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Financial Management Assignment - 2

Q.1. (i) Loan amount : 20000

Monthly payment (arrears) = 427.90

Time : 5 years

$$20000 = (12)(427.9)\, a^{(12)}_{\overline{5}|} \text{ @ } i$$

$$a^{(12)}_{\overline{5}|} = 3.8949910242$$

$$\frac{1-v^5}{i^{(12)}} = 3.89499$$

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

if $i = 10\%$; LHS = 3.96154

$i = 11\%$; LHS = 3.87872

∴ By ~~interpolating~~ interpolating,

$i = 10.8\%$

So, APR = 10.8%

(ii) $PV_1 = 427.9 \times 12\, a^{(12)}_{\overline{4}|} \text{ @ } i = 10.8\%$

$$= 427.9(12)\frac{1-(1.108)^{-4}}{(12)[0.008583007]}$$

$PV_1 = 16775.97728$

$16775.97728 = (12)(274.49)\, a^{(12)}_{\overline{T}|} \text{ @ } 10.8\%$

$$\frac{1-v^{-T}}{(12)(0.008583007)} = 5.09307$$

$(1.08)^{-T} = 0.475433238$

$T = 7.2499$ years

(iii) Interest paid in I^{st} loan = 3763.22
Interest paid in II^{nd} loan : 7104.3233
Interest paid more : 3341.43

Q.2. (b) Payback period - It is the number of years necessary to recover funds invested in project without considering the interest at all both on the borrowing & investing.

(a) Discounted Payback Period - Discounted Payback Period is the number of years after which the cumulative discounted cash inflows cover the initial installment.

(ii) Unlike the NPV, neither the DPP nor the PP gives any indication of how profitable a project is, as they ~~ignore~~ ignore cash flows after the accumulated value of zero is reached.

The PP can give misleading results, as it does not take into account the time value of money.
Hence, NPV is a superior measure as compared to DPP or PP.

(iii) a] Project A

$$PV \text{ of outlay} = \cancel{170} - 170 - 20v - 10v^2$$
$$PV \text{ of inlay} = 20v + 20v^2 + 200v^3$$
$$NPV = -170 - 20v - 10v^2 + 20v + 20v^2 + 200v^3$$
$$0 = -170 + 10v^2 + 200v^3$$
$$IRR \Rightarrow 0 = -170 + 10v^2 + 200v^3$$
$$-170 + 10(1+i)^{-2} + 200(1+i)^{-3} = 0$$
$$170 = 10(1+i)^{-2} + 200(1+i)^{-3}$$
at $i = 0.07$; LHS = 171.99
$i = 0.08$; LHS = 167.33
So by interpolating ; $i = 7.4\%$

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Project B

PV of outlay = 200

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

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

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

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

at $i = 0.07$, LHS = 200

So, By interpolating,

$i = 7\%$

b) $NPV_A = -170 + 10v^2 + 200v^3$

At $d = 6\%$

$NPV_A = -170 + 10(1-0.06)^2 + 200(1-0.06)^3$

$NPV_A = 4.9528$

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

$= -200 + 14\left(\frac{1-(0.94)^6}{0.06}\right)(0.94) + 200(0.94)^6$

$NPV_B = 5.9958509$

c] So Project A would be profitable if the borrowing rate is less than 7.4% & for Project B, the interest rate should be less than 7%

Other factors –
1) Project A (no net income during FY)
2) Comparison time period
3) lower IRR for Project B for longer period
4) The rates of interest available in years 4 to 6 (i.e after Project A has finished) will affect the comparison between the accumulated profits at the end of the year 6 (i.e. when Project B finishes)

Q 3. PV of annuity 1 = $200\ \ddot{a}_{\overline{22}|}\ v^{(3/12)}$

$= (1.08)^{-1/4}\ (200)(10.2007)\ \frac{0.08}{0.074074}$

$= 2161.365534$

PV of annuity 2 $= 320\ \ddot{a}^{(4)}_{\overline{16.25}|} \times v^{1/6}$

$= 320 \cdot \frac{1-v^{16.25}}{i} \times \frac{1}{d^{(4)}}$

$= 320\left(\frac{1-(1.08)^{-16.25}}{0.08}\right)(1.049519)(1.08)^{-1/6}$

$= 2996.048870$

PV of annuity 3 $= 15\ \ddot{a}_{\overline{226}|}$ @ $\frac{d^{(12)}}{12} = 0.006392917$

$= 15\left(\frac{1-(1.08)^{-226/12}}{0.006392917}\right)$

$= 1795.651419$

Total PV = 6953.065823

Revised annuity = 6953.065823 = $x \, \ddot{a}^{(2)}_{\overline{21.5}|}$ @ $d^{(2)}$

$$6953.065823 = x \left(\frac{1-(1.08)^{-21.5}}{0.08} \right) (1.059615)$$

$$x = 649.0135657$$

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

Proof →

$$PV = 1 + 2v + 3v^2 + \dots + nv^{n-1} \quad \text{(i)}$$

$$(1-d)(PV) = v + 2v^2 + 3v^3 + \dots + (n-1)v^{n-1} \quad \text{(ii)}$$

(i) − (ii)

$$PV - (1-d).PV = 1 + v + v^2 + v^3 + \dots + v^{n-1} - nv^n$$

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

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

Q.5 (i) For property fund

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

TWRR = i = 32.2580645 %

For equity fund,

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

TWRR = i = 28.0991736 %

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(ii) a] ~~?~~ $12.4(1+i) + 13.1(1+i)^{3/4} + 14.8(1+i)^{1/2} + 15.8(1+i)^{1/4} = 4(16.4)$

