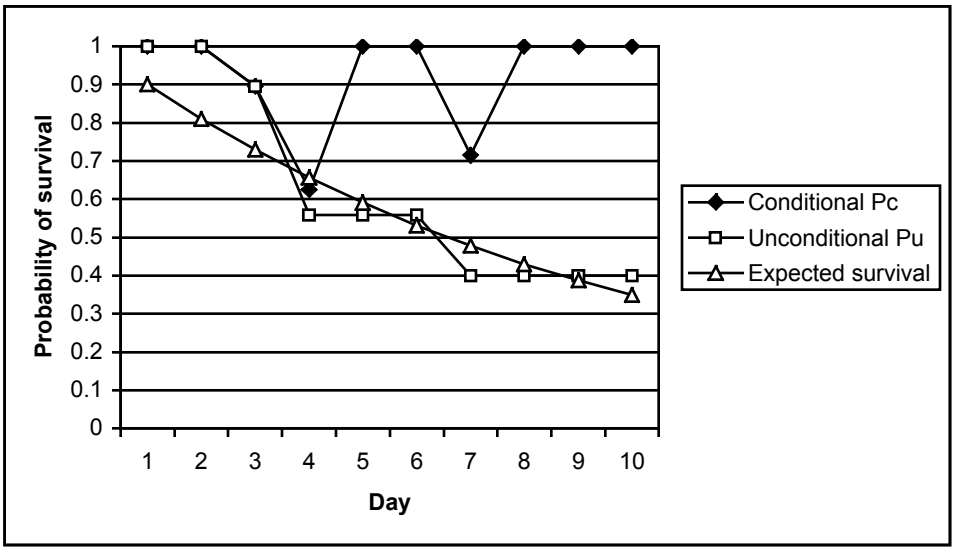
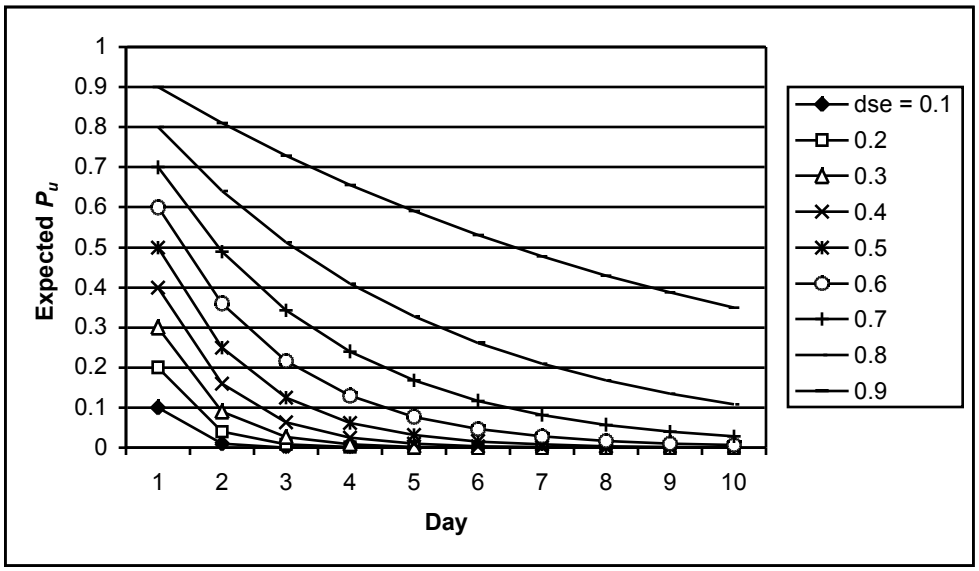
Answers to Exercise 24

Survival Analysis

1. Your graph will look different than ours, but the interpretation is more or less the same. Our graph (below) shows that P_c varies from 0.6 to 0.1. To evaluate the Kaplan-Meier survival curve, look at the P_u line and compare it to the expected survival over time. Our simulation shows that the P_u starts above the expected line, indicating that fewer deaths occurred than expected until day 3, at which time the curve drops precipitously downward, indicating a sudden abrupt increase in the number of deaths. Another such drop in the curve occurs 3 days later; then the curve flattens out, indicating few or no deaths from day 7 on.



2. In order for a population to persist for a 10-day interval, a daily survival rate of at least 0.7 is needed. The graph on the next pageis based on the expected P_u's. However, given that there is tremendous variation from simulation to simulation, 0.7 is probably overoptimistic and higher survival rates are likely needed to ensure the population does not go extinct within 10 days. (Note that we have not considered the birth side of the equation in this question.)



3. When censored observations are involved in the study, it has the same effect as decreasing the sample size. Without censored observations, any stochasticity associated with computing P_c and P_u is strictly a function of the survival rate itself and the number of individuals in the population. Since our sample size is somewhat small, $N = 25$, there is still quite a bit of variation from simulation to simulation in both P_c and P_u. However, this variation is increased as censored observations are added.

4. When censored observations occur early in the study, it has the effect of decreasing the total sample size. Because this effect is magnified throughout the study, observations that are censored early affect P_u much more than observations censored late in the study.