Mal Tamil French

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ASSIGNMENT 2

1. (i) Flat Rate $\approx \dfrac{\text{total interest}}{\text{loan} \times \text{total years}}$ APR is the double of it

Original loan amount = ₹ 20,000

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

$$a_5^{(12)} = 3.8499$$

Flat Rate $= \dfrac{(5 \times 12 \times 427.90) - 20000}{20000 \times 5}$

$= 5.67\%$

$$APR \approx 2 \times 5.67 \approx 11\%$$

Solving using calculator

At $i = 11\%$, $a_{\overline{5}|}^{(12)} = 3.87872$

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

Using interpolating,

$$\frac{P - 10\%}{3.87872 - 3.96154} = \frac{11\% - 10\%}{3.87872 - 3.96514}$$

At $i = 10.8\%$

$$12 \times 427.90\, a_{\overline{5}|}^{(12)} = 20000.2$$

At $i = 10.9\%$

$$12 \times 427.90\, a_{\overline{5}|}^{(12)} = 19958.2$$

$i = 10.8\%$ is more close hence APR is 10.8%.

(ii) APR = 10.8%

Capital left after 1 year = $12 \times 427.90\, a_{\overline{4}|}^{(12)}$ @ 10.8%

$= 16775.98$

$$16775.98 = 12 \times 274.49\, a_{\overline{t}|}^{(k)}$$

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

$$1.108^{-t} = 0.4754$$

$$t = 7.25 \text{ years}$$

(iii) 4 years payment remaining in orignal loan

Total interest = $(4 \times 12 \times 427.90) - 16775.68$

$= \underline{3763.22}$

Term of new loan = 7.25 years

Total interest = $7.25 \times 12 \times 274.49 - 16775.98$

$= 7104.65$

$7104.65 - 3763.22 = 3341.43$

Thus, they must pay 3341.43 more interest.

Q2. (i) (a) Discounted Payback period

→ The discounted payback period is the smallest time t for which the present (or accumulated) value of the returns up to time t exceeds the process (or accumulated) value of the costs upto time t.

(b) Payback Period

It is almost the same as discounted payback period, except the present value calculation (or accumulation) is carried out using an interest rate of 0. that is, it is the earliest time for which the monetary value of the returns exceeds the monetary value of the costs.

(iii) (a) Internal Rate of Return

IRR for Project A

$-170000 - 20000v - 100000v^2 + 20000v + 20000v^2$

$+ 200000v^3 = 0$

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

At $i = 7\%$ $\quad 10v^2 + 200v^3 = 171.99$

At $i = 8\%$ $\quad 10v^2 + 200v^3 = 167.34$

Using interpolation,

$$i = 7 + \frac{170 - 171.99}{167.34 - 171.99} \times (8 - 7)$$

$$i = 7.4\%$$

Project B,

Income includes 7% of initial capital (6yrs)

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

(b) Net Present Value

$$NPV_A = -1,70,000 + 10000\, v^2 + 200000\, v^3$$
$$= 6,823.82 \text{ Rs}$$

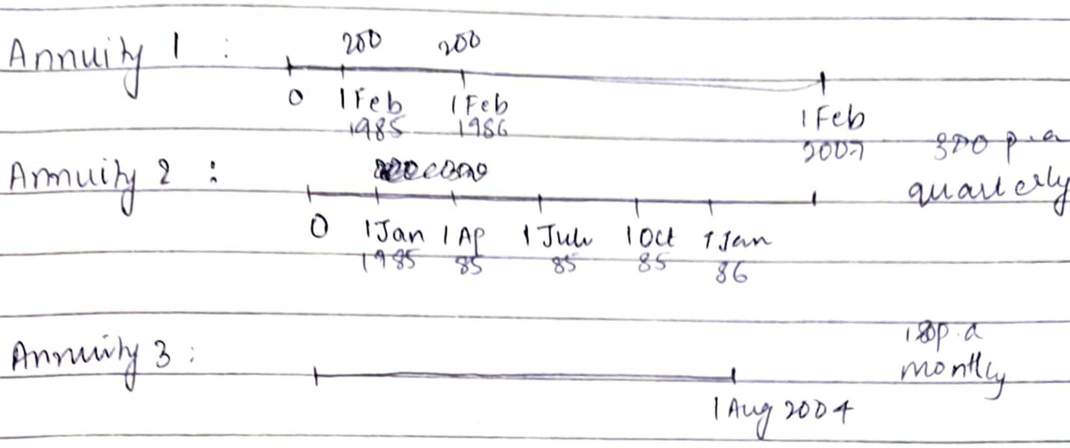
$$NPV_B = -200000 + 14000\, a_{\overline{6|}} + 200000\, v^6$$
$$= ₹\ 9,834.65$$

