P8110: Homework 3

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Problem 1

Based on the survival graph, it appears participants enrolled in the body-cleansing treatment are experiencing greater survival time compared to those enrolled in the routine cleansing treatment. For example, the survival function for those in the body-cleanising treatment never reaches 50% failure rate by the end of the study while the survival function for those in the routine cleansing treatment does.

Problem 2

log-rank test

1. $H_0 : S_1(t) = S_0(t), \text{ for all } t \leq \tau$
   $H_A : S_1(t) \neq S_0(t), \text{ for all } t \leq \tau$

2.

$$Q = 3.7924 \sim X_1^2$$
$$p = P(\chi_1^2 \leq 3.7924) = 0.0515$$

3.

$$0.0515 > 0.05 \rightarrow \text{ fail to reject the null}$$

4. At the 5% level of significance, using a log-rank test, there is insufficient evidence to conclude that differential surivival itme exists between participants enrolled in the body-cleansing treatment and those enrolled in the routine cleansing treatment

Wilcoxon test

1. $H_0 : S_1(t) = S_0(t), \text{ for all } t \leq \tau$
   $H_A : S_1(t) \neq S_0(t), \text{ for all } t \leq \tau$

2.

$$Q = 2.8639 \sim \chi_1^2$$
$$p = P(\chi_1^2 \leq 2.8639) = 0.0906$$

3.

$$0.0906 > 0.05 \rightarrow \text{ fail to reject the null}$$

4. At the 5% level of significance, using a Wilcoxon rank test, there is insufficient evidence to conclude that differential survival time exists between participants enrolled in the body-cleansing treatment and those enrolled in the routine cleansing treatment.

Difference between tests

The log-rank test is more sensitive to differences between survival functions at time points later in follow-up while the Wilcoxon test is more sensitive to differences earlier in time. This is because the Wilcoxon rank test applies a weight to each unique event time point according to the number of at risk individuals at that time point. This is why the p-value for the Wilcoxon test is larger in this case compared to the p-value from the log-rank test.

Problem 3

1. $H_0 : S_1(t) = S_2(t) = S_3(t) = S_4(t)$ for all $t \leq \tau$
   $H_A :$ At least one S_k is different for some $t \leq \tau$
2. $$Q = 5.4722 \sim \chi^2_3$$
   $$p = P(\chi^2_3 \leq 5.4722) = 0.1403$$
3. $$0.1403 > 0.05 \rightarrow \text{ fail to reject the null}$$
4. At the 5% level of significance, using the generalized log-rank test, there is insufficient evidence to conclude that the survival functions are different among the 4 different groups of surface area burned.