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FM

Assignment - 2.

Q1 (i) Loan = 20,000
Payment = 427.90
Time : 5 years

$20,000 = (12)(427.9)\, a_{\overline{5}|}^{(12)}$ @ i.

$a_{\overline{5}|}^{(12)} = 3.894991042$

$\frac{1-v^5}{i^{(12)}} = 3.894991042$

$\frac{1-(1+i)^{-5}}{12((1+i)^{1/12}-1)} - 3.89 = 0.$

By trial & error.
$i = 10\%$; LHS = 0.07
$i = 11\%$, LHS = -0.01627

∴ By interpolation.
$i = 10.8\%$.
∴ APR = 10.8%

(ii) $PV_t = 427.9 \times 12\, a_{\overline{4}|}^{(12)}$ @ $i = 10.8\%$.

$= 427.9 \times \cancel{12} \left(\frac{1-(1.108)^{-4}}{\cancel{12}[0.008583]} \right)$

$= 16,775.97728$

$16775.977028 = (12)(274.49)\, a_{\overline{t}|}^{(12)}$ @ 10%

$\frac{1-v^{-t}}{12(0.008583)} = 5.09307$

$\cancel{1}(1.108)^{-t} = 5.09307$

$\therefore t = 7.2499$ years.

(iii) Interest paid more $= \cancel{2}274.49 \times 7.2499 \times 12 - 427.9 \times 12 \times 5$

$= 3341.43$

Q2 (i)

a) Discounted payback period is the time when the invested amount is recovered from ~~int~~ investment considering interest and time value of money.

b) Payback period is the time when the ~~interest~~ invested amount is recovered from investment without considering the interest and time value of money.

(ii) Unlike the NPV, neither the DPP nor the PP gives any indication of profitability of the project. It just finds the time when the accumulated value of all cashflows become 0. For determining investment in project NPV is the best option.

The PP gives misleading results as it does not take interest and time value of money into account. Hence NPV is superior measure as compared to DPP and PP

(a) IRR of Project A

NPV = 0

$-170 - \cancel{20}v - 10v^2 + \cancel{20}v + 20v^2 + 200v^3 = 0$

$-170 + 10v^2 + 200v^3 = 0$

$-170 + 10(1+i)^{-2} + 200(1+i)^{-3} = 0$

By trail & error

$i = 7\%$, RHS = 1.99.

$i = 8\%$, RHS = -2.66.

By interpolation.

$i = 7.4\%$

IRR of Project B.

NPV = 0

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

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

By trail & error.

when $i = 0.07$, RHS = 0

$\therefore i = 7\%$

(b) $d = 6\%$

Project A

$NPV = -170 - \cancel{20v} - 10v^2 + \cancel{20v} + 20v^2 + 200v^3$

$= -170 - \cancel{20(1-d)} + 10(1-d)^2 + 200(1-d)^3$

$= 4.7528$

Project B

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

$= 5.99585$

(c) So, Project A would be ~~project~~ Profitable if the borrowing rate is ~~lote~~ less than 7.4% & for Project B less than 7%.

other factors:

→ Project A doesn't provide any net income during first year.

→ Project B is good investment for long term because of low IRR.

3)

i) $v^{3/12}\ 200\ \ddot{a}_{\overline{22}|}$ $\Rightarrow$ Annuity 1 (PV)

$= (1.08)^{-3/12} \times 200 \times a_{\overline{22}|} \frac{i}{d}$ @ 8%

$= (1.08)^{-3/12} \times 200 \times 10.2007 \times 1.0800018$

$= 2161.365534$

ii) $320\ \ddot{a}^{(4)}_{\overline{16.25}|} \times v^{1/6}$ $\Rightarrow$ Annuity 2 (PV)

$= 320\ a_{\overline{16.25}|} \times \frac{i}{d^{(4)}} \times v^{1/6}$

$= 2996.0488$

iii) $15\ \ddot{a}_{\overline{226}|}$ @ $\frac{d^{(12)}}{12} = 0.006392$ $\Rightarrow$ Annuity 3 (PV)

