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FM Assigment - 1

1) $i^{(4)} = 8\%$

~~ii) $i = p[(1+$~~

ii) $i = \left(1+\frac{i^{(p)}}{p}\right)^{p} - 1$

$= \left(1+\frac{\cancel{0.08}^{\,0.02}}{\cancel{4}}\right)^{4} - 1$

$= (1.02)^{4} - 1$

$= 1.08243216 - 1$

$= 0.08243216$

$= 8.243216\%$

i) $\delta = \ln(1+i)$

$= \ln(1+0.08243216)$

$= 0.079210509$

$= 7.9210509\%$

~~iii) $i^{(12)} = 12[(1+i)^{1/12} - 1]$~~

~~$= 12[(1.08243)^{1/12} - 1]$~~

~~$=$~~

iii) $d^{(12)} = 12[1 - (1+i)^{-1/p}]$

$= 12[1 - (1.08243)^{-1/12}]$

$= 12[0.006579138]$

$= 0.078949654$

$= 7.8949654\%$

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2) $\delta(t) = 0.004t + 0.0002t^2$

i) $PV_0 = 1000$

$AV_{10} = PV \cdot A(0,10)$

$A(0,10) = e^{\int_0^{10} 0.004t + 0.0002t^2 \, dt}$

$= e^{\left(0.004\frac{t^2}{2} + 0.0002\frac{t^3}{3}\right)_0^{10}}$

$= e^{\left(0.002(100) + \frac{0.0002(1000)}{3}\right)}$

$= e^{\left(0.2 + \frac{0.2}{3}\right)}$

$= e^{0.26666667}$

$= 1.305605172$

$AV_{10} = 1000 \cdot (1.305605172)$

$= ₹1305.605172$

ii) $i = \frac{A(10) - A(0)}{A(0) \cdot 10} = \frac{1305.605172 - 1000}{1000 \cdot 10}$

$= \frac{305.605172}{1000 \cdot 10} = 0.0305605172$

$= 3.05605172\%$

$\delta = \ln(1+i) = \ln(1 + 0.0305605172)$

$= 0.030102846$

$= 3.0102846\%$

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i) $\frac{1}{1-d} = 1+i$

$1-d = \frac{1}{1+i}$

$d = 1 - \frac{1}{1+i}$

$= \frac{\cancel{1}+i-\cancel{1}}{1+i} = \frac{i}{1+i}$

$v = \frac{1}{1+i}$

$d = \frac{i}{1+i} = i \cdot \frac{1}{1+i} = iv$

ii)

a) $\frac{d^{(4)}}{4} = 0.0225$

$d^{(4)} = 0.09$

$\cancel{\left(1+\frac{i^{(2)}}{2}\right)^2 = \left(1 - \frac{d^{(4)}}{4}\right)}$

$d = \cancel{\left(1-\frac{d^{(4)}}{4}\right)}\ 1 - \left(1 - \frac{d^{(4)}}{4}\right)^4$

$= 1 - (1-0.0225)^4$

$= 1 - (0.9775)^4$

$= 1 - 0.912992194$

$= 0.087007806$

$d^{(2)} = 2(1 - (1-0.087007806)^{1/2})$

$= 0.0889875$

$= 8.89875\%$

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b) $d^{(0.5)} = 0.05$

$d = 1 - (1 - \underset{0.5}{\underline{0.05}})^{0.5}$

$= 1 - 0.948683298$

$= 0.051316702$

$= 5.1316702\%$

$d^{(2)} = p[1 - (1-d)^{1/p}]$

$= 2[1 - (1 - 0.05131)^{\frac{1}{2}}]$

$= 0.051992507$

$= 5.1992507\%$

~~d = 0.05~~

~~$n = \frac{91}{365}$~~

4 $i = 0.08$

a) $d^{(12)} = p[1 - (1+i)^{-1/p}]$

$= 12[1 - (1.08)^{-1/12}]$

$= 0.076714776 = 7.6714776\%$

b) $i^{(365)} = p[(1+i)^{1/p} - 1]$

$= 365[(1+i)^{1/365} - 1]$

$= 0.076969155 = 7.6989155\%$

c) $\delta = \ln(1+i) = \ln(1.08) = 0.076961041 = 7.6961041\%$

d) $i^{(0.5)} = 0.5[(1.08)^{0.5} - 1] = 0.0832 = 8.32\%$

5) i) $d^{(4)} = 0.06$

$$d = 1 - \left(1 - \frac{\cancel{0.06}^{\,0.015}}{4}\right)^4$$

$$= 0.058663449$$

$$= 5.8663449\%$$

$$i = \frac{d}{1-d} = 0.062319315 = 6.2319315\%$$

a) $$i^{(2)} = 2\left[(1+i)^{1/2} - 1\right]$$

$$= 0.061377516 = 6.1377516\%$$

b) $$d^{(12)} = p\left[1 - (1-d)^{1/p}\right]$$

$$= 12\left[1 - (1 - 0.058663449)^{1/12}\right]$$

$$= 0.060302525 = 6.0302525\%$$

ii) $PV_0 = 2{,}00{,}000$

$AV_1 = 2{,}20{,}000$

$$i = \frac{2{,}20{,}000 - 2{,}00{,}000}{200000} = \frac{20{,}000}{2{,}00{,}000} = 0.10$$

$$AV(0, 93/365) = 2{,}00{,}000\,(1+i)^n$$

$$= 2{,}00{,}000\,(1+0.1)^{93/365}$$

$$= 2{,}00{,}000\,(1.1)^{93/365}$$

$$= 2{,}00{,}000\,(1.024581782)$$

$$= 2{,}04{,}916.3564$$

7) $PV = ₹20,000$

$AV_{17} = ₹26000$.

