Assignment - 2

1. loan amount = ₹20,000
monthly repayment = ₹427.90
Term = 5 years

(i) Calculating APR

$$20,000 = 12 \times 427.90 \, a^{(12)}_{\overline{5}|}$$

$$a^{(12)}_{\overline{5}|} = \frac{20\,000}{12 \times 427.90}$$

$$\frac{1-(1+i)^{-5}}{12\left[(1+i)^{1/12}-1\right]} = 3.89499$$

$$\rightarrow \quad 1-(1+i)^{-5} = 46.7398925\,(1+i)^{1/12} - 46.7398925$$

$$= \quad 1-(1+i)^{-5} + 46.7398925 - 46.7398925\,(1+i)^{1/12} = 0$$

$$= \quad 47.7398925 - (1+i)^{-5} - 46.7398925\,(1+i)^{1/12} = 0$$

using table method

$\rightarrow$ i is between 0.1 & 0.2

again,

0.10 & 0.11

value is between 10.8% & 10.9%

thus i = 10.8%

APR = 10.8%.

(ii) ATP

$$12 \times 274.49\, a^{(12)}_{\overline{n}|} @10.8\% = 20,000$$

$$a^{(12)}_{\overline{n}|} = 6.07187$$

$$\Rightarrow \frac{1-(1+i)^{-n}}{12\left[(1+i)^{1/12}-1\right]} = 6.07187$$

$$\frac{1-(1.108)^{-n}}{12\left[(1.108)^{1/12}-1\right]} = 6.07187$$

$$1-(1.08)^{-n} = 0.62538$$

$$(1.08)^{-n} = 0.37462$$

$$-n \log(1.108) = \log(0.37462)$$

$$+n\ 0.0769610414 = +0.9818399736$$

$$n = 12.76$$

or $n = 13$ yrs.

$n = 7.25$ yrs.

(iii) interest payable in loan 1

= 12 × 427.90 × 7.25 = 16775.98

= ₹ 56774 ~~3763.22~~

interest payable in loan 2

= 12 × 274.49 × @ - 20,000

= ₹ 22820.44 ~~7104.65~~

paying interest more of ₹ 3341.43. than loan 1.

2. (i) (a) Discounted payback period - the smallest time t for which the present value of income up to time t exceeds the present value of outgo up to time t.

(b) Payback period - same as discounted payback period, ~~exp~~ except that the present value calculation is carried out using an interest rate of 0%.
Earliest time for which monetary value of income exceeds the monetary value of outgo.

(ii) ~~PP is useful in case of uncertainty & it is simple to use and easy to understand~~ • NIV is better as neither DPP nor PP give any indication of how profitable a project is, as they ignore cashflows after NPV of 0 is reached

(iii) (A) Project A

$$NPV_A = -170 - 90v - 10v^2 + 80v + 20v^2 + 200v^3 = 0$$

$$= -170 + 10v + 200v^3 = 0$$

calculating 'i' using Table method

step 1: between 0 and 10%.
step 2: btw 9% & 10%.
step 3: 9.2% & 9.3%.

9.3% is more closer value
$\Rightarrow i = 9.3\%$ $\quad i = 7.4\%$

Project B

$$NPV_B = -(170 + 30) + 14\, a_{\overline{6}|}^{(i)} + 200v^6 = 0$$

$$= -200 + 14\left(\frac{1 - (1+i)^{-6}}{i}\right) + 200v^6 = 0$$

$= -200 + 200v^6 + 14(1+(1+i)^{-1} \ldots 14i^{-1} - 14i^{-1}(1+i)^{-7}$

$= 0$

$i = 7\%$

(iii) (b) $i = 6.1$.

Project A

$NPV_A = -170 + 100(1.06)^{-2} + 200(1.06)^{-3}$

~~£ 15.724 × 1000~~

~~£ 15724~~ 6823.82

Project B

$NPV_B = -200 + 14\dfrac{(1-(1.06)^{-6})}{0.06} + 200(1.06)^{-6}$

~~£ 9.83464~~

£ 9834.64

c. To be profitable, Project A requires a borrowing rate less than 7.4% and project B requires a rate lower than 7%.