c) Maximum Interest Rate beyond which the projects are unprofitable:

Each project will be profitable if the rate of return at which funds can be borrowed is less than the internal rate of return.

So to profitable, Project A requires a borrowing less than 7.4% and Project B requires a rate lower than 7%

Q3.



Annuity 1 :

PV : $200\, v^{1/4}\, \ddot{a}_{\overline{22}|}$ @ 8%

$= 200 \left(\frac{1}{1.08}\right)^{1/4} (11.01676)$

$= 2161.363$

Annuity 2 :

PV = $320 (1+i)^{1/12}\, a^{(4)}_{\overline{16.25}|}$ @ 8%

$= (320)(1.006434)(9.184257)$

$= 2957.872$

Annuity 3 :

PV = $180\, a^{(12)}_{\overline{18.7}|}$ @ 8%

$= 180 (9.892583)$

$= 1780.665$

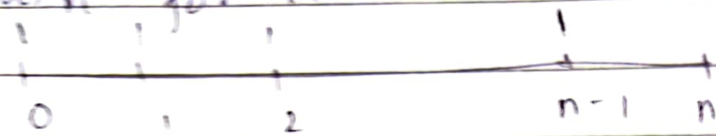
Total value of three annuities = 6899.90

Value of revised annuity = $X (1+i)^{1/4}\, a^{(2)}_{\overline{21.5}|}$

$X = \dfrac{6899.90}{1.019427 \times 10.30886}$

$X = 656.56$

Q4. $(I\ddot{a})_{n}$ for $i > 0$



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

multiplying v in both sides

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

Subtracting

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

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

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

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

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Q5. (i) Time-weighted rate of return (2014)

$$\frac{16.4}{12.4} - 1 = 0.3226 \quad \text{Proprietory fund}$$
$$= 32.26\%$$

Time-weighted rate of return equity fund

$$\frac{15.5}{12.1} - 1 = 0.2810$$
$$= 28.10\%$$

(ii) Let the investor buy 100 units per quarter.

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

as i is the yield premium per annum

$$i = 0.2932$$
$$i = 29.32\%$$

(iii) Let invest purchases ₹ 100 worth of units each quarter.

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

$$\ddot{s}^{(4)}_{\overline{1}|} = 1.1801$$
$$i = 0.2979$$
$$i = 29.8\%$$

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25/1/22

Q6. (i) Let x be the payment amount

$$1,60,000 = x\, a_{\overline{10}|} \text{ @ } 8\%$$

$$x = \frac{160000}{6.7101}$$

$$x = 23844.65$$

(ii) Loan o/s after 4^{th} payment

$$23844.65\, a_{\overline{6}|} \text{ @ } 8\%$$

$$= 23844.65\,(4.6229)$$

$$= 110231.442$$

Let Y be the revised annual installment

$$Y a_{\overline{6}|} = 110231.442 \text{ @ } 10\%$$

$$Y = \frac{110231.442}{4.3553}$$

$$Y = 25309.72$$

(iii) Loan o/s after 7^{th} payment.

