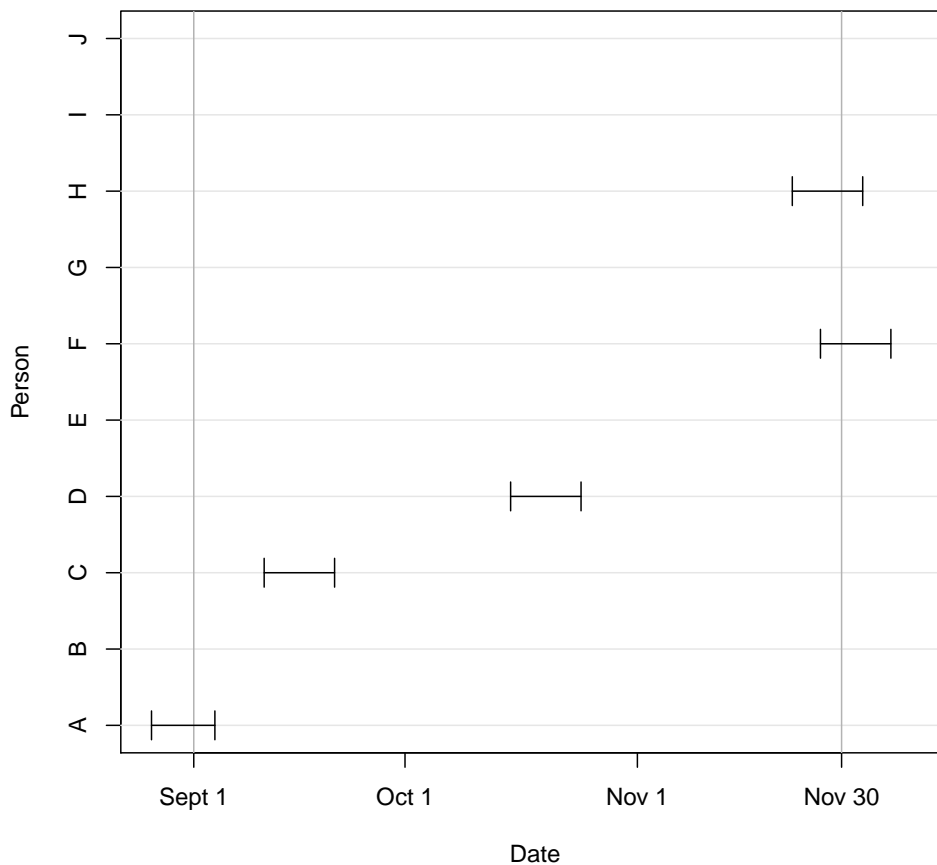


Homework 1, Due Friday September 9, 2016

1. We are studying upper respiratory infections (URI) under the following assumptions:

- Each infection lasts 10 days and the person is immune once he/she recovers.
- Infections begin at 12:01 AM on the indicated date.
- No one dies during the study period.
- September and November have 30 days, August and October have 31 days.
- A person with a URI is not at risk of other URI infections during the 10 days he/she is sick.

The time period of interest is September 1 - November 30 inclusive. The plot below shows the results for each of the 10 people. The following histories are observed with the dates indicating the date of onset of URI: Person A got sick on August 25, Person C got sick on September 10, Person D got sick on October 15, Person F got sick on November 28, and Person H got sick on November 24. The other individuals did not get sick. The disease histories are shown below.



- a. Compute point prevalence on September 1.
 - b. Compute point prevalence on November 30.
 - c. Compute incidence proportion over the interval [Sept 1, Nov 30].
 - d. Compute person-days at risk for the interval.
 - e. Compute incidence rate for the interval.
2. On page 9 of the notes I give Incidence Proportions and Point Prevalences for CHD for the data in Table 2.1 on page 11. Verify these values.
 3. Given the definition we have for the incidence proportion we have in Jewell, it could, stangely enough, theoretically exceed 1. What type of disease process would be implied by such a result?
 4. Problem 3.1 on page 29 in Jewell. Read over the problem carefully. Note that the problem asks for CIs for two groups: one who ate no fish and one group who did eat fish. The (approximate) 95% CIs you will be computing are for incidence proportions of CHD related deaths in a 25 year time period. Give me the following for both groups.
 - Approximate continuity corrected Wald intervals.
 - Approximate continuity corrected Score intervals (use `prop.test`).
 - The exact intervals (use `binom.test`).

Based on the intervals does there appear to be evidence of a relationship between CHD related deaths and fish consumption? Justify your answer. (Note: the clearest way to answer this question is to construct an interval for the difference between two incidence proportions, but just address the question by looking at the intervals from the two groups separately. Care is needed and we will all admit to a bit of speculation here.)

5. Problem 3.2 on pages 29 and 30 in Jewell.
6. STAT Graduate Students:

(a) Recalling that

$$h(t) = \frac{d}{dt}(-\log S(t))$$

show that, if $S(0) = 1$ then

$$S(t) = \exp \left\{ - \int_0^t h(u) du \right\}$$

(b) Use the result in (a) to find the survival function if

$$h(t) = \frac{\alpha t^{\alpha-1}}{\beta^\alpha}$$

- (c) Find the probability density function for survival time given the survival function you found in part (b).