SURVIVAL MODELS
ACMT 412
MAIN EXAM

QUESTION ONE (30 MARKS)

A. Differentiate between initial and central rates of mortality **(4 Marks)**

B. Show algebraically that $e_x = P_x(1+_{ex+t})$ ***(5 marks)***

C. What is censoring in data? Give two types of data censoring and explain them ***(6 marks)***

D. State the formula for the relationship between the Kaplan - Meier and Nelson Aalen estimates ***(5 marks)***

E. Give and explain an example of a situation in which the hazard function may be expected to follow each of the below distributions **(10 marks)** *i. Exponential ii. Decreasing Weibull iii. Gompertz Makham iv. Log logistic*

QUESTION TWO (20 MARKS)

A. Differentiate between covariate and proportional hazard model.***(4marks)***

B. The covariates' for the i^{th} observed life are (56, 183 ,40) representing (age last birthday, height in cm, daily dose of drug A in mg) Using the regression parameters β=(0.0172, 0.0028, - 0.0036) . Calculate λ (t:Z_i) in terms of λ_0 (t) ***(6 marks)***

C. (i) If μ_x takes the constant value 0.001 between ages 25 and 35. Calculate the probability that a life aged exactly 25 will survive to age 35.
(5 marks)
(ii)) If μ_x takes the constant value 0.0025 at all ages. Calculate the age x for which $_xP_o$ = 0.5 . What does this age represent?
(5 marks)

QUESTION 3 (20 MARKS)

A. Differentiate between Type 1 censoring and type II censoring ***(4 marks)***

B. What are the two conventions adapted by the Kaplan – Maier estimate of the survivor function ***(6 marks)***

C. Butterflies of a certain species have short lives after hatching each butterfly experience a lifetime defined by the following probability distribution

Life time (days)	Probability
1	0.10
2	0.30
3	0.25
4	0.20
5	0.15

D. Calculate λ_t= for J = 1, 2, … 5 and sketch a graph for a discrete hazard function. ***(10 marks)***

QUESTION 4 (20 MARKS)

A. Losses arising from a certain group of policies are assumed to follow an Exp (λ) distribution. You are given the below data

(i) The exaxct amount of x_1, x_2, …. X_n paid by the insurer in respect of n losses

(ii) Data from a further m losses in respect of whch the insuer paid an amount M. The actual loss amount exceeded M But we don't know how much.

Calculate the maximum likelhood estimator of λ ***(10 Marks)***

B. List and explain the main problem of using a parametric approach to analyze observed survivor times. ***(10 marks)***

QUESTION FIVE (20 MARKS)

A. List and explain scenarios where type 1 censoring occurs ***(8 marks)***

B. If μ_{60} = 0.01, μ_{61}= 0.02 and $\mu_{3\,=}$ 0.03. Calculate the values of

(i) P_{60}

(ii) ${}_2P_{60}$

(iii) ${}_3p_{60}$

(9 marks)

C. List and explain 3 examples scenarios of Random censoring **(3 marks)**

END