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Assignment - 2

Q1.

time = 5 years
payments = Rs 427.90
loan = Rs 20,000

(i)

$$20000 = 427.90\, a_{\overline{60}|}^{(12)}\ @\ i^{(12)}$$

$$\frac{1 - v^{60}}{\frac{i^{(12)}}{12}} = 46.7398924982$$

$$\frac{1 - \left(\frac{12}{12 + i^{(12)}}\right)^{60}}{i^{(12)}} = 8.8949916415$$

$$1 - \left(\frac{12}{12+i^{(12)}}\right)^{60} - 3.8949916415\, i^{(12)} = 0$$

$$i^{(12)} = 0.103 = 10.3\%$$

$$i = \left[1 + \frac{i^{(12)}}{12}\right]^{12} - 1 = 10.8004303\%$$

(ii)

$$20000 = 274.49\, a_{\overline{n}|}^{}\ @\ 10.3\%$$

$$\frac{1 - \left(\frac{12}{12+10.8\%}\right)^{n}}{10.3\%} = 6.071867$$

$$1 - \left(\frac{12}{12+10.3\%}\right)^{n} = 0.693630719$$

$$\ln(0.30689281) = n \ln(0.991489713)$$

$$n =$$

$$(0.9914898)^n = 0.374598$$

$$n = \frac{\ln(0.374598)}{\ln(0.9914898)} \times \frac{1}{12}$$

$n = 9.58$ years

(iii) Intrust in (i) = $(427.90)(60) - 20000$
= Rs 5,674

~~Intrust in (ii) = (247.49)(12) - 20000~~
~~= Rs~~

Intrust in (ii) = $(247.49)(114.88) - 20000$
= Rs 11,533.4112

Q2. (i)(a) Discounted Payback period → It is the number of years after which the cumulative discounted cashflow covers the initial installment.

(b) Payback Period → It is the no. of years necessary to recover funds invested in project without considering the intrust at all on the borrowing & investment.

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Q3.

Annuity - 1

Payment = 200
$i = 8\%$

$PV = 200\ \ddot{a}_{\overline{22}|}\ v^{3/12}$

$= 200 \times a_{\overline{22}|} \times \frac{i}{d} \times (1+8\%)^{-3/12}$

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

$= Rs.\ 2161.365534$

Annuity - 2

Payment = 320
$i = 8\%$

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

$= 320 \left(\frac{1-v^{16.25}}{d^{(4)}}\right) \times (1+8\%)^{-1/6}$

$= 320 \times 9.362701197 \times 0.987255$
$= Rs.\ 2957.879762$

Annuity - 3

Payment = 180
$i = 8\%$

$$PV = \frac{180}{12}\, \ddot{a}_{\overline{226}|}\, @\, d^{(12)}/12$$

$$= 15\, \frac{(1 - v^{226/12})}{d^{(12)}/12}$$

$$= 15 \times 119.7100946$$

$$= Rs.\ 1795.651419$$

⇒ Total of 3 annuities = Rs. 6953.065823

→ Revised annuity:-

Let the payment = x

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

$$6953.065823 = x\, a_{\overline{21.5}|} \times \frac{i}{d^{(2)}}$$

$$6953.065823 = x \times 10.10875 \times \frac{1.059615}{1.019}$$

$$x = \frac{6953.065823}{10.71138313}$$

$$x = Rs.\ 649.1286641$$

Q4. $I\, \ddot{a}_{\overline{n}|}$, $i > 0$

T.P → $I\, \ddot{a}_{\overline{n}|} = \frac{\ddot{a}_{\overline{n}|} - nv^n}{d}$

Proof:-

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

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

$$(1-d)PV = v + 2v^2 + 3v^3 + \ldots + nv^n \rightarrow (2)$$

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→ subtracting (2) from (1), we get :-

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

$$\because \ddot{a}^{(m)}_{\overline{n}|} = 1 + v + v^2 + \dots$$

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

→ Hence, proved

Qs (i) WTWRR for property fund :-

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

$$1+i = 1.322580645$$

$$i = 32.258064\%$$

(b) TWRR for equity fund :-

$$1+i = \frac{9.2}{12.1} \times \frac{10.3}{9.2} \times \frac{13.1}{10.5} \times \frac{15.1}{13.1}$$

$$1+i = 1.280991736$$

$$i = 28.0991736\%$$

(ii.) Project A (Property fund)

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

i.e.

