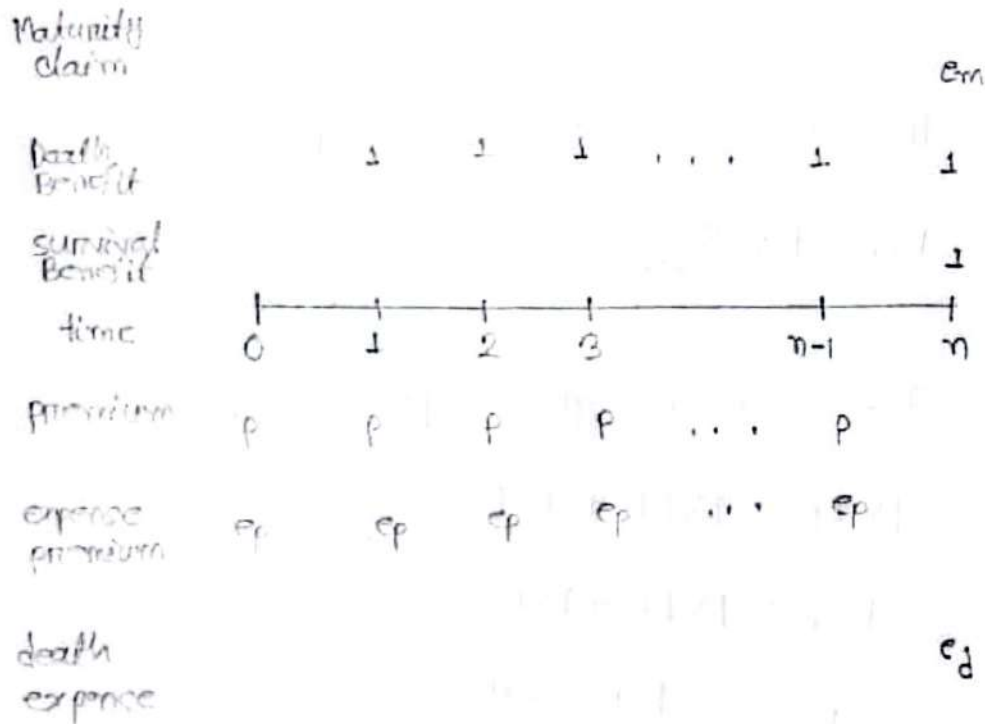


Answer to the question no 1(a)

The cash flow diagram for n -year endowment insurance policy,



We know,

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

The steps to derive the annual gross premium per policy for n -year endowment is given below:

Step 1: The present value of Death Benefit:

$$PVDB = A \frac{1}{x:n} \quad [\because F=1]$$

Step 2: Present value of expense,

$$PVE = e_0 + e_p \left[1 + \frac{l_{x+1}}{l_x} v + \dots + \frac{l_{x+n-1}}{l_x} v^{n-1} \right] + e_m \frac{l_{x+n}}{l_x} v^n$$

Step 3: Present value of future premiums,

$$PVP = P \times \ddot{a}_{\overline{x:n}|}$$

Step 4: The annual gross premium:

$$PVTE = PVDB + PVE$$

$$\Rightarrow PVP = PVDB + PVE$$

$$\Rightarrow P = \frac{PVDB + PVE}{\ddot{a}_{\overline{x:n}|}}$$

Here, the cash flow is an in-flow insurance policy because the policyholder must pay the annual gross premium at the beginning of each year with the additional expenses for the next n th years to maintain the life insurance coverage.

Answer to the question no 1 (b)

Given,

$$i = 0.05$$

$$n = 3$$

$$x = 55$$

$$\therefore v = \frac{1}{1+0.05} = 0.95238$$

$$A \frac{1}{x:n} = \sum_{t=0}^{n-1} \frac{d_{x+t} v^{t+1}}{l_x}$$

$$\therefore A \frac{1}{55:3} = \sum_{t=0}^2 \frac{d_{x+t} v^{t+1}}{l_x}$$

$$= \frac{1}{l_{55}} [d_{55} v + d_{56} v^2 + d_{57} v^3]$$

$$= \frac{1}{8640863} [77426 \times 0.95238 + 89527 \times (0.95238)^2 + 90082 \times (0.95238)^3]$$

$$= 0.026307$$

$$\therefore \text{Present value of death benefit} = 1000 \times 0.026307 \\ = 26.307$$

$$\therefore \ddot{a}_{\overline{x:\infty}|} = 1 + \sum_{t=1}^{\infty} \frac{l_{x+t}}{l_x} v^t$$

$$= 1 + \sum_{t=1}^3 \frac{l_{x+t}}{l_x} v^t$$

$$= 1 + \frac{l_{56}}{l_{55}} v + \frac{l_{57}}{l_{55}} v^2 + \frac{l_{58}}{l_{55}} v^3$$

$$= 1 + \frac{8563435}{8640863} (0.95238) + \frac{8479908}{8640863} \times (0.95238)^2$$

$$+ \frac{8389826}{8640863} \times (0.95238)^3$$

$$= 1 + 0.94385 + 0.89013 + 0.83874$$

$$= 3.6727$$

$$\therefore p = \frac{PVDB}{\ddot{a}_{\overline{x:\infty}|}} = \frac{26.307}{3.6727}$$

$$= 7.163$$

(Ans)