

STAT 311 HW#1 Jacob Plaza

#1a

$$\hat{S}(t) = \prod_{j=1}^K \frac{(n_j - d_j)}{n_j}$$

6 males + 6 Females

Males: 1.2 3.4 5.0* 5.1 6.1 7.1

Females: 0.4 1.2 4.3 4.9 5.0 5.1*

Male survival function

j	Interval	n _j	d _j	n _j - d _j / n _j	$\hat{S}(t)$
1	[0, 1.2]	6	1	0.833	0.833
2	[1.2, 3.4]	5	1	0.800	0.666
3	[3.0, 5.1]	3	1	0.666	0.444
4	[5.1, 6.1]	2	1	0.500	0.222
5	[6.1, 7.1]	1	1	0	0

Female survival function

Interval	n _j	d _j	n _j - d _j / n _j	$\hat{S}(t)$
[0, 0.4]	6	1	0.833	0.833
[0.4, 1.2]	5	1	0.800	0.666
[1.2, 4.3]	4	1	0.750	0.500
[4.3, 4.9]	3	1	0.666	0.333
[4.9, 5.0]	2	1	0.5	0.166

Males

b)	$\hat{s}(+)$	$se \{ \hat{s}(+)\}$	$95\% CI$
1.2	0.833	0.152	(0.533, 1.31)
3.4	0.666	0.149	(0.374, 0.958)
5.1	0.444	0.181	(0.089, 0.79876)
6.1	0.222	0.157	(0, 0.530)
	0		

$$\hat{s}(+) \cdot \sqrt{\sum_{j=1}^k \frac{d_j}{n_j(r_j - d_j)}}$$

interval	d_j	n_j	$\frac{d_j}{n_j(r_j - d_j)}$	$\hat{s}(+) \cdot \sqrt{\frac{d_j}{n_j(r_j - d_j)}}$
[0, 1.2]	1	6	0.03	0.152
[1.2, 3.4]	1	5	0.05	0.149
[3.4*, 5.1]	1	3	0.16	0.181
[5.1, 6.1]	1	2	0.5	0.157

$$0.833 \pm 1.96(0.152) = (0.533, 1.31)$$

$$0.666 \pm 1.96(0.149) = (0.374, 0.958)$$

$$0.444 \pm 1.96(0.181) = (0.089, 0.79876)$$

$$0.222 \pm 1.96(0.157) = (-0.0857, 0.530)$$

Females			
$\hat{S}(+)$	$S_e[\hat{S}(+)]$	95% CI	
0.9	0.152	(0.533, 1.31)	
1.2	0.199	(0.374, 0.958)	
1.3	0.144	(0.218, 0.782)	
1.9	0.136	(0.666, 0.600)	
5.0	0.117	(0, 0.395)	

Interval	d_j	n_j	$n_j \frac{d_j}{(n_j - d_j)}$	$\hat{S}(+) \sqrt{\frac{d_j}{n_j(n_j - d_j)}}$
0, 0.4	1	6	0.03	0.152
0.4, 1.2	1	5	0.05	0.1489
1.2, 1.3	1	1	0.083	0.144
1.3, 1.9	1	3	0.16	0.136
1.9, 5.0	1	2	0.5	0.117

$$\frac{1}{6(5)} \quad \frac{1}{5(4)} \quad \frac{1}{4(3)} \quad \frac{1}{3(2)} \quad \frac{1}{2(1)} =$$

$$0.833 \pm 1.96(0.152) = (0.533, 1.31)$$

$$0.666 \pm 1.96(0.149) = (0.374, 0.958)$$

$$0.500 \pm 1.96(0.144) = (0.218, 0.782)$$

$$0.333 \pm 1.96(0.136) = (0.666, 0.600)$$

$$0.166 \pm 1.96(0.117) = (-0.06, 0.395)$$

or 0

c) Male: Female

$$25\% : 1.2 \quad 25\% : 0.9$$

$$75\% : 6.1 \quad 75\% : 4.9$$

$$S1QR: (2.45)$$

$$S1QR: 2.25$$

d) Male | Female

$$\hat{t}_{so} = 5.1 \quad \hat{t}_{so} = 4.3$$

$$se[5.1] = 0.181 \quad se[4.3] = 0.144$$

$$\hat{u}_{so} = 3.4 \quad \hat{u}_{so} = 1.2$$

$$\hat{t}_{so} = 6.1 \quad \hat{t}_{so} = 4.9$$

$$\left[\hat{t}_{so} \right] = \frac{0.666 - 0.222}{6.1 - 3.4} = \hat{f}[\hat{t}_{so}] = \frac{0.666 - 0.333}{4.9 - 1.2}$$

$$0.1644$$

$$= \frac{0.333}{3.7} = 0.09$$

$$se[\hat{t}_{so}] \approx \frac{0.181}{0.1644} \approx$$

$$se[\hat{t}_{so}] = \frac{0.144}{1.6} = 0.09$$

$$5.1 \pm 1.96(1.1) =$$

$$(2.94, 7.26)$$

$$4.3 \pm 1.96(1.6) =$$

$$(1.164, 7.436)$$

e) see attached output

F) Male

<u>Interval</u>	T_j	n_j	d_j	$\frac{d_j}{n_j \cdot T_j}$ or $\hat{n}(+)$
0 -	1.2	-	-	-
1-2 -	2.2	6	1	0.0758
3-4 -	1.6	5	1	0.125
5. 0* -	-	-	-	-
5. 1 -	0.1	3	1	3.333
6. 1 -	1.0	2	1	0.5
7. 1	1.0	1	1	1.0

$$T_j = + \sum_{j=1}^n - + c_j$$

female

<u>Interval</u>	T_j	n_j	d_j	$\hat{n}(+)$
0 -	0.4	-	-	-
0.4 -	0.8	6	1	0.208
1.2 -	3.1	5	1	0.0645
1.3 -	0.6	4	1	0.4167
1.9 -	0.1	3	1	3.3
5.0 -	0.1	2	1	5
5.1* -	-	-	-	-

g)

$$H(t) = -\log(\hat{S}(t))$$

Males

Interval	$\hat{S}(t)$	H(t)
1.2 -	0.833	0.079
3.4 -	0.666	0.177
5.1 -	0.444	0.333
6.1 -	0.222	0.654
7.1	0	

