

# CHAPTER#4

## LIFE ANNUITIES(PART2)

# SUMMARY

## X Whole life annuity-due

A whole life due annuity is a series payments made at the beginning of the year while an individual is alive.

## X n-year temporary annuity

A due n-year term annuity guarantees payments made at the beginning of the year while an individual is alive for at most n payments.

## X n-year deferred annuity

A due n-year deferred annuity guarantees payments made at the beginning of the year while an individual is alive starting in n years.

## X n-year certain annuity

A n-year certain due life annuity pays at the beginning of the year while either the individual is alive or the number of payments does not exceed n.



# EXAMPLES

X For a three-year temporary life annuity due of 100 on (75), you are given:

(i)  $\int_0^x \mu(t)dt = 0.01x^{1.2}, x > 0$

(ii)  $i = 0.11$

Calculate the actuarial present value of this annuity.

$$\ddot{a}_{x:\overline{n}|} = \sum_{k=0}^{n-1} v^k {}_k p_x$$

(A) 264

(B) 266

(C) 268

(D) 270

(E) 272



X For a special 3-year temporary life annuity-due on (x), you are given: (i)

$t$	Annuity Payment	$p_{x+t}$
0	15	0.95
1	20	0.90
2	25	0.85

(ii)  $i = 0.06$

Calculate the variance of the present value random variable for this annuity.

(A) 91

(B) 102

(C) 114

(D) 127

(E) 139



- X A person age 40 wins 10,000 in the actuarial lottery. Rather than receiving the money at once, the winner is offered the actuarially equivalent option of receiving an annual payment of  $K$  (at the beginning of each year) guaranteed for 10 years and continuing thereafter for life.

You are given:

- (i)  $i = 0.04$
- (ii)  $A_{40} = 0.30$
- (iii)  $A_{50} = 0.35$
- (iv)  $A^1_{\overline{40:10}|} = 0.09$

Calculate  $K$ .

- (A) 538 (B) 541 (C) 545 (D) 548 (E) 551

X for a whole life annuity due of 1 on (x) payable annually:

- $q_x = 0.01$
- $q_{x+1} = 0.05$
- $i = 0.05$
- $\ddot{a}_{x+1} = 6.951$

Calculate the change in the actuarial present value of this annuity due if  $p_{x+1}$  is increased by 0.03.

$$\ddot{a}_{x:\overline{n}|} = 1 + v p_x \ddot{a}_{x+1:\overline{n-1}|}$$

- (A) 0.16
- (B) 0.17
- (C) 0.18
- (D) 0.19
- (E) 0.20



X For a 1-year term insurance on (66.2), you are given:

(i) The insurance pays 10, 000 at the end of the half-year of death.

(ii)  $q_{66} = 0.06$  and  $q_{67} = 0.08$ .

(iii) Mortality is uniformly distributed between integral ages.

(iv)  $i = 0.03$ .

Calculate the expected present value of the insurance.

We assume that  $i = 0.06$  and  $\mu = \ln(1.02)$  for  $t > 0$ , calculate  $A_x^{(4)}$

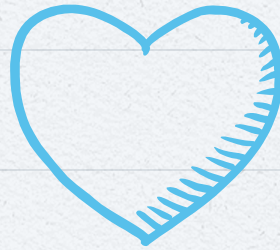
1/mthly Insurance

$$K_x^{(m)} = \frac{1}{m} [mT_x]$$

$$\Pr [K_x^{(m)} = r] = {}_r p_x \cdot \frac{1}{m} q_{x+r} = {}_r | \frac{1}{m} q_x$$

$$A_x^{(m)} = \sum_{k=0}^{\infty} v^{(k+1)/m} \cdot \frac{k}{m} | \frac{1}{m} q_x$$





# THANKS!

Any questions?