INSTRUCTIONS TO CANDIDATES

1. Answer Question ONE and any other Two questions.
2. Show all the workings clearly
3. Do not write on the question paper

4. All Examination Rules Apply.
Question One (30 Marks)

a) Define the following terms as used in Survival Models and Analysis
   i) Survival Analysis (2 Marks)
   ii) Censoring (2 Marks)
   iii) Truncation (2 Marks)

b) Given the hazard function \( h(t) = e^\lambda t \), derive \( s(t) \) and \( f(t) \) (5 Marks)

c) Suppose that the survival distribution of a group of patients follows exponential distribution with \( \lambda = 0.25 \)
   i) Calculate the (a) Mean survival time (2 Marks)
   (b) Median survival time (2 Marks)
   (c) probability of surviving 6 years or more (3 Marks)
   ii) Plot the hazard function. (2 Marks)

d) The following show the lifetime of patients enrolled in a clinical trial, with (+) indicating censored observations: 4.0, 5.0+, 6.7+, 7.5, 7.5, 9.4+, 11.0, 11.0+, 13.0, 16.0
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i) Calculate the PL estimate of the survivorship function
   (5 Marks)
ii) Determine the variance of S(t) for each failure time.
   (5 Marks)

Question Two (20 Marks)

a) Define the following terms as used in Survival analysis
   i) Survivorship function (2 Marks)
   ii) The probability function of the survival time (2 Marks)
   iii) Hazard function (2 Marks)

b) Consider the survival data given below
Question Three (20 Marks)

The data below are remission times in weeks for a group of 30 patients with a disease who received a similar treatment: 1, 1, 2, 4, 4, 6, 6, 6, 7, 8, 9, 9, 10, 12, 13, 14, 18, 19, 24, 26, 29, 31\(^+\), 42, 45\(^+\), 50\(^+\), 57, 60, 71\(^+\), 85\(^+\), 91

i) Obtain and plot the K-M estimate of the survivor function for the remission time.

(10 Marks)

ii) Obtain the 95% confidence Interval for the median remission time

(5 Marks)
iii) Determine the 95% confidence interval for the probability that remission lasts over 26 weeks

(5 Marks)
**Question Four (20 Marks)**

**a)** In a clinical trial the following results were obtained for a group of 146 patients.

<table>
<thead>
<tr>
<th>$I_j$</th>
<th>$D_j$</th>
<th>$W_j$</th>
<th>$N_j$</th>
</tr>
</thead>
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<td>27</td>
<td>3</td>
<td>146</td>
</tr>
<tr>
<td>[1, 2]</td>
<td>18</td>
<td>10</td>
<td>116</td>
</tr>
<tr>
<td>[2, 3]</td>
<td>21</td>
<td>10</td>
<td>88</td>
</tr>
<tr>
<td>[3, 4]</td>
<td>9</td>
<td>3</td>
<td>57</td>
</tr>
<tr>
<td>[4, 5]</td>
<td>1</td>
<td>3</td>
<td>45</td>
</tr>
<tr>
<td>[5, 6]</td>
<td>2</td>
<td>11</td>
<td>41</td>
</tr>
<tr>
<td>[6, 7]</td>
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<td>5</td>
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<tr>
<td>[8, 9]</td>
<td>2</td>
<td>1</td>
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<tr>
<td>[9, 10]</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

**i)** Carry out a full life table analysis (14 Marks)

**ii)** Find the life-table estimate of $S(4)$, $S(7)$, and $S(10)$ and their estimated variance (6 Marks)

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