

MATH 3631
Actuarial Mathematics II
Class Test 1 - 3:35-4:50 PM
Wednesday, 19 February 2020
Time Allowed: 1 hour and 15 minutes
Total Marks: 100 points

Please write your name and student number at the spaces provided:

Name: _____ Student ID: _____

- There are ten (10) written-answer questions here and you are to answer all ten. Each question is worth 10 points.
- Please provide details of your workings in the appropriate spaces provided; partial points will be granted.
- Please write legibly.
- Anyone caught writing after time has expired will be given a mark of zero.

Question No. 1:

For a fully discrete whole life insurance of 10 issued to (50) , you are given:

- Mortality follows the **Survival Ultimate Life Table**.
- $i = 0.05$
- L_{10} is the prospective loss random variable at the end of year 10.

Calculate $E[L_{10}]$.

Question No. 2:

For a fully discrete whole life insurance of 10 issued to (50) , you are given:

- Mortality follows the Survival Ultimate Life Table.
- $i = 0.05$
- L_5 is the prospective loss random variable at the end of year 5.

Calculate $\text{Var}(L_5)$.

Question No. 3:

For a fully discrete whole life insurance of 100 on (35) , you are given:

- First year expenses are 10% of the gross premium.
- Renewal expenses are 5% of the gross premium.
- Expenses are incurred at the beginning of the policy year.
- Mortality follows the **Survival Ultimate Life Table**.
- $i = 0.05$
- Gross premium is calculated according to the equivalence principle.

Calculate the gross premium reserve at the end of year 10.

Question No. 4:

For a whole life insurance on (40) , you are given:

- The death benefit is 1000, payable at the end of the year of death.
- There is only one single premium of 125, payable at policy issue.
- There are no expenses.
- Mortality follows the **Survival Ultimate Life Table**.
- $\delta = 0.05$
- L_{10} is the loss for this policy in year 10.

Calculate $\Pr[L_{10} > 180]$.

Question No. 5:

For a fully discrete whole life insurance of 1000 on (65), you are given:

- The net premium reserve at the end of year 24 is 502.58.
- $q_{89} = 0.17$
- $i = 0.05$
- $A_{65} = 0.6135$

Calculate ${}_{25}V$, the net premium reserve at the end of year 25.

Question No. 6:

For a special fully discrete whole life insurance on (40) , you are given:

- The death benefit is 20 in the first year and 10 in all subsequent years.
- $q_{40} = 0.0020$ $q_{50} = 0.0025$
- $i = 0.03$
- $A_{40} = 0.37$ $A_{50} = 0.48$
- Deaths within one year are uniformly distributed throughout the year.

Calculate ${}_{10.4}V$, the net premium reserve in year 10.4.

Question No. 7:

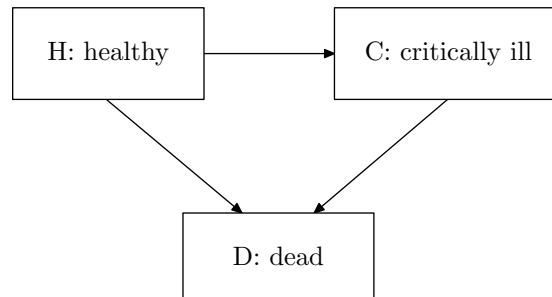
For a 3-year term insurance on (60) , you are given:

- There is only one single premium, P , payable at issue.
- The death benefit, payable at the end of the year of death, is equal to 10 plus the benefit reserve.
- $q_{60+k} = 0.01$, for $k = 0, 1, 2, \dots$
- $i = 0.04$

Calculate P .

Question No. 8:

You are given the following critical illness multiple state model:



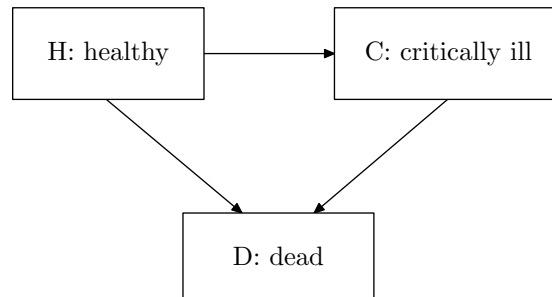
You are given that all the forces of transition are independent of age and time with:

$$\mu^{\text{HC}} = 0.025 \quad \mu^{\text{HD}} = 0.018 \quad \mu^{\text{CD}} = 0.048$$

Calculate the probability that a Healthy policyholder will remain healthy at the end of 10 years.

Question No. 9:

You are given the following critical illness multiple state model:



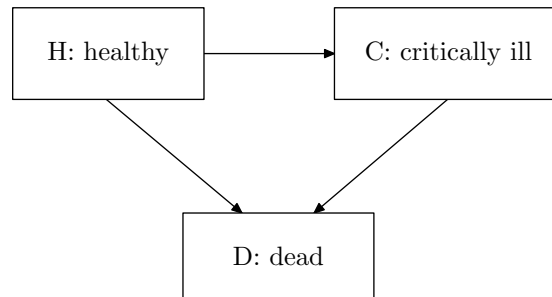
You are given that all the forces of transition are independent of age and time with:

$$\mu^{\text{HC}} = 0.025 \quad \mu^{\text{HD}} = 0.018 \quad \mu^{\text{CD}} = 0.048$$

Calculate the probability that a Healthy policyholder will be critically ill at the end of 10 years.

Question No. 10:

You are given the following critical illness multiple state model:



You are given that all the forces of transition are independent of age and time with:

$$\mu^{\text{HC}} = 0.025 \quad \mu^{\text{HD}} = 0.018 \quad \mu^{\text{CD}} = 0.048$$

Calculate the probability that a Critically Ill policyholder will remain critically ill at the end of 10 years.

EXTRA PAGE FOR ADDITIONAL OR SCRATCH WORK