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

$$= 25309.72\,(2.4869)$$

$$= 62942.74$$

Let Z be the revised installment.

$$Z a_{\overline{3}|} = 62942.74 \text{ @ } 9\%$$

$$Z = \frac{62942.742}{25313}$$

$$Z = 24865.77$$

$$160000 = 23844.65\, a_{\overline{4}|} + 25309.72\, a_{\overline{3}|} v^4 + 24865.77\, a_{\overline{3}|} v^7$$

25/1/22

Q7. (i) Investing in property may not be prefered as:

→ there may be periods when the property is void and no income is received

→ It may be difficult and expensive to value the property

→ Marketability is poor

→ The buying and selling expenses are huge.

(ii) (a) By floating a loan on stock exchange, government may raise money.
The terms of the issue are set out by tender.
The investors are invited to nominate the price that they are prepared to pay and the loan is issued to the highest bidders, subject to certain rules of allocation.

(b) Advantages: It will be administratively less difficult by tender.
Disadvantages: govt. may not meet its financial requirement.

(c) Equity, property, index-linked bonds.

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Q8. ~~a~~ Calculating in crores

(i) 200 $i = ?$

PV of outlay $= 2.7 + 0.2\, a_{\overline{3}|} @ i$

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

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

Q9. (i) TWRR

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

$$(1+i)^3 = (1.081967)(0.937179)(1.11084)(1.090487)$$

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

$$(1+i) = 1.070951$$

TWRR $= 7.0951\%$

MWRR

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

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

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

By interpolation

MWRR $= 7.206\%$

(ii) Linked rate of return

Year 2011 $30.5(1+i) + 6(1+i)^{0.25} = 38.5$

$i = 6\%$ LHS $= 38.42$

$i = 6.5\%$ LHS $= 38.57$

By interpolation $i = 6.266\%$

(iii) TWRR eliminates the effect of cash flow amount and timing and hence gives a ~~fair~~ better basis for comparing the investment performance for the fund.

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Q10. Let the loan amount be P

$P = 180000\, a_{\overline{15}|} + 20000\, (Ia)_{\overline{15}|}$ @ 12%

$P = 180000 \times 6.8109 + 20000 \times 40.7313$

$P = 20,40,588$

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

(ii) Loan o/s at the beginning of 9th year:

$= 340000\, a_{\overline{7}|} + 20000\, (Ia)_{\overline{7}|}$ @ 12%

$= 1551672 + 324158.33$

$=$ ₹ $\underline{\underline{18,75,850.33}}$

(iii) Let New Installment be ₹ x

$1569866.65 = x\, a_{\overline{5}|}$

$x = \underline{\underline{414126.87}}$

extra payment made : Total Installment − loan o/s @ end of 10th yr.

$=$ Total inst. + 1% processing fees − loan o/s

$= 5 \times 414126.90 + 0.01 \times 1569866.65 - 1569866.65$

$= 2070634.337 + 15698.665 - 1569866.65$

$= \underline{\underline{516466.35}}$

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Q11. TWRR

$$(1+i)^2 = \frac{50\cancel{0}}{46\cancel{0}} \times \cancel{600} \left(\frac{550+50}{500+40}\right) \frac{x}{550}$$