$15\left(\frac{1-(1.08)^{-\frac{226}{12}}}{0.006392}\right) = 1795.65142$

$\therefore$ Total all PV = 6953.065823

Revised annuity

$6953.065823 = X\ \ddot{a}^{(2)}_{\overline{21.5}|}$ @ i = 8%

$6953.065823 = X\left(\frac{1-(1.08)^{-21.5}}{0.08}\right) \times \frac{i}{d^{(2)}}$

$X = 649.0135657$

4) $I\ddot{a}_{\overline{n}|} = \dfrac{\ddot{a}_{\overline{n}|} - nv^n}{d}$ ⇒ To Prove

Proof :-

$PV = 1 + 2v + 3v^2 + \ldots\ldots nv^{n-1}$

$I\ddot{a}_{\overline{n}|} = 1 + 2v + 3v^2 + \ldots\ldots nv^{n-1} \rightarrow (1)$

multiplying $(1+i)^{-1}$ both side.

$(1+i)^{-1} I\ddot{a}_{\overline{n}|} = (v + 2v^2 + 3v^3 \ldots\ldots nv^n \rightarrow (2)$

$(2) - (1)$

$d\,I\ddot{a}_{\overline{n}|} = (1 + v + v^2 + v^3 + v^4 + v^5 \ldots) - nv^n$

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

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

Hence Proved

5)

i) TWRR for Property fund

$$= \frac{13.1}{12.4} \times \frac{14.8}{13.1} \times \frac{15.8}{14.8} \times \frac{16.4}{15.7} - 1$$

$$= 1.331004726 - 1$$

$$= 33.1004726\%$$

TWRR for Equity fund

$$= \frac{9.2}{12.1} \times \frac{10.3}{9.2} \times \frac{13.1}{10.3} \times \frac{15.5}{13.1} - 1$$

$$= 1.280991736 - 1$$

$$= 28.0991736\%$$

ii)

a) ~~Property~~ Equity fund

$$12.1(1+i) + 9.2(1+i)^{3/4} + 10.3(1+i)^{1/2} + 13.1(1+i)^{1/4} - 4 \times 15.5 = 0$$

$$i = 67.31\%$$

Property fund

$$\cancel{12.1(1+i) + 9.2(1+i)^{3/4}} +$$

$$12.4(1+i) + 13.1(1+i)^{3/4} + 14.8(1+i)^{1/2} + 15.8(1+i)^{1/4} - 4 \times 16.4 = 0$$

$$i = 29.32\%$$

6)

i) $160000 = X a_{\overline{10}|}$ @8%

$X = 23844.65209$

ii) So, loan o/s at $t=4$.

$PV_4 = 23844.65209\, a_{\overline{6}|}$ @8%

$PV_4 = 110231.4422$

New Payment $= Y$

$110231.4422 = Y\, a_{\overline{6}|}$ @10%

$Y = 25309.72428$

iii) $PV_7 = 25309.72428\, a_{\overline{3}|}$ @10%

$= 62942.7533$.

New Payment $= Z$

$62942.7533 = Z\, a_{\overline{3}|}$ @9%

$\therefore Z = 24865.78174$

8)

i) The PV of outflow $= 2.7 + 0.2 a_{\overline{3}|}$ @i

Expected PV of income $= 0.1v^3 + \bar{a}_{\overline{10}|}(0.25v + 0.2v^2 + 0.1v^3)$

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

$2.7 + 0.2\left(\frac{1-v^3}{i}\right) = 0.1v^3 + \frac{1-v^{10}}{\delta}\left[0.25v + 0.2v^2 + 0.1v^3\right]$

$\therefore i = 9.3\%$

(iii) $0.1v^3 + 0.85\,\bar{a}_{\overline{10|}}\,v^3 - 2.7 - 0.2a_{\overline{3|}}$

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

$= 4.19 - 3.19$

$= 1.0089$.

