# Homework 2

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Due date: Thursday, October 9

1. Show that (algebraically) in the absence of censoring $\hat{S}_{\text{KM}}(t) = \hat{S}_{\text{e}}(t)$.

2. In the absence of censoring, show that the Greenwood Formula (page 30 on note 2) can be reduced to

$$\frac{\hat{S}_{\text{KM}}(t) \times \{1 - \hat{S}_{\text{KM}}(t)\}}{n}.$$

   You might assume there are no ties among the observations.

3. Consider the Leukemia data from the `survival` package:

```
> library(survival)
> head(aml)
```

```
  time status          x
1    9      1 Maintained
2   13      1 Maintained
3   13      0 Maintained
4   18      1 Maintained
5   23      1 Maintained
6   28      0 Maintained
```

   In here, each row represent one patient. `aml` is the observed survival time, `status` is the censoring indicator (1 = event, 0 = censored), and `x` is the treatment indicator. We will ignore the treatment indicator for now.

   a. Plot the Kaplan-Meier survival curve for the data.
   b. Add the Nelson-Aalen survival curve to the Kaplan-Meier plot from (3a).

4. The expected survival time for the Leukemia data in #(3) does not exist because the last observation is a censored event. An alternative is to lookInstead of looking at the expected survival time, an alternative is to look at the restricted mean survival time. Compute $E(T|T < 161)$ based on the survival curve in (3a).

5. Let $N_i(t)$ be the number of events over time interval $(0, t]$ for the $i$th patient in #(3). Let $N(t) = \sum_{i=1}^{n} N_i(t)$ be the aggregated counting process.

   a. Plot $N(t)$.
   b. Plot $M(t)$, where $M(t) = N(t) - \hat{H}(t)$.