Assignment-2

8.1 i) APR = $\frac{\text{average annual interest}}{1/2 \times \text{original loan}}$ = ~~2×60~~.

Original loan amount = 20,000.

$20000 = 12 \times$ ~~4.27~~ $427.90\, a_{\overline{5}|}^{(12)} = 3.8499$.

Flat rate = $\frac{\text{total interest}}{\text{loan} \times \text{years}} = \frac{[5 \times 12 \times 427.90 - 20000]}{20,000 \times 5}$

$= 5.67\%$

$A.P.R \approx 2 \times 5.67 \approx 11\%$.

$i = 11\%$, $a_{\overline{5}|}^{(12)} = 3.8782\%$.

$i = 10\%$, $a_{\overline{5}|}^{(12)} = 3.96154\%$.

interpolating A.P.R $i = 10.8\%$.

ii) APR = 10.8%.

After 1 year capital left to pay = $12 \times a_{\overline{47}|}^{(12)}$ @ 10.8% $\times 427.90 =$ 16775.98

$$16775.98 = 3293.88\left(\frac{(1-1.108^{-t})}{12(1.108^{1/12}-1)}\right)$$

$\frac{1}{t} = \frac{6.4754}{12 \times 1.108^{1/12}}$ $\Rightarrow$ $t = 7.25$ years

iii) Total Interest = $4 \times 12 \times 627.90 - 16775.68$

$= 3763.22$

New ~~New~~ loan Term = 7.25 yrs

Total Interest = $7.25 \times 12 \times 274.19 - 16775.68$

$= 7104.65$

Interest payable = 3341.23

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8.2 i) Discounted Payback Period - It is a capital budgeting period procedure used to determine the profitability of a project.

Payback Period - It refers to time required to the time required to recap the funds expanded in an investment.

iii) ~~Unlike the NPV, neither the PPP nor the~~

a) IRR = $17000 - 20000v - 10000v^2 + 20000v + 20000v^2 + 20000v^3 = 0$

$10v^2 + 200v^3 = 170$

$v = 0.9309$

$\frac{1}{1+i} = 0.9309$

$i = 7.42292\% \approx 7.4\%$

So IRR for this project B is 7.4%.

$14a_{\overline{6}|} + 200v^6 = 200$

b) NPV =

~~P(A)~~ $NPV_{P(A)} = -17000 + 10,000v^2 + 20000v^3 = 6823.82$

$NPV_{P(B)} = -20000 + 14000a_{\overline{6}|} + 20,000v^6 = 9834.65$

Q.3) Value at 1/11/1985

Annuity-1

$= 200 v^{(1/4)} a_{\overline{22}|}$ @ 18%

$= 200 \times 0.980944 \times 11.61676$

$= 2161.363$

Annuity-2

$= 320(1+i)^{1/12} \times a^{(4)}_{\overline{16.25}|}$

$= 2957.872$

Annuity-3

$= 180 a^{(12)}_{\overline{18.75}|}$

$= 180 \times 9.892583$

$= 1780.665$

Total $= 2161.363 + 2957.872 + 1780.665$

$= 6899.90$

Revised Annuity: $x(1+i)^{1/4}\, a^{(2)}_{\overline{21.5}|}\,(1+i)^{1/4}$

$$x = \frac{68.99 - 90}{1.019427 \times 10.330886}$$

$$= 656.56$$

Q.4) To derive $(I\ddot{a})_{\overline{n}|} = \dfrac{\ddot{a}_{\overline{n}|} - nv^n}{d}$

Proof

$$P.V = 1 + 2V + 3V^2 + \cdots\cdots + nv^{n-1} \quad -①$$

$$(1-d)(P.V) = V + 2V^2 + 3V^3 + \cdots\cdots + (n-1)v^{n-1} + nv^n \quad -②$$

1 − 2

$$P.V - (1-d)P.V = 1 + V + V^2 + V^3 + \cdots\cdots + (n-1) - nv^n$$

$$dPV = \ddot{a}_{\overline{n}|} - nv^n$$

$$(Ia)_n = \frac{\ddot{a}_{\overline{n}|} - nv^n}{d}.$$

~~Q.5)~~

Q.5) i) For Property fund

$$1+i = \frac{13.1}{12.4} \times \frac{14.8}{13.1} \times \frac{19.8}{14.8} \times \frac{16.4}{15.8}$$

TWRR = i = 32.258%.