$i = 29.32\%$

(iii) $(12.1)(1+i) + 9.2(1+i)^{3/4} + 10.3(1+i)^{1/2} + 13.1(1+i)^{1/4} = 4(15.5)$

$i = 67.31\%$

Q.6 (i) $160000 = X\, a_{\overline{10}|} @ 8\%$

$X = \dfrac{160000}{6.7107}$

$= 23844.65201$

(ii) $PV_4 = 23844.65201\, a_{\overline{6}|} @ 8\%$

$= 23844.65201\,(4.6229)$

$= 110231.4422$

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

$x' = \dfrac{110231.4422}{4.3553}$

$= 25309.72428$

(iii) $PV_2 = 25309.72428\, a_{\overline{3}|} @ 10\%$

$= \cancel{23}\,25309.72428\,(2.4869)$

$= 62942.75331$

$62942.75331 = x''\, a_{\overline{3}|} @ 9\%$

$x'' = \dfrac{62942.75331}{2.5313}$

$= 24865.78174$

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

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

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

$$\therefore 0 = \frac{1-v^{10}}{-\ln(v)}(0.25v) + 0.2v^2 + 0.1v^3) + 0.1v^3 - 2.7 - 0.2\left(\frac{1-v^3}{v^{-1}-1}\right)$$

$$i = 9.3\%$$

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

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

$$= 1.0089$$

Q.9 (i) $$(1+i)^3 = \frac{33}{30.5} \times \frac{38.5}{33+6} \times \frac{41.05-4.5}{38.5} \times \frac{45}{41.05} \times \frac{45.6}{45} \times \frac{47}{45.5-2.5}$$

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

$$i = 7.0951\% = TWRR$$

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

at $i = 7\%$; 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 : $37.5(1+i) + 4.5(1+i)^{0.5} = 45$

$$i = 4.92\%$$

$2013 = 45(1+i) - 2.5(1+i)^{0.5} = 47$

$i = 10.276\%$

$(1+i)^3 = 1.06266 \times 1.0492 \times 1.10276$

$i = 7.13\%$

(iii) TWRR eliminates the effect of the cashflow amount & timing & therefore gives a fairer basis for assessing the investment performance for the fund.

MWRR is sensitive to the amount & timing of the net cashflows

Q.11 (i) $PV = 180000\, a_{\overline{15}|} + 20000\, (Ia)_{\overline{15}|}$ @ 12%

$= 180000\,(6.8109) + 20000\,(40.7313)$

$= 2040588$

$\therefore$ Total cost of house $= \dfrac{2040588}{0.8}$

$= 2550735$

(ii) $PV_9 = 340000\, a_{\overline{7}|} + 20000\, (Ia)_{\overline{7}|}$ @ 12%

$= 340000\,(4.5638) + 20000\left(\dfrac{5.1114 - 7 \times 0.45235}{0.12}\right)$

$= 1875850.33$

Year	Loan	Payment	Interest	Capital repayment
9	1875850.33	360000	225102.04	134897.96
10	1740952.37	380000	208914.28	171085.72
11	1569866.65			

(iii) $1569866.65 = x\,a_{\overline{5}|}$ @ 10%

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

$$= 414126.87$$

Total installments less loan outstandings at the end of 10^{th} year $= 630133.35$

Extra payment made $= 5(414126.87) + 0.01(1569866.05)$
$- 1569866.65$
$= 516486.35$

Q11 (i) $TWRR = (1+i)^2 = \frac{500}{460} \times \frac{550-50}{550+40} \times \frac{600}{550} \times \frac{x}{600}$

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

$$x = 786.9312$$

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

$i = 30.909\%$

Q12 (i) Discounted Payback Period (DPP) is the number of years after which the cumulative discounted cash inflows cover the initial investment.

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

$t = 17.767$

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

$$100\left(\frac{(1.06)^{4.233}-1}{\ln(1.06)}\right) = 480$$

(iii) $-800(1+i)^{t} - 50(1+i)^{t-1} + 102.971\, s_{\overline{t-2}|}$ @ 7% $= 0$ $\quad t = 18$

$$-800(1+i)^{18} - 50(1+i)^{17} + 102.971\, s_{\overline{16}|} \text{ @ } 7\% = 0$$

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

$= 462.79 \rightarrow$ Accumulated amount after 22 years.

Q.13 (i) $988000 = X(12)\, a^{(12)}_{\overline{15}|}$ @ 7%

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

$X = 6848 \Rightarrow$ monthly payment

(ii) $X a^{(12)}_{\overline{34/3}|} = 6848\left(a^{(12)}_{\overline{34/3}|} \text{ @ } 7\%\right)$

$= 648620$

(iii) PV after 10th september's payment $= X a^{(12)}_{\overline{83/6}|}$ @ 7%

PV after 10th october's payment $= X a^{(12)}_{\overline{13.75}|}$ @ 7%

Capital required $\Rightarrow X a^{(12)}_{\overline{13.75}|} - X a^{(12)}_{\overline{83/6}|}$

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

$= 26.86$

(iv) Capital repayment in these 12 installments →

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

$= 516.2$

∴ Total interest in these 12 installments →

$12x - 51620$

$= 30556$