



UNIVERSITY EXAMINATIONS 2016/2017

ORDINARY EXAMINATION FOR BSC ACTUARIAL SCIENCE

BAS2202 ACTUARIAL MATHEMATICS II (WEEKEND)

DATE: APRIL, 2017

TIME: 2 HOURS

INSTRUCTIONS: Answer question ONE and Any other TWO questions

QUESTION ONE (30 MARKS)

1. Define the following terms in actuarial mathematics:
 - a. Policy value. (2 Marks)
 - b. Future loss random variable. (2 Marks)
 - c. Death Strain at risk. (2 Marks)
 - d. total force of decrement. (2 Marks)
 - e. de Moivre's law. (2 Marks)

2. The benefit reserve at the end of year n for a fully discrete whole life insurance of \$1 on (x) is 0.6. Given that:

- $P_x = 0.009$
- $P_{x:\overline{n}|}^1 = 0.00864$

Calculate $P_{x:\overline{n}|}^1$ (10 Marks)

3. In a double decrement table where cause d is death and cause w is withdrawal, you are given:
 - Both deaths and withdrawals are each uniformly distributed over each year of age in the double decrement table.
 - $l_x^{(\tau)} = 1000$
 - $q_x^{(w)} = 0.48$

- $d_x^{(d)} = 0.35d_x^{(w)}$

Calculate $q_x^{(d)}$ and $q_x^{(w)}$ (10 Marks)

QUESTION TWO

1. For a special fully discrete three-year term insurance on (x), Level benefit premiums are paid at the beginning of each year. Benefit amounts with corresponding death probabilities are

k	b_{k+1}	q_{x+k}
0	200,000	0.03
1	150,000	0.06
2	100,000	0.09

Assuming an interest rate of 6%, calculate the initial benefit reserve for year 2. (14 Marks)

2. Outline the three major features of universal life products. (6 Marks)

QUESTION THREE

1. Consider a fully discrete whole life insurance of 100,000 on (45) which has a gross premium reserve at duration 5 of \$5500 and at duration 6 of \$7100. Assume that:

- $q_{50} = 0.009$
- $i = 0.05$
- Renewal expenses at the start of each year are 50 plus 4% of the gross premium
- Claim settlement expenses are 200.

Calculate the gross premium. (10 Marks)

2. For a universal life insurance policy with death benefit of 10,000 plus account value, you are given:

Policy Year	Monthly Premium	Percent of Premium Charge	Cost of Insurance Rate Per Month	Monthly Expense Charge	Surrender Charge
1	100	30%	0.001	5	300
2	100	10%	0.002	5	100

- The credited interest rate is $i^{(12)} = 0.048$.
- The actual cash surrender value at the end of month 11 is 1000.
- The policy remains in force for months 12 and 13, with the monthly
- Premiums of 100 being paid at the start of each month.

Calculate the cash surrender value at the end of month 13. (10 Marks)

QUESTION FOUR

1. Consider a fully discrete whole life insurance with a death benefit B and an annual premium P payable in advance. Show that the benefit reserve for this insurance is

$${}_{k+1}V = \frac{({}_kV + P)(1 + i) - Bq_{x+k}}{1 - q_{x+k}}$$

at time $k+1$ (12 Marks)

2. With respect to the accounting principle of going concern, discuss the essence of reserving by life insurance companies. (8 Marks)

QUESTION FIVE

1. Explain the essence of multiple decrement modeling. (10 Marks)
2. Discuss five common decrements that can impact one a life. (10 Marks)