For Equity fund

$$1+i = \frac{9.2}{12.1} \times \frac{16.3}{9.2} \times \frac{13.1}{10.3} \times \frac{15.5}{13.1}.$$

TWRR = i = 28.09917364%

ii) a)

$$12.4(1+i) + 13.1(1+i)^{3/4} + 14.8(1+i)^{1/2} + 15.8(1+i)^{1/4} = 4(16.4)$$

$$\Rightarrow i = 29.32\%$$

iii) a) $(12.1)(1+i) + (9.2)(1+i)^{3/4} + 16.3(1+i)^{1/2} + 13.1(1+i) = 4 \times 15.5$.

$$i = 67.31\%$$

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8.64 i) $16000 = C \times a_{10\neg}$ @ 8%.

$$C = \frac{16000}{6.7101} = 23844.65201.$$

ii) $PV_4 = 23844.65201 \; a_{6\neg}$ @ 8%.

$= 23844.65201 (4.6229)$

$= 110231.4422.$

$110231.4422 = X' a_{6\neg}$ @ 10%.

$$X' = \frac{110231.4422}{4.3553}$$

$X' = 25309.72428$

iii) $PV_7 = 25309.72428 \; a_{3\neg}$ @ 10%.

$= 25309.72428 (2.4869)$

$= 62942.75331$

£2943.75331 = X'' $a_{\overline{3}|}$ @ 9%.

$X'' = \frac{62942.75331}{2.5313} = 24865.78174$

Q.8) i) P.V of outlay = $2.7 + 0.2a_{\overline{3}|}$

P.V of Inlay = $\bar{a}_{\overline{10}|}(0.25v + 0.2v^2 + 0.1v^3) + 0.1v^3$

$0 = NPV = \bar{a}_{\overline{10}|}(0.25v + 0.2v^2 + 0.1v^3) + 0.1v^3 - 2.7 - 0.2a_{\overline{3}|}$

$\therefore i = 9.3\%$.

ii) $NPV = 0.1v^3 + 0.85\bar{a}_{\overline{10}|}v^3 - 2.7 - 0.2a_{\overline{3}|}$ @10%

$= 0.1(1.1)^{-3} + 0.85(1.1)^{-3}\left(\frac{1-(1.1)^{-10}}{\ln(1.1)}\right) - 2.7 - 0.2\left(\frac{1-(1.1)^{-3}}{0.1}\right)$

$= 1.0089$

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Q.9 i) $(1+i)^3 = \frac{33}{30.5} \times \frac{38.8}{33+6} \times \frac{41.05-4.5}{38.5} \times \frac{45}{41.65} \times \frac{45.6}{45} \times \frac{47}{45.6-2.5}$

$(1+i)^3 = 1.228313$

$i = 7.0951\% = TWRR$

$80.5(1+i)^3 + 6(1+i)^{2.25} + 4.5(1+i)^{1.5} - 2.5(1+i)^{0.5} = 47$

At $i = 7\%$, RHS = 46.74.

$i = 7.5\%$, RHS = 47.37.

By interpolation $i = 7.208\% = MWRR$

ii) Linked rate of return

2011 ⇒

$30.5(1+i) + 6(1+i)^{0.25} = 38.5$

$i = 6.266\%$

2012 ⇒

$38.5(1+i) + 4.5(1+i)^{0.5} = 45$

$i = 4.92\%$

2013 ⇒

$45(1+i) + 2.5(1+i)^{0.5} = 47$

$i = 70.276\%$

$(1+i)^3 = 1.6266 \times 1.0492 \times 1.10776$

$i = 7.13\%$.

iii) TWRR eliminates the effect of the cashflow amount and timing, and therefore gives an accurate basis for assessing investment for the fund.

