

ST520, Fall 2008

Homework 7, due: Thursday, 11/14/2008

1. (10 pts) In class, we discussed one version of the as-treated analysis. Let's consider the as-treated analysis as we did for the Clofibrate clinical trial where we only included patients randomized to the new treatment. That is, our as-treated analysis uses the following estimate:

$$\widehat{\Delta}_{AT2} = \bar{Y}_{A=1,C=1} - \bar{Y}_{A=1,C=0}.$$

- (a) Using the notation in the lecture notes, find out the expectation of $\widehat{\Delta}_{AT2}$. Is $\widehat{\Delta}_{AT2}$ an unbiased estimate of the population average causal effect Δ , or complier average causal effect Δ^{COM} (CACE), or any portion of Δ or Δ^{COM} ?
2. (10 pts) The following table gives the survival time in days of rats implemented with brain cancer cells and then treated with two different treatments (trt 1 and trt 2).

Trt 1	Trt 2
26	31
28	32 ⁺
29	34
29 ⁺	35
30	36
30 ⁺	38
31	38 ⁺
31 ⁺	39
32	42 ⁺
35 ⁺	42 ⁺

⁺ right censored observation

- (a) Conduct the two-sample log-rank test by hand to compare the survival times for two treatments. (You may want to check your result using SAS.)
3. (10 pts) The time (in months) to relapse data for 10 patients with bone marrow transplant are : 5, 8, 12, 16⁺, 17, 17⁺, 19⁺, 24, 30⁺, 32. Do the following by hand:
- (a) Construct the life-table estimates of the survival function $S(t)$ using following intervals: $[0, 10)$, $[10, 20)$, $[20, 30)$, $[30, 40)$. That is, estimate $S(10)$, $S(20)$, $S(30)$ and $S(40)$, where $S(t)$ is the true survival function.

- (b) Construct the Kaplan-Meier estimate of $S(t)$.
4. (10 pts) During the design stage, we expect 100 patients per year will enter into a study to compare two treatments. Assume exponential distributions for the survival times of both treatments and assume the **median** survival time for treatment 2 is 1 year. We wish to detect with 90% power that treatment 1 has **median** survival time of 2 years using a two-sided log-rank test at 0.05 significance level. Suppose We will enroll patients for 1 years. How long should the study last? (**Note:** You may plot the expected total number of deaths vs. the study length and find the required study length by visualization or write a program to solve this problem. You may even solve the equation explicitly)