$A(0,17) = \frac{26,000}{20,000} = 1.3$.

$$\left(1 + \frac{i^{(12)}}{12}\right)^{17} = 1.3$$

$$1 + \frac{i^{(12)}}{12} = \sqrt[17]{1.3} = 1.015552899$$

$$\frac{i^{(12)}}{12} = 0.015552899$$

$$i^{(12)} = 0.186634785 = 18.6634785\%$$

$$A(0,17) = (1+i)^{17/12}$$

$$1.3 = (1+i)^{17/12}$$

$$1+i = 1.203457067$$

$$i = 0.203457067 = 20.3457067\%$$

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

$= 0.189552546 = 18.9552546\%$

ii) $d^{(2)} = 2[1 - (1+i)^{-1/2}]$

$= 0.176882353 = 17.6882353\%$

iii) $1.3 = \left(1 + \frac{17}{12} i\right)$

$$0.3 \times \frac{12}{17} = i$$

$i = 0.211764706 = 21.1764706\%$

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i) Force of interest refers to nominal ~~rate~~ interest rate or discount rate compounded continuously (infinite no. of time) per time period

ii) $i^{(2)} = 0.0775$

$$i = \left(1 + \frac{i^{(2)}}{2}\right)^2 - 1$$

$$= \left(1 + \frac{0.0775}{2}\right)^2 - 1$$

$$= 0.079001563$$

$$= 7.9001563\%$$

$\delta = \ln(1+i) = \ln(1+0.079001) = 0.076036134$

$= 7.6036134\%$

$d^{(12)} = 12\left[1 - (1+i)^{-1/12}\right]$

$= 0.075795747 = 7.5795747\%$

$i^{(0.5)} = 0.5\left[(1+i)^{1/0.5} - 1\right]$

$= 0.082122186$

$= 8.2122186\%$

10) $\delta(t) = 0.08$ for $0 \le t \le 5$
$= 0.06$ for $5 \le t \le 10$
$= 0.04$ for $t \ge 10$

$v(t) = e^{-\delta}$

$$\boxed{\begin{aligned} v(t) &= e^{-0.08} = 0.923116346, \quad 0 \le t \le 5 \\ &= e^{-0.06} = 0.941764534, \quad 5 \le t \le 10 \\ &= e^{-0.04} = 0.960789439, \quad t \ge 10 \end{aligned}}$$

11)

a) $AV_9 = 50000$
$d = 18\%$
$PV_0 = 50000(1-0.18)^{9/12}$
$= 50000(0.82)^{9/12}$
$= 50000(0.861768525)$
$= 43085.42623$

b)
i) $\delta = 0.06$
$d = 1 - e^{-0.06}$
$= 1 - 0.941764534$
$= 0.058235466$.
$d^{(12)} = 12[1-(1-d)^{1/12}]$
$= 0.05985025$
$= 5.985025\%$

ii) $d^{(4)} = 6\%$

$d = 1 - \left(1 - \frac{0.06}{4}\right)^4$

$= 0.058663449$

$i = \frac{d}{1-d} = 0.062319315$

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

$= \underline{0.060607088}$

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

$= 0.060913705$ //

c] $i, d, i^{(4)}, \delta$

$i > i^{(4)} > \delta > d$ //

12) $PV = 7049$

$i^{(12)} = 0.06$

$AV_2 = 7049 \left(1 + \frac{0.06}{12}\right)^{24}$

$= 7049 \times 1.127159776$

$= 7945.349262$

$AV_{4.5} = 7945.349262 (1 + 10^{+0.015})$

$= 9137.151652$

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$$AV_6 = 9137.151652\left(1 - \frac{0.06}{12}\right)^{-18}$$

$$= 9999.893613$$

13) $PV_0 = 1$

$AV_n = 2$

i) $i = 0.1$

$A(0,n) = (1.1)^n$

$AV_n = 1.(1.1)^n$

$2 = (1.1)^n$

$\log 2 = n \log 1.1$

$n = \frac{\log 2}{\log 1.1} = 7.272540897$ years.

ii) $d^{(12)} = 0.1$

$A(0,n) = (0.99)^{-n}$

$2 = (0.99)^{-n}$

$\log 2 = -n \log(0.99)$

$-\frac{\log 2}{\log(0.99)} = n$

$n = 68.96756394$ years.