Other factors:

- Long IRR of Project B applies for longer period
- Project A does not provide net income during year 1.

~~(1) 2~~

3. Value at 1/11/1975

Annuity 1 = $200 (v)^{1/4} (\ddot{a}_{\overline{22}|})$ @ 8%.

= $200 (0.980944)(11.016786)$

= 2161.363

Annuity 2 = $320 (1+i)^{1/12} (a^{(4)}_{\overline{16.75}|})$ @ 8%.

= $320 (1.006434)(9.184257)$

= 2957.872.

Annuity 3 = $180\ a^{(12)}_{\overline{18.75}|}$

= $180 \times 9.892583 = 1780.665$

Annuity (1+2+3) = 6899.90

Annuity revised = $c (1+i)^{1/4}\ a^{(2)}_{\overline{21.5}|}$

$= \frac{6899.90}{1.019427 \times 10.308816} = 656.56$

4. $I\ddot{a}_{\overline{n}|} = 1 + 2v + 3v^2 + \cdots nv^{n-1}$ — (1)

multiply v on both sides:

$v(I\ddot{a}_{\overline{n}|}) = v + 2v^2 + 3v^3 + \cdots nv^n$ — (2)

subtract (2) from (1):

$(1-v)I\ddot{a}_{\overline{n}|} = 1 + v + v^2 + \cdots - nv^n$

since $(1-v = d)$ & $1 + v + v^2 + \cdots v^{n-1} = \ddot{a}_{\overline{n}|}$

$\rightarrow \quad d\, I\ddot{a}_{\overline{n}|} = \ddot{a}_{\overline{n}|} - nv^n$

$\rightarrow$ $$I\ddot{a}_{\overline{n}|} = \frac{\ddot{a}_{\overline{n}|} - nv^n}{d}$$

6. loan amount = 160,000

term = 10 yrs $\quad i = 8\%$ p.a

(i) let x be the annual repayment

$160\,000 = x\, a_{\overline{10}|}$ @ 8%

$x = \frac{160\,000}{6.7101} = 23,844.65$

(ii) loan o/s immediately after 4th payment =

$$23844.65\, a_{\overline{6}|}^{@8\%} = 23844.65\,(4.6229)$$

$$= 110,231.442$$

let x be the revised annual installment.

$$\Rightarrow x\, a_{\overline{6}|} = 110,231.442 \;@\; 10\%.$$

$$x_1 = \frac{110\,231.442}{4.3553} = 25309.72$$

(iii) loan o/s immediately after 7th payment is:

$$25309.72\, a_{\overline{3}|} \;@\; 10\%.$$

$$= 25309.72 \times 2.4869$$

$$= 62,942.74$$

let x_2 be revised annual instalment:

$$x_2\, a_{\overline{3}|} = 62942.74 \;@\; 9\%.$$

$$x_2 = \frac{62942.742}{2.5313}$$

$$x_2 = 24865.77$$

yield:

$160,000 + 1465.07 \cdot a_{\overline{4}|} - 443.95 \, a_{\overline{4}|} - 24865.72 a_{\overline{10}|} = 0$

by table method: $i = 8.4\%$.

5. (i) TWRR for property fund

$\frac{16.4}{12.4} = 1+i$

$i = 32.26\%$.

for equity fund:

$\frac{15.5}{12.1} = 1+i$

$i = 28.10\%$.

(ii) (a) eqn:

$1240(1+i) + 1310(1+i)^{3/4} + 1480(1+i)^{1/2} + 1580(1+i)^{1/4} = 4(1640)$

by hit & trial

$i = 29.3\%$.

