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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2019/2020 ACADEMIC YEAR TWO**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF PURE AND APPLIED SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: ACS 202**

**COURSE TITLE: FUNDAMENTALS OF ACTUARIAL MATHEMATICS II**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 13/02/2020 TIME: 09.00-11.00 PM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) questions**
* **Use sketch diagrams to illustrate your answer whenever necessary**
* **Do not carry mobile phones or any other written materials in examination room**
* **Do not write on this paper**

**This paper consists of THREE (3) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

1. Let T be the future lifetime (in years, including fractions) of (*x*). Derive expression table function for
2. The mean of T **[3 marks]**
3. The variance of T **[3 marks]**
4. Suppose
$$S\_{0}\left(x\right)=\frac{-x^{2}-110x+18000}{18000}$$
5. What is the implied limiting age **[4 marks]**
6. Calculate 20P0 **[2 marks]**
7. Determine the survival function for a life aged 20 **[4 marks]**
8. Calculate the probability that a life aged 20 will die between ages 30 and 40  **[4 marks]**
9. Calculate the force of mortality **[4 marks]**
10. Calculate the expected present value and variance of the present value of a term assurance of 1 payable immediately on death for a life aged 40 exact, if death occurs within 30 years; Assume AM92 Ultimate mortality and 4% p.a interest **[6 marks]**

**QUESTION TWO**

1. A life office has just sold a 25 year assurance policy to a life aged 40. The sum assured is Ksh 50, 000 and is payable at the end of the year of death. Calculate the variance and present value of this benefit. Assume AM92 Ultimate mortality and 4% p.a interest **[8 marks]**
2. An impaired life aged 40 experiences 5 times the force of mortality of a life of the same age subjected to standard mortality. A two year term assurance policy is sold to this impaired life, and another two years term assurance is sold to a standard life aged 40. Both policies gave a sum assured of Ksh. 100,000 payable at the end of year of death. Calculate the expected present value of the benefit payable to each life assuming that the standard mortality is AM92 Ultimate mortality and interest is 4% p.a **[12 marks]**

**QUESTION THREE**

1. Assume that the force of mortality between consecutive integer ages is constant in the AM92. Calculate the exact value of $\overbar{A\_{50;2}}$ using a rate of interest of 4% **[5 marks]**
2. For a special whole life insurance on (x), payable at the moment of death

 $μ\_{x}\left(t\right)=0.05 for t>0 and δ=0.08$ and it pays a benefit of $b\_{t}=e^{-0.06t} for t>0.$ Calculate the variance of this benefit **[7 marks]**

1. Let $F\_{0}\left(t\right)=1-\left\{1-\frac{t}{120}\right\}^{\frac{1}{6}}for 0\leq t \leq 120$
2. Calculate the probability that a new born life survives beyond age 30 **[3 marks]**
3. Derive an expression for $μ\_{x}$ **[5 marks]**

**QUESTION FOUR**

1. A year annuity to a life aged 55 under which the first payment will be made one year hence has been purchase with Kshs. 1,500,000. Assuming the AM92 select mortality and 4% is used, find the annual payment under the contract **[7 marks]**
2. An insurer issues a 25 year annual premium endowment insurance with sum assured Kshs. 100,000 to a selected life aged 35. The death benefit is payable immediately on death
3. Write down the gross future loss random variable **[5 marks]**
4. Calculate the gross premium using AM92 mortality with 4% per year interest **[5 marks]**
5. A life aged exactly 50 buys endowment assurance policy with a sum assured of Kshs. 50,000 payable on maturity or at the end of earlier death. Level premium are payable monthly in advance. Calculate the monthly premium assuming AM92 ultimate mortality and 4% pa interest **[3 marks]**

**QUESTION FIVE**

1. Julie aged 45, buys a 20-year term assurance with a sum assured of Kshs. 150,000 payable immediately on death. Assume mortality follows AM92 select and interest is 4% pa. Calculate the quarterly premium payable by Julie for this policy. **[8 marks]**
2. Calculate the annual premium for a term assurance with a 10 year to a male aged 30, with a sum assured of Kshs 200,000 assuming AM92 ultimate mortality and interest of 4% pa. Assume that the death benefits are paid at the end of year of death. **[5 marks]**
3. Given that the force of mortality $μ\_{x}$ is given by the function

$$μ\_{x}=\left\{\begin{array}{c}0.04, 0\leq x\leq 40\\0.05 x>40\end{array}\right.$$

 Calculate $e\_{x}^{0}$ **[7 marks]**