
3	35	16.5
4	35	16.5

MARR = 10%.

$NPW_X(10\%) > 0 \Rightarrow IRR_X > MARR$

$NPW_Y(10\%) > 0 \Rightarrow IRR_Y > MARR.$

For the incremental investment X - Y

Period	X - Y
0	-$50
1	16.5
2	16.5
3	16.5
4	16.5

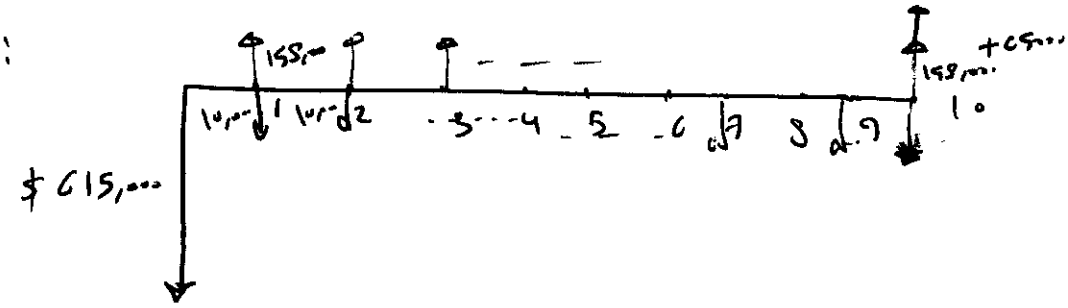
$NPW_{(X-Y)}(10\%) = NPW_Y(10\%) > 0$

$\Rightarrow IRR_{(X-Y)} > 10\%$

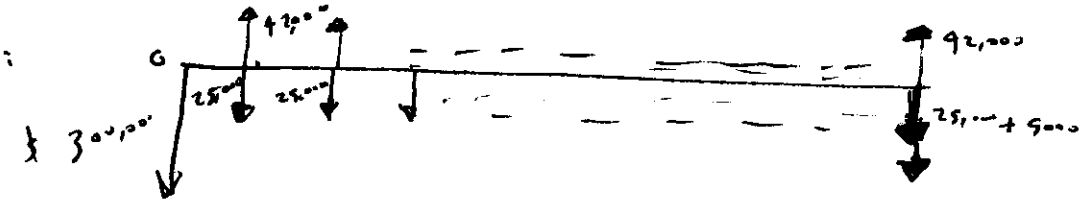
$\Rightarrow$ Select X

(5)

54. A:



B:



MARR = 15%.

$NPW_A(15\%) = 158{,}000(P|A,15\%,10) + 65{,}000(P|F,15\%,10) - 10{,}000(P|A,15,10) - 615{,}000$

$= 148{,}000(P|A,15\%,10) + 65{,}000(P|F,15\%,10) - 615{,}000$

$= 148{,}000(5.019) + 65{,}000(0.2472) - 615{,}000 = \boxed{143{,}880} > 0$

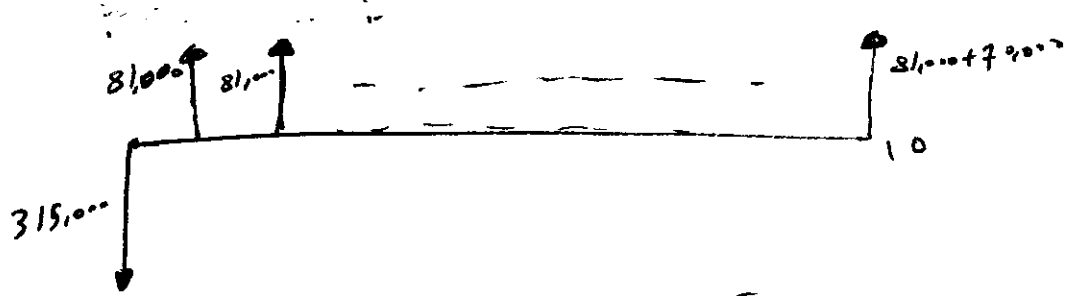
$\Rightarrow IRR_A > MARR$

$NPW_B(15\%) = 67{,}000(5.019) - 5000(0.2472) - 30{,}000$

$= \boxed{35{,}037} > 0$

$\Rightarrow IRR_B > MARR.$

Now Consider the Incremental investment. (A - B) the cash flow will be:



(6)

Hence $NPW_{(A-B)}(15\%) = 81{,}000(5.019) + 70{,}000(0.2472) - 315{,}000 > 0$

$\Rightarrow IRR_{(A-B)} > 15\% \Rightarrow$ select A.

