



QP CODE: 25050522



25050522

Reg No :

Name :

MSc DEGREE (CSS) EXAMINATION DECEMBER 2025

First Semester

M Sc ACTUARIAL SCIENCE

Core Courses - AS010104 - SURVIVAL MODELS

2019 Admission Onwards

0F240C47

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. $S_{29}(36)$ represents ?
2. Short note about expected future lifetime.
3. Write the equations of ${}_t p_x$, ${}_t q_x$ in terms of μ_{x+s} .
4. What are the informations get from proposal form ?
5. What are the rules to calculate central exposed to risk Date A and Date B follows?
6. State the characteristics of graduation.
7. Pros and cons of overestimate and underestimate in life insurance ?
8. What would be the major problem of charging premium that are too high ?
9. Irreducible chains.
10. Define markov property.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. Distinguish between complete expectation and curtate expectation of life .
12. Develop a useful link between ${}_t q_x$, ${}_t p_x$ and μ_x .
13. Describe the major problems associated with charging premiums that are:
 - (a) too low
 - (b) too high.
14. Statistical tests.





15. A study of causes of death in elderly men in the 1970s showed the proportions given in the table below. Carry out a chi-squared test to assess whether these percentages can still be considered to provide an accurate description of causes of death in 2015.

Cause of death	Proportion of deaths in 1975	Number of deaths in 2015
Cancer	8%	286
Heart disease	22%	805
Other circulatory disease	40%	1,548
Respiratory diseases	19%	755
Other causes	11%	464

16. An insurance company is concerned that the ratio between the mortality of its female and male pensioners is unlike the corresponding ratio among insured pensioners in general. It conducts an investigation and estimates the mortality of male and female pensioners, $\hat{\mu}_x^m$ and $\hat{\mu}_x^f$. It then uses the $\hat{\mu}_x^m$ to calculate what the expected mortality of its female pensioners would be if the ratio between male and female mortality rates reflected the corresponding ratio in the PMA92 and PFA92 tables, S_x , using the formula:

$$\tilde{\mu}_x^f = S_x \hat{\mu}_x^m$$

The table below shows, for a range of ages, the numbers of female deaths actually observed in the investigation and the number which would be expected from the

Age, x	Actual deaths $E_x^c \hat{\mu}_x^f$	Expected deaths $E_x^c \tilde{\mu}_x^f$
65	30	28.4
66	20	30.1
67	25	31.2
68	40	33.5
69	45	34.1
70	50	41.8
71	50	46.5
72	45	44.5

- (i) Describe and carry out an overall test of the hypothesis that the ratios between male and female death rates among the company's pensioners are the same as those of insured pensioners in general. Clearly state your conclusion.
17. A Markov chain is determined by the transition matrix:

$$P = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0.5 & 0 & 0.5 & 0 \end{bmatrix}$$

Determine the period of each of the states in this chain.

18. Why may the mortality of people with life insurance policies be lower than that of the population as a whole?

(6×2=12 weightage)





Part C (Essay Type Questions)

Answer any **two** questions.

Weight 5 each.

19. Survival probabilities can be found using In the case of Gompertz' Law:

$${}_tP_x = g^{c^x(c^t-1)}$$

$$(ii) -\log(-\log p_x) = \log \left[\frac{\log c}{B(c-1)} \right] - x \log c$$

20. A mortality investigation is being conducted between 1/1/2008 and 31/12/2011. The data of four lives under consideration was as follows :

Life	Date of Birth	Date of Entry	Date of Exit	Mode of Exit
Pele	11.11.77	24.3.06	29.12.11	Death
Johan	1.9.84	30.8.09		Did not leave
Gary	10.2.83	10.10.07	21.6.08	Surrender
Diego	8.2.86	10.8.09		Did not leave

Assuming that the day of entry ,but not the day of exit ,counts in the exposed to risk ,calculate the number of days of exposure contributed to the central exposed to risk by each life at each age ..

21. Describe the following three desirable features of a graduation . (i) smoothness (ii)adherence (iii)suitability for the purpose to hand.
22. (i) Create an N.C.D model with minimum three states with rules .
(ii) Draw it's transition graph.
(iii) Find P^4 .

(2×5=10 weightage)