(b) $400\,\ddot{s}^{(4)}_{\overline{1}|} = 100(16.4)\left(\frac{1}{12.4} + \frac{1}{13.1} + \frac{1}{14.8} + \frac{1}{15.8}\right)$

$\ddot{s}^{(4)}_{\overline{1}|} = 1.1801$

$i = 29.8\%$

(iii) (a) eqn:

$1210(1+i) + 920(1+i)^{3/4} + 1030(1+i)^{1/2} + 1310(1+i)^{1/4} = 4(1530)$

$i = 67.3\%$

(b) $400\,\ddot{s}^{(4)}_{\overline{1}|} = 100(15.5)\left(\frac{1}{12.1} + \frac{1}{9.2} + \frac{1}{10.3} + \frac{1}{13.1}\right)$

$\ddot{s}^{(4)}_{\overline{1}|} = 1.4135$

$i = 70.8\%$

7. (i) Reasons to invest in govt. securities rather than property:

- Return on property may be lower in short term
- Large buying & selling cost

- Maintainance costs for property
- Poor Marketability.

(ii) (a) Government may raise money by floating a loan on stock exchange. Terms of the issue are set out by tender. Investors are invited to nominate the price that they are prepared to pay & loan is issued to highest bidders.

(b) Advantage:
- Govt. will know the price that investor will pay at outset so it will know cost of borrowing money.

Disadvantage:
- Insufficient investor may be prepared to pay the set price causing only part of offer to be sold & Govt. may not meet its finance requirement.

(c) • Index linked bonds -
- Property
- Stocks.

8. (i) PV of outlay: (in crores)

$2.7 + 0.2a_{\overline{3}|}$ @ i%.

expected PV:

$0.1v^3 + \bar{a}_{\overline{10}|}(0.25v + 0.2v^2 + 0.1v^3)$ @ i%.

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

using table method & hit & trial:

$i = 9.3\%$

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

$= 0.1(0.7513) + 0.85(0.7513)(6.4469) - 2.7 - 0.2(2.4868)$

$= 1.0089$

since NPV is +ve, we can invest in the project.

9. TWRR

$$(1+i)^3 = \frac{33}{30.50} \times \frac{41.05-4.5}{33+6} \times \frac{45.6}{41.05} \times \frac{47}{45.6-2.50}$$

$$(1+i)^3 = 1.228313$$

$$i = (1.228313)^{1/3} - 1$$

$$i = 7.0951\ \%$$

MWRR

$$30.5(1+i)^3 + 6(1+i)^{2.25} + 4.5(1+i)^{1.5} - 2.5(1+i)^{0.5} - 47 = 0$$

using table & hit & trial method

$$i = 7.2\%$$

(ii) LRR

yr 2011 : $30.5(1+i) + 6(1+i)^{0.25} - 38.50 = 0$

$$i = 6.26\%$$

yr 2012 : $38.5(1+i) + 4.5(1+i)^{1/2} = 45$

$$i = 4.9\%$$

yrs 2013 : $45(1+i) + 2.50(1+i)^{1/2} - 47 = 0$

$i = 10.27\%$.

LHR:

$(1+i)^8 = (1+0.06266)(1+0.04992) + (1+0.1024)$

$i = 7.13\%$.

(iii) MWRR is highly sensitive to amount of net cashflows.

10. loan amount → L 80% of expense by bank

term = 15 yrs

~~1,80,000~~

increasing annuity:

$L = (P-Q)\, a_{\overline{n}|} + Q(Ia)_{\overline{15}|}$ @ 12%.

$L = 1,80,000\, a_{\overline{15}|} + 20,000\,(Ia)_{\overline{15}|}$

$= 1,80,000(6.8109) + 20,000(40.7313)$

$L = ₹\, 20,40,588$.

Total cost of house $= \frac{2040588}{80\%}$

$= ₹\, 25,50,735$

(ii) loan o/s at beginning of 9th yr:

$L_9 = 3,40,000\ a_{\overline{7}|} + 20,000\ Ia_{\overline{7}|}$ @ 12%.