Females

Interval	$\hat{S}(t)$	H(t)
0.4 -	0.833	0.079
1.2 -	0.666	0.177
4.3 -	0.500	0.301
4.9 -	0.333	0.478
5.0 -	0.166	0.780

The logrank test

Death time	Female		male		d_j	n_j	e_{ij}	v_{ij}
	d_{1j}	n_{1j}	d_{2j}	n_{2j}				
0.4	1	5	0	6	1	11	0.454	0.2479
1.2	1	4	1	5	2	9	0.888	0.432
3.4	0	4	1	4	1	8	0.5	0.25
4.3	1	3	0	4	1	7	0.429	0.2449
4.9	1	2	0	4	1	6	0.333	0.2222
5.0	1	1	0*	4	1	5	0.20	0.16
5.1	0*	1	1	3	1	2	0.50	0.75
6.1	0	0	1	2	1	1	0	0
7.1	0	0	1	1	1	0	0	0
Total	5						3.296	2.3071

$$U_L = 5 - 3.296 =$$

$$V_L = 2.3071$$

$$W_L = 1.2586 \quad \text{chi-sq value: } 0.2619$$

Wilcoxon Test

	$n_j(d_{2j} - e_{ij})$		
0.4	6.006	29.9959	
1.2	1.008	33.0001	$\frac{14.013^2}{107.9953}$
3.4	-4	16	
4.3	3.997	12.0001	
4.9	4.002	7.9992	1.818
5.0	4	4	Chi-sq =
5.1	-1	3	
6.1	0	0	
7.1	0	0	0.1775

$$U_W = 14.013$$

$$107.9953$$

For both of the tests, the p-values, 0.2619 and 0.1775, for log rank and Wilcoxon respectively, renders the differences between the male and female groups insignificant at the 5% level.

Therefore, we can uphold the proportional hazards assumption, so we would prefer the log rank test.

The LIFETEST Procedure**Stratum 1: gender = 0**

Product-Limit Survival Estimates						
times	Survival	Failure	Survival Standard Error	Number Failed	Number Left	
0.00000	1.0000	0	0	0	6	
1.20000	0.8333	0.1667	0.1521	1	5	
3.40000	0.6667	0.3333	0.1925	2	4	
5.00000	*	.	.	2	3	
5.10000	0.4444	0.5556	0.2222	3	2	
6.10000	0.2222	0.7778	0.1925	4	1	
7.10000	0	1.0000	.	5	0	

Note: The marked survival times are censored observations.**Summary Statistics for Time Variable times**

Quartile Estimates				
Percent	Point Estimate	95% Confidence Interval		
		Transform	[Lower]	Upper)
75	6.10000	LOGLOG	3.40000	.
50	5.10000	LOGLOG	1.20000	.
25	3.40000	LOGLOG	1.20000	6.10000

Mean	Standard Error
4.83333	0.93595

The LIFETEST Procedure**Stratum 2: gender = 1**

Product-Limit Survival Estimates						
times	Survival	Failure	Survival Standard Error	Number Failed	Number Left	
0.00000	1.0000	0	0	0	6	
0.40000	0.8333	0.1667	0.1521	1	5	
1.20000	0.6667	0.3333	0.1925	2	4	
4.30000	0.5000	0.5000	0.2041	3	3	
4.90000	0.3333	0.6667	0.1925	4	2	
5.00000	0.1667	0.8333	0.1521	5	1	
5.10000	*	.	.	5	0	

Note: The marked survival times are censored observations.**Summary Statistics for Time Variable times**

Quartile Estimates				
Percent	Point Estimate	95% Confidence Interval		
		Transform	[Lower]	Upper)
75	5.00000	LOGLOG	1.20000	.
50	4.60000	LOGLOG	0.40000	.

Quartile Estimates				
Percent	Point Estimate	95% Confidence Interval		
		Transform	[Lower]	Upper)
25	1.20000	LOGLOG	0.40000	4.90000

Mean	Standard Error
3.46667	0.87387

Note: The mean survival time and its standard error were underestimated because the largest observation was censored and the estimation was restricted to the largest event time.

Summary of the Number of Censored and Uncensored Values					
Stratum	gender	Total	Failed	Censored	Percent Censored
1	0	6	5	1	16.67
2	1	6	5	1	16.67
Total		12	10	2	16.67

The LIFETEST Procedure

Testing Homogeneity of Survival Curves for times over Strata

Rank Statistics		
gender	Log-Rank	Wilcoxon
0	-1.6346	-14.000
1	1.6346	14.000

Covariance Matrix for the Log-Rank Statistics		
gender	0	1
0	1.84781	-1.84781
1	-1.84781	1.84781

Covariance Matrix for the Wilcoxon Statistics		
gender	0	1
0	149.000	-149.000
1	-149.000	149.000

Test of Equality over Strata			
Test	Chi-Square	DF	Pr > Chi-Square
Log-Rank	1.4459	1	0.2292
Wilcoxon	1.3154	1	0.2514
-2Log(LR)	0.2079	1	0.6484