NPV is +ve.

∴ worth to invest.

Q9 TWRR

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

$(1+i)^3 = 1.228313$

$1+i = 1.070951$

$i = 0.070951$

$= 7.0951\%$

MWRR.

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

By trail & error,

$i = 7\%$, $LHS = 46.74$

$i = 7.5\%$, $LHS = 47.37$

By interpolation

$i = 7.206\%$

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9 i) LRR

~~Year 2011~~ Year 2011 $\rightarrow 30.5(1+i) + 6(1+i)^{0.75} = 38.5$
$\Rightarrow i = 6.266\%$

Year 2012 $\rightarrow 38.5(1+i) + 4.5(1+i)^{0.5} = 45$
$\Rightarrow i = 4.92\%$.

Year 2013 $\rightarrow 45(1+i) - 2.5(1+i)^{0.5} = 47$
$\Rightarrow i = 10.28\%$.

LRR $\Rightarrow (1+i)^3 = (1.06266)(1.0492)(1.1028)$
$(1+i)^3 = 1.229558999$
$1+i = 1.071313204$
$i = 0.071313204$
$= 7.13\%$

(iii) TWRR removes the effect of big cashflows amount and timing and gives a fair rate by assessing investment performance

10) i) Loan amount = PV_0.

$PV_0 = 1,80,000\ a_{\overline{15}|} + 20,000\ (Ia)_{\overline{15}|}$ @ 12%.
$= ₹20,40,588$

Total cost of house $= \dfrac{2040588}{0.8} = 25,50,735$

(ii) Loan o/s at time 9 $= 3{,}40{,}000\, a_{\overline{7}|} + 20{,}000(Ia)$

$= 1875850.33$

Loan Schedule:

Year	Loan o/s start	Loan Installment	Interest	Cap element	
9	1875850.33	3,60,000	2,25,102.04	1,34,897	
10	1740952.37	3,80,000.	2,08,914.28	1,21,085	
11	1569866.65				

Q11(i) TWRR

$$(1+i)^2 = \frac{500}{460} \times \frac{550-50}{500+40} \times \frac{600}{550} \times \frac{X}{\cancel{600}}$$

$$(1.2)^2 = \frac{500}{460} \times \frac{500}{540} \times \frac{X}{550}$$

$\therefore X = 786.9312$

(ii) $460(1+i)^2 + 400(1+i)^{21/12} - 50(1+i) = 786.9312$

$\Rightarrow i = 30.909\%$

Q12

(ii)

a) DPP : $-800(1+i)^t - 50(1+i)^{t-1} + 100\, s_{\overline{t-2|}} = 0$

$\Rightarrow -800(1.07)^t - 50(1.07)^{t-1} + 100\, s_{\overline{t-2|}} = 0$

By trail & error,

$t = 17$, NPV = -25

$t = 18$, NPV = 22.85

∴ By interpolation,

$t = 17.767$

b) Accumulated Profit after 22 years

$100\, \bar{s}_{\overline{4.233|}}$ @ 6% = 480

∴ Accumulated Profit = ₹4,80,000

(iii) The businessmen may accumulate his rental income @ 6% each year

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

$\boxed{t = 18 \text{ years}}$

$-800(1+i)^{18} - 50(1+i)^{17} + 102.971\, s_{\overline{16|}} = 9.7714$

Accumulated Profit after 22 years

$= 9.7714(1+i)^4 + 10\, s_{\overline{4|}}$ @ 6%

$= 462.79$

Q13(i) $980000 = 12 \cdot X\, a^{(12)}_{\overline{7.5}|}$

$X = 6848$

$\therefore$ Monthly Payments $= 6848$

(ii) Loan O/S after repayment on 10th March, 2029

$X\, a^{(12)}_{\overline{34/3}|}$ @ 7% = 648600

(iii) Loan O/s after repayment on 10th Sept 2026

$X\, a^{(12)}_{\overline{83/6}|}$ @ 7%