$= 3,40,000(4.5638) + 324158.33$

$L_9 = ₹\ 18,75,850.33$

loan schedule:

Yr	loan o/s	installment	int.	Capital repaid.
9	1875850.33	360 000	225102.04	134897.96
10	1740952.37	380 000	208714.28	171085.72
11	15,69,866.65	4,00,000		

(iii) let new installment be x

$1569866.65 = x\ a_{\overline{5}|}$ @ 10%.

$x = \frac{1569866.65}{3.790786}$

$x = 4,14,126.87$

Extra payment sam will would make with bank:

$(4,00,000 + 4,20,000 + \cdots 4,80,000) - 1569866.65$

$= 6,30,133.35$

Extra payment Sam would make with Bank 2:

$= 5(41\,41\,\%.90) + 1\%\text{ of } 1569\,866.65 - 1569866.65$

$= 516466.35$.

$\Rightarrow$ Sam should transfer his loan to Bank 2 since extra payment is less.

11. (i) $i = 20\%$ pa

for X:

$$(1+i)^2 = \frac{500}{460} \times \frac{550+50}{500+40} \times \frac{x}{550}$$

we know that

$$(1+i)^2 = (1.2)^2 = 1.44$$

$$\Rightarrow x = \frac{(1.44)(500)}{(1.0869)(1811)}$$

$$x = 655.78$$

(ii) MWRR

$$460(1+i)^2 + 40(1+i)^{7/4} - 50(1+i) - 655.78 = 0$$

$i = 19.85\%$ pa [from table 2. hit & trial method]

(iii) 2015

$$460(1+i) + 40(1+i)^{3/4} - 600 = 0$$

$i = 20.4\%$

2016

$$(1+i) = \frac{655.78}{550} = 1.1923$$

⟹ Linked RR:

$$(1+i)^2 = (1.1923)(1.2044)$$

$i = 19.83\%$

(v) TWRR is better as:-

- MWRR is highly sensitive to cashflow amount.
- TWRR is independent of amount & timing of net cashflows.

12. (i) ans 2(i)(a).

(ii) (a)

$i = 7\%$

$\Rightarrow -800(1.07)^{t} - 50(1.07)^{t-1} + 100\,\bar{s}_{\overline{t-2}|}$ @ 7%.

$= 0$

$t = \underline{\underline{17.76}}$

(b) $100\,\bar{s}_{\overline{4.23}|}$ @ 6%.

AV = ₹ 4,80,000.

(iii) $i = 6\%$.

$100\,\bar{s}_{\overline{1}|} = 102.97$

$-800(1+i)^{6} - 50(1+i)^{t-1} + 102.97\,s_{\overline{t-1}|}$ @ 7%.

≥ 0

$t = 18$ yrs

Balance after 18 yrs:

$-800(1+i)^{18} - 50(1+i)^{17} + 102.97\,s_{\overline{16}|}$ @ 7%.

$= 9.7714$

$\Rightarrow$

$AV_{22} = 9.7214(1+i)^7 + 100\bar{s}_{7|}$ @ 6%.

$= 462.79$

$AV_{22} = \text{₹}\ 462,790$

13. (i) let x be the annual repayment

$\rightarrow \quad x\, a_{25}^{(12)} = 9880$ @ 7%.

$x = 821.76$

monthly repayment $= \frac{x}{12} = 68.48$

$\Rightarrow \quad \text{₹}\ 6,848$.

(ii) loan o/s immediately after 10/3/2029:

$x\, a_{34/3}^{(12)} = 648,600$ at 7%.

(iii) loan o/s after 10/9/2026:

$x\, a_{83/6}^{(12)}$ @ 7%.

loan o/s after 10/10/2026

$x\, a_{13.75}^{(12)}$ @ 7%.

Capital repaid =

$x\, a^{(12)}_{\overline{6.5}|6} - x\, a^{(12)}_{\overline{13.5}|}$

$= 26.86$

(iv) Capital :

$x\, a^{(12)}_{\overline{22}|3} - x\, a^{(12)}_{\overline{19}|3}$ @ 7%.

$= 516.20$

interest $= x - 516.20$

$= 305.56$.