

# P8110 Homework Two

Nick Williams  
ntw2117

## Problem 1

(a)

$$\hat{t}_{0.5} = \min\{t_j : \hat{S}(t_j) < 0.5\}$$

1: identify  $\hat{t}_j$  such that  $\hat{S}(t_j) < 0.5$

$\hat{t}_j$	$\hat{S}(t_j)$
$t_6$	0.0000
$t_5$	0.2667
$t_4$	0.4000

2: identify minimum  $\hat{t}_j : \hat{t}_4 = 5$

$$\begin{aligned}
 95\% \text{CI} &= \text{all } t_j \text{CI} \ni 0.5 \\
 &= t_1, t_2, t_3, t_4, t_5 \\
 &= [0.4, 1.2), [1.2, 4.3), [4.3, 5.0), [5.0, 5.1), [5.1, 7.1) \\
 &= [0.4, 7.1)
 \end{aligned}$$

We estimate that 50% of patients will survive for more than 5 years. Furthermore, we are 95% confident that the true median survival time is between 0.4 and 7.1 years.

(b)

$$\begin{aligned}
 \hat{\mu}_{t_j} &= \sum_{j=1}^J \hat{S}(t_{j-1})(t_j - t_{j-1}) \\
 &= 1(0.4) + 0.9(1.2 - 0.4) + 0.8(4.3 - 1.2) + 0.6667(5.0 - 4.3) + 0.4(5.1 - 5.0) + 0.2667(7.1 - 5.1) \\
 &= 0.4 + 0.72 + 2.48 + 0.4667 + 0.04 + 0.5334 \\
 &= 4.64
 \end{aligned}$$

The estimated average survival time is 4.64 years.

(c)  $\hat{\mu}_1$  will be bigger. If  $\hat{\mu}_2$  is the mean survival time where all the listed points are events, then 2 more events are occurring before  $\hat{\mu}_1 = (4.64)$  and thus the average survival time will decrease.

## Problem 2

```
data hw2;
  input year status;
  datalines;
0.4 1
1.2 1
1.2 0
3.4 0
4.3 1
5.0 1
5.0 1
5.1 1
6.1 0
7.1 1
;
run;

proc lifetest data = hw2 method = KM
  conftype = loglog outsurv = hw2_conf
  stderr plots = survival(c1);
  time year*status(0);
run;
```

(a)

Quartile Estimates				
Percent	Point Estimate	95% Confidence Interval		
		Transform	[Lower	Upper)
75	7.10000	LOGLOG	5.00000	7.10000
50	5.00000	LOGLOG	0.40000	7.10000
25	4.30000	LOGLOG	0.40000	5.00000

We estimate that 50% of patients will survive for more than 5 years. Furthermore, we are 95% confident that the true median survival time is between 0.4 and 7.1 years.

(b)

Mean	Standard Error
4.64000	0.76310

The estimated average survival time is 4.64 years.