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(Assignment -2)

Q1) i) APR = $\frac{\text{average annual interest}}{\text{average loan amount}}$

$= \frac{2 \times \text{average annual int.}}{\text{original loan}}$

∴ original loan amount = ₹ 20000

$20000 = 12 \times 427.9 \; a^{(12)}_{\overline{5}|} \Rightarrow a^{(12)}_{\overline{5}|} = 3.8499$

Flat rate = $\frac{\text{total interest}}{\text{loan} \times \text{years}}$

$= \frac{5 \times 12 \times 427.9 - 20000}{20000 \times 5} = 5.67\%$

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

$i = 11\%$

$i = 10\% \; i$

Interpolating APR, I is $\frac{i - 10\%}{3.8499 - 3.90154} = \frac{11\% - 10\%}{3.87872 - 3.90154}$

$i = 10.8\%$

At 10.8%. $12 \times 427.9 \; a^{(12)}_{\overline{5}|} = 20000.2$

At 10.9%. $12 \times 427.9 \; a^{(12)}_{\overline{5}|} = 19958.2$

$i = 10.89$ is most close APR = 10.8%.

(ii) APR = 10.8%

After 1 year capital left to pay = $12 \times a_{\overline{4}|}^{(12)}$ 10.8% $\times 427.9$

$= 16775.98$

Let t denote the term of new loan

$16775.98 = 12 \times 274.4 a_{\overline{t}|}^{(12)}$

$16775.98 = 3293.80 \dfrac{(1 - 1.108^{-t})}{(12 \times 1.08^{1/12} - 1)}$

$1.108^{-t} = 0.4754$ $\quad t = 7.25$ years.

(iii) The original loan had 4 years of remaining payments.

Total int $= 4 \times 12 \times 427.9 - 16775.68$

$= 3763.22$

New loan has a term of 7.25 years hence

Total interest $= 7.25 \times 12 \times 274.4 - 16775.68$

$= 7104.65$

Amount to be paid $= 3341.23$

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Q2) i) a) Discounted payback period - It is the time t for which the present value of the upto time t exceeds the present value the last upto t.

b) Payback period :- Is same as the discount payback period, except the calculation for PV is carried out using an interest rate of 0.

ii) Unlike the the NPV, neither the PPP nor the pp give an indication how profitable a project is, as they ignore cashflows after the accumulated value is reached 0.
Balance of investors account changes from -ve to positive can always be calculated.

iii) Internal rate of return

IRR for Project A

$$-170000 - 20000v - 10000v^2 + 20000v + 20000v^2 + 200000v^3 = 0$$

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

$0.7 \rightarrow -16.1$

$1 \rightarrow 40$

$0.93 \rightarrow -0.479$

$0.94 \rightarrow 4.1538$

$0.9309 \rightarrow 0.0040$

$\therefore v = 0.9309$

$\frac{1}{1+i} = 0.9309$ $\quad i = 7.42421 = 7.4\%$

3)

b) BNPV are found by discounting the payments at 6%.

Project A NPV = $-170000 + 60000v^2 + 200000v^3 =$ 6823.82

Project B = $-200000 + 140000v + 200000v^6 = 9834.65$

c) Maxm interest rate by which projects are unprofitable, Each profitable if the rate of interest at which funds can be borrowed is less than the internal rate of return.

Project A requires a borrowing rate less 7.42292% and Project B requires a rate lower than 7%.

Other factors to be considered include:-

- Project A does not provide any net income during first year.
- The lower internal rate of return for Project B applies for longer period.
- Rate of interest available in years 4.106 (i.e. after Project A finished) will object the comparison between the accumulation.
- The risk associate with the receipt of income.

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3) Value of 1st November 1985 is

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

$v^{1/4} = 0.980944$

$a_{22} = 10.2007$

$d = 0.074074$

$= 200 \times v^{1/4} \times a_{22} \times \frac{i}{d}$

$= 2161.366301$

Annuity 2 = $320(1+i)^{1/12} \times a^{(4)}_{16.25|}$ at 8%.