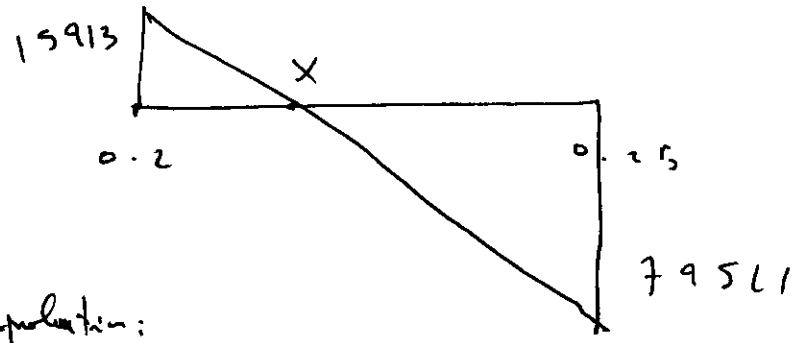
You may compute the IRR A.

$NPW_A(18\%) = 148{,}000(4.494) + 65{,}000(0.1911) - 615{,}000 \doteq 62{,}573$

$NPW_A(20\%) = 148{,}000(4.192) + 65{,}000(0.1615) - 615{,}000 = 15{,}913$

$NPW(25\%) = 148{,}000(3.5711) + 65{,}000(0.1074) - 615{,}000 = -79{,}511.$

$\Rightarrow \quad 20\% < IRR_A < 25\%.$



by Interpolation:

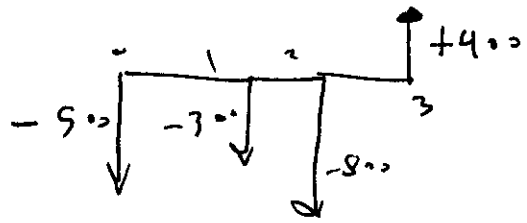
$$\frac{x}{0.05-x} = \frac{15913}{79511} \Rightarrow x = 0.0044$$

$\Rightarrow IRR_A = 0.2 + 0.0044 = 0.2044$

$\simeq 20.44\%$

7A-5 The investment is simple.

but the cumulative net cash flow-test gives,

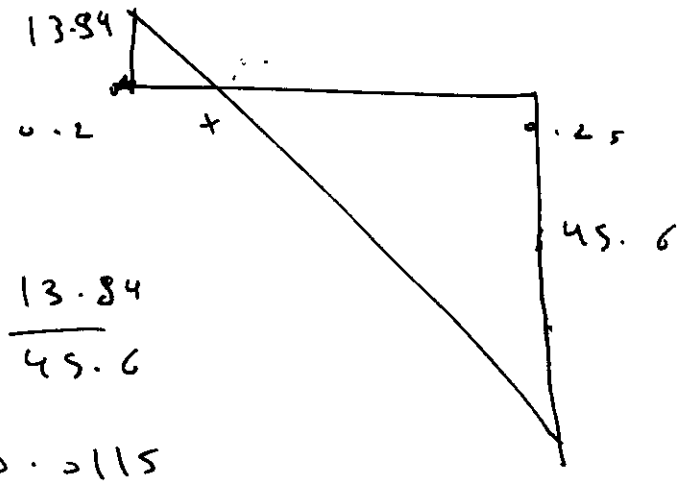


$\Rightarrow$ The investment has a unique positive IRR value.

$$NPW(20\%) = 200(0.833) - 500(0.6944) + 1200(0.5787) - 500 = 13.54$$

$$NPW(25\%) = 200(0.8) - 500(0.64) + 1200(0.512) - 500 = -45.6.$$

By interpolation:



$$\frac{x}{0.05 - x} = \frac{13.54}{45.6}$$

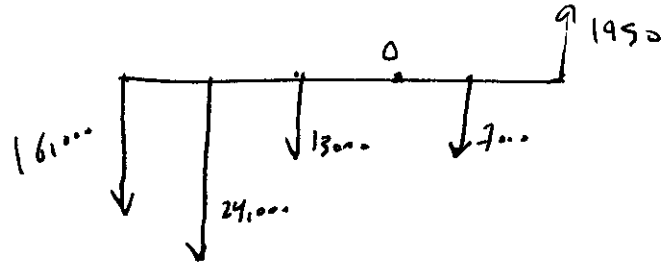
$$\Rightarrow x = 0.0115$$

$$\Rightarrow i = 0.2 + x = 0.2115$$

$$\Rightarrow IRR \simeq 21.15\%$$

7A21 The investment is not simple.

The cumulative cash flow is:



The cumulative cash flow has on sign change

$\Rightarrow$ The investment has a unique (+) IRR value.

From the original cash flow: $\frac{\text{sum of upper flow} - \text{sum of lower flow}}{\text{sum of lower flow}} = 0.06$

$\Rightarrow i = \frac{0.06}{5} = 0.012 \simeq 1.2\%$

$$NPW(i) = -8000\,(P|F,i\%,1) + 11{,}000\,(P|F,i\%,2) + 13{,}000\,(P|F,i\%,3) - 7000\,(P|F,i\%,4) + 8950\,(P|F,i\%,5) - 16{,}000$$

$NPW(2.5\%) = 3.5$

$NPW(3\%) = -1.5$.

$\Rightarrow$ **IRR $\simeq$ 3%**