$$(1+i)^2 = \frac{600\,x}{46 \times 540 \times 11}$$

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

$$x = \frac{1.44 \times 46 \times 540 \times 11}{600}$$

$$x = 655.776$$

(ii) MWRR

$$460(1+i)^2 + 40(1+i)^{7/4} - 50(1+i) = 6655.776$$

let $1+i$ be u

$$460u^2 + 40u^{7/4} - 50u - 655.776 = 0$$

$1.1 \rightarrow -106.915622$

$1.2 \rightarrow 1.6575$

$1.198 \rightarrow -0.0609$

$1.1985 \rightarrow -0.0427895241$

$1.19854 = 0.025233$

$(1+i) = 1.19854$

$i = 0.19854$

$i = 19.854\%$

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

$1.2 \rightarrow -2.138$

$1.3 \rightarrow 46.698$

$1.21 \rightarrow 2.7475$

$1.204 \rightarrow -0.184$

$1.205 \rightarrow 0.3044$

$1.044 \rightarrow 0.01131475$

$1+i = 1.20438$

$i = 0.20438$

$i = 20.438\%$

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i for the yr 2016

$1+i = \frac{655.78}{550} = 1.92327$

Linked rate of return

$(1+i)^2 = 1.92327 \times 1.202138$

$(1+i)^2 = 1.436015121$

$1+i = 1.198338483$

$i = 0.198338483$

$i = 19.8338483\%$

$LRR = 19.83\%$

(iv) When the sub-intervals chosen for calculating LRR coincide with the interval b/w net cash flow ~~are~~ being received then the linked interval rate of return will be identical to time wighted rate of return

(v) TWRR is better (Answered earlier)

Q12. Calculating in 1000 units

(i) Done earlier

(ii) $-800(1+i)^t - 50(1+i)^{t-1} + 100\,\bar{s}_{\overline{t-2}|}$ @ $7\% = 0$

$-800(1+i)^t - 50(1+i)^{t-1} + 100\left(\frac{(1+i)^{t-2}-1}{\delta}\right) = 0$

$-800(1.07)^t - 50(1.07)^{t-1} + 100\left[\frac{(1.07)^{t-2}-1}{\ln(1.07)}\right] = 0$

t → 17 → −74.79

18 → 23.4626

17.7 → −6.741

17.8 → 3.24632

17.76 → −0.757

17.767 → −0.057

17.768 → 0.0426

t = 17.767 yrs

(b) Accumulated profit after 22 yrs is found by accumulating the income after DPP has elapsed at 6% p.a

$$100 \ \bar{s}_{\overline{4.233}|} @ 6\% = 100 \times \frac{(1+0.06)^{4.233} - 1}{\ln(1.06)}$$

$$= 480.0743066$$

Acc. amt = ₹480,074.3066

(iii) $$100 \ \bar{s}_{\overline{1}|} = 100 \ \frac{(1.06)^{1} - 1}{\ln(1.06)}$$

$$= 102.9708672$$

The DPP is smallest integer

$$-800(1+i)^{t} - 50(1+i)^{t-1} + 102.97088 \ s_{\overline{t-2}|} @ 7\% > 0$$

using interpolation

$$t = 18 \text{ yrs}$$

The balance is

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

$$= 9.77896$$

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Q13. (i) Let $x/12$ be the repayment monthly

$$X\, a_{\overline{25}|}^{(12)} = 9880 \text{ @ } 7\%$$

$i^{(12)} = 0.067850$

$a_{\overline{26}|} = 11.6536$

$$X(11.6536) \times \frac{0.07}{0.067850} = 9880$$

$$X = 821.7669096$$

$$X/12 = 68.4805758$$

monthly repayment = ₹ 68.4805758

(ii) Loan o/s after 10th March 2027 payment

$$X\, a_{\overline{34/3}|}^{(12)} = 821.7669096 \left(\frac{1-(1/1.07)^{34/3}}{0.067850}\right)$$

$$= 648574.5315$$

(iii) Loan o/s after 10 sep 2026 = $X\, a_{\overline{83/6}|}^{(12)}$ @ 7%

Loan o/s after 10 oct 2026 = $X\, a_{\overline{13.75}|}^{(12)}$ @ 7%

Capital repaid on 10 oct 2026

$$X\left[a_{\overline{83/6}|}^{(12)} - a_{\overline{55/4}|}^{(12)}\right] \text{ @ } 7\%$$

$$X\left[\frac{v^{13.75} - v^{83/6}}{i^{(12)}}\right] \text{ @ } 7\%$$

$$821.7669096\,(0.03268447611) = 26.85902023$$

(iv) Capital repayment continued in 12 installments.

$$X\left[a_{\overline{22/3}|}^{(12)} - a_{\overline{19/3}|}^{(12)}\right] \text{ @ } 7\%$$

$$821.7669096\left[\frac{v^{19/3} - v^{22/3}}{i^{(12)}}\right]$$

$$= 516.1973861$$