$(1+i)^{1/12} = 1.006434$

$v^{16.25} = 0.958926$

$i^{(4)} = 0.077706$

$= 320 \times 1.006434 \times \underline{1-(0.925926)} \quad 0.077706$

$= 320 \times 1.006434 \times 9.184257$

$= 2957.870081$

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

$i^{(12)} = 0.072008$

$v = 0.925926$

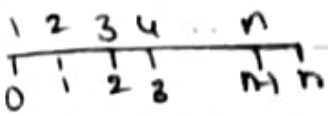
$= 180 \times 9.892578702$

$= 1780.6641.66$

$A = \frac{6887.90}{1.019427 \times 10.30886}$

$= 656.56$

4) $(I\ddot{a})_{\overline{n}|}$ for $i > 0$



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

Multiplying both sides by v

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

$(I\ddot{a})_{\overline{n}|} = (1+i)(Ia)_{\overline{n}|}$

$= (1+i)\dfrac{\ddot{a}_{\overline{n}|} - nv^n}{i}$

$= \dfrac{\ddot{a}_{\overline{n}|} - nv^n}{\frac{i}{1+i}}$

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

Subtracting

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

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

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

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

5) Time-weighted rate of return for each fund for the year 2014

Property fund: $\dfrac{16.4}{12.4} - 1 = 0.3226$ or 32.26

Equity fund: $\dfrac{15.5}{12.1} - 1 = 0.2810$ or 28.10%.

ii)

a) Assuming that the investor bough 100 units per quarter in property fund the equation of value is given by

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

Let $1+i = x$.

$1240(1+i) + 1310(1+i)^{3/4} + 1480(1+i)^{1/2} + 1580(1+i)^{1/4} - 6560 = 0$

1 → -95
1.2 → -29.51
1.3 → 2.145
1.29 → -0.991
1.3 → 2.145

1.293 → -0.
1.294 → 0.2638
1.2931 → -0.018
1.2932 → 0.0126...

∴ x ≈ 1.2932
1+i ≈ 1.2932
i ≈ 29.32%

b) Assuming that the investor purchases INR 100 worth of units quater $400 \times s_{\overline{1}|}^{(4)} = 100 \times 16.4\left(\frac{1}{12.4} + \frac{1}{13.1} + \frac{1}{14.8} + \frac{1}{15.}\right)$

$s_{\overline{1}|}^{(4)} = \frac{100 \times 4.720517\ldots}{400}$

$s_{\overline{1}|}^{(4)} = 1.1801$

$\frac{(1+i)^n - 1}{i^{(4)}} = 1.1801$

$\frac{(1+i)^n - 1}{i^{(4)}} \times \frac{i}{i} = 1.1801$

$\frac{(1+i)^n - 1}{i} \times \frac{i}{i^{(4)}} = 1.1801$

$\frac{i}{i^{(4)}} = 1.1801$

$\frac{i}{4[(1+i)^{1/4} - 1]} = 1.1801$

$\frac{i}{4[(1+i)^{1/4} - 1]} - 1.1801 = 0$

$i \to 2 \to -0.219$
$i \to 2.9 \to -0.0012$
$i \to 3 \to 0.08660\ldots$

$i \to 2.95 \to -0.001224$
$i \to 2.96 \to 0.0009567\ldots$
$i \to 2.956 \to 0.0000845\ldots$

$\therefore i = 2.956\%$

$1+x = 1.2979$

$i = 0.2979$ or 29.79%

$i^{(4)} = 4[(1+i)^{1/4} - 1]$

$\frac{(1+i)^1 - 1}{4(1-(1/1+i)^{1/4})} = 1.1801$

$\frac{x^1 - 1}{4(1-(1/x)^{1/4})} - 1.1801$

$i \to 1.8 \to -0.057$
$1.3 \to 0.0012$
$1.2978 \to -0.00003$
$1.2979 \to 0.000026$

$1.29 \to -0.004\ldots$
$1.297 \to -0.0005$
$1.298 \to 0.000084$