Exercise 1:

1. Which model would you choose to best describe these data? Why?
   The first model (S(1)), since it has the lower AIC value.
2. Does a "z-test" comparison of survival rates between the 2 groups agree with the AIC model selection table?
   a. $Z = (S_{cnt}-S_{trt})/sqrt((var(S_{cnt})+var(S_{trt})))$
   b. Need R function, pnorm

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   R output:
        Pr(z< 0.2561426 )= 0.6010796
        Pr(chisq< 0.06556 )= 0.7979146
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   Yes, both the z-test indicates no