Q.10 i) $18600\, a_{\overline{15}|} + 20000 (Ia)_{\overline{15}|} @ 12\%$.

$18000 (6.8109) + 20000 (40.7313)$

$= 2040588$

Total cost of house $= \frac{2040.588}{0.8} = 2550735$

ii) $PV_q = 340000\, a^q_{\overline{7}|} + 20000\, a(Ia)_{\overline{7}|} @ 12\%$

$= 340000 (4.5638) + 20000 \left(\frac{5.1114 - 7 \times 0.4523}{0.12}\right)$

$= 1875850.33$

Year	Loan	Payment	Interest	CR
9	1875850.33	360,000	225102.04	134897.96
10	1740952.37	380000	208914.28	171085.72
11	1569866.65			

iii) $1569866.65 = X a_{\overline{5}|}$ @10%.

$$X = \frac{1569866.65}{3.796786} = 414126.87$$

Total Installments less than Loan O/S at the end of 10th year = 630133.35

Extra Payment made = 5(414126.87) + 0.01(1569866.65) - 1569866.65

= 516466.35

Q.11) i) $TWRR = (1+i)^2 = \frac{500}{460} \times \frac{550-50}{500+40} \times \frac{660}{550} \times \frac{X}{600}$

$$1.44 = \frac{500}{460} \times \frac{500}{540} \times \frac{X}{550}$$

$$X = 786.9312$$

ii) $MIORR = 460(1+i)^{2} + 40(1+i)^{21/12} - 50(1+i) = 786.9312$

$$i = 30.909\%$$

Q.12 i) Discounted Payback Period is the number of years after which cumulative discounted cash inflows cover the initial investment.

ii) a) $-800(1+i)^{t} - 50(1+i)^{t-1} + 100\bar{s}_{\overline{t-2}|} = 0$

@ $i = 7\%$

$= -800(1.07)^{t-1} - 50(1.07)^{t-1} + 100\left(\frac{(1.07)^{t-2} - 1}{\ln(1.07)}\right)$

$= 0$

$t = 17.767$.

b) $= 100\,\bar{s}_{\overline{4.233}|}$ @ 6%

$= 100\left(\frac{(1.06)^{4233} - 1}{\ln(1.06)}\right) = 480$

iii) $-800(1+i)^{t} - 50(1+i)^{t-1} + 102.971\,s_{\overline{t-2}|}$ @7%

$= 0$

$t = 18$.

$-800(1+i)^{18} - 50(1+i)^{17} + 102.9715\,s_{\overline{16}|}$ @ 7% = ~~9.77~~

$= 9.7714$.

$9.7714(1+i)^{4} + 100\,\bar{s}_{\overline{4}|}$ @ 6%

$= 462.79$ = ~~A.V~~ Accumulated amount after 22 years

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Q.13(ii) $988000 = C\,(12)\,a_{\overline{25}|}^{(12)}$ @ 7%.

$$988000 = 12 \times C\left(\frac{1-(1.07)^{-25}}{((1.07)^{1/12}-1)\,12}\right)$$

$C = 6848$, Monthly repayment = $6848

ii) $C\,a_{\overline{34\frac{1}{3}}|}^{(12)} = 6848\left(a_{\overline{34\frac{1}{3}}|}^{(12)} @ 7\%\right) = 648600$

iii) P.V after 10th September's Payment

$= C\,a_{\overline{33\frac{1}{6}}|}^{(12)}$ @ 7%.

P.V after 10th Oct $= C\,a_{\overline{13\frac{3}{4}}|}^{(12)} - C\,a_{\overline{33\frac{1}{6}}|}^{(12)}$

$$= C\left(\frac{v^{13.75} - v^{33\frac{1}{6}}}{i^{(12)}}\right) @ 7\%$$

$= 26.86$.

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iv) Capital repayment ⇒

$$= C\left(a^{(12)}_{\overline{22}/3} - a^{(12)}_{\overline{19}/3}\right) @ 7\%.$$

$$= 516.2$$

Total Interest:- $12 \times 516.2 = 30556$