Answer to the question no 1 (a)

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

Maturity claim							e_m
Death Benefit		1	1	1	. . .	1	1
survival Benefit							1
time	0	1	2	3		n-1	n
premium	P	P	P	P	. . .	P	
expense premium	e_p	e_p	e_p	e_p	. . .	e_p	
death expence							e_d

We know,

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

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

<u>step 1:</u> The present value of Death Benifit:

$$PVDB = A^{\;\;1}_{x:\overline{n}|} \quad [\because F = 1]$$

Step 2: Present value of expense,

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

Step 3: Present value of future premiums,

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

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 beggining of each year with the additional expenses for the next n^{th} years to maintain the life insurance converage.

Answer to the question no 1 (b)

Given,

$i = 0.05$ $\quad$ $n = 3$

$x = 55$

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

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

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

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

$$= \frac{1}{8640863}\left[77426 \times 0.95238 + 83527 \times (0.95238)^2 + 90082 \times (0.95238)^3\right]$$

$$= 0.026307$$

$\therefore$ Present value of death benefit $= 1000 \times 0.026307$

$= 26.307$

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

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

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

$$= 1 + \frac{8563495}{8640863}(0.95238) + \frac{8479908}{8640863} \times (0.95238)^2$$

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

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

$$= 3.6727$$

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

$$= 7.163$$

(Ans)