

Time allowed: $1\frac{1}{2}$ hours

1. The cdf of a random variable T is given by

$$F(t) = 1 - \left(\frac{1}{1+t^2} \right)^2, t > 0$$

Find its hazard function.

2. You are given the results of a study of time (in weeks) to accomplish a particular skill at work:

Interview Time	Not yet accomplished	Just accomplished	Already accomplished
1	2	3	0
2	1	4	2
3	0	1	3
4	1	2	2

What is the estimated probability that the skill can be accomplished within 2 weeks?

3. Let t_i and t_{i+1} be two consecutive time points where failures occurred in a right-censored sample. Explain why the product limit estimator of the survivor probability of $t \in [t_i, t_{i+1})$ equal to $\hat{S}(t_i)$.
4. Suggest a transformation to make the mean and variance of the transformed variable functionally independent if the original random variable X has the following property:

$$\text{Var}(X) \propto [E(X)]^4$$

5. The data file "test.csv" contains the following data.

- time: time to event occurred.
- failure: 0: alive; 1: death.

Use your seat number as the seed to generate a subsample of size one third of total data. Use this subsample to answer the following questions.

- (a) Construct a 95% confidence interval of the survival probability at $t = 6$ using a transformation which not resulting inadmissible limits.
- (b) Construct a 90% confidence interval of the 60 percentile using a variance stabilizing transformation.
6. Let T be a random variable with survivor function

$$S(t) = \left(\frac{300}{t+300} \right)^3, t > 0.$$

Find $E[T]$.

7. You study the time between accidents and reports of claims. The study was terminated at time 3.

You are given:

Time of Accident	Time between Accident and Claim Report	Number of Reported Claims
0	1	15
0	2	11
0	3	14
1	1	9
1	2	8
2	1	11

Estimate the conditional probability that the time between accident and claim report is less than 2, given that it does not exceed 3.

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