$12.4(1+i) + 13.1(1+i)^{3/4} + 14.8(1+i)^{1/2} + (1+i)^{1/4}(15.8) - 65.6 = 0$

$\Rightarrow i = 29.32\%$

Project B (Equity fund)

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

$12.1(1+i) + 9.2(1+i)^{3/4} + 10.3(1+i)^{1/2} + 13.1(1+i)^{1/4} + 62 = 0$

$\Rightarrow i = 67.81\%$

Q6.

Loan = 160000

i = 8% p.a.

t = 10 years

Let initial payment = x

(a.) $160000 = x\, a_{\overline{10}|} @ 8\%$

$x = \frac{160000}{6.7101} = Rs.\ 23844.65209$

(b.) Loan o/s at $t = 4$

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

$= 23844.65209 \times 4.6229$

$= Rs.\ 110231.4422$

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Let revised payment = y

$$110231.4422 = y\, a_{\overline{7}|}@10\%$$

$$y = \frac{110231.4422}{4.8553} = Rs.\ 25309.72428$$

(C.) $PV_7 = y\, a_{\overline{8}|}@10\%$

$PV_7 = 25309.72428 \times 5.3349$

$= Rs.\ 62942.75331$

Let the final amt = z

$PV_7 = z\, a_{\overline{3}|}@9\%$

$62942.75331 = z \times 2.5771$

$z = Rs.\ 24865.78174$

Q8. The present value of outlay is:

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

Expected PV of income is:

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

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Equating the PV of outlay to that of income:-

$$2.07 + 0.2\,a_{\overline{3}|} = 0.1v^3 + a_{\overline{10}|}(0.25v + 0.2v^2 + 0.1v^3)$$

$$\Rightarrow i = 9.3\%$$

(ii) $NPV = (0.1v^3 + 0.85\,a_{\overline{10}|}v^3 - 2.07 - 0.2\,a_{\overline{3}|})$ @ 10%

$= 0.1(0.7513) + 0.85(0.7513)(6.4469) - 2.07 - 0.2(2.486836)$

$= 1.0089$

$\therefore$ NPV is +ve

$\therefore$ It is worth to invest in the project

Q9 (i) TWRR

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

$(1+i)^3 = 1.228313$

$1+i = 1.070351$

$i = 7.0951\%$

MWRR

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

$\Rightarrow i = 7.206\% =$ MWRR

(ii) LRR:-

Year 2011 → eq. of value

$30.5(1+i) + 6(1+i)^{0.25} = 38.50$

$\Rightarrow i = 6.266\% \rightarrow (1)$

Year 2012 → $38.5(1+i) + 4.5(1+i)^{0.5} = 45$

$\Rightarrow i = 4.92\% \rightarrow (2)$

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

$\Rightarrow i = 10.276\% \rightarrow (3)$

LRR $\Rightarrow (1+i)^3 = (1+0.06266)(1+0.0492)(1+0.10276)$

$\Rightarrow i = 7.13\%$

Q10. (i) Let the loan amt = L

$L = [180K\ a_{\overline{15}|} + 20K\ (I a_{\overline{15}|})]$ @ 12%

$L = Rs.2050588$

$\Rightarrow$ Total cost of the house = $\frac{2050588}{80\%}$

$= Rs.2550835$

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

$L = (180Kv + 180Kv^2 + \dots + 180Kv^7) + (180Kv + 20Kv^7)$

$L(9) = [340K\ a_{\overline{7}|} + 20K\ (Ia_{\overline{7}|})]$ @ 7%

$L(9) = Rs.1875850.33$

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Loan schedule :-

Year	Loan O/S	Loan Inst.	Interest	Cap. Repayment
9	1375850.33	360000	225102.04	134897.98
10	1740852.87	380000	208914.28	171085.72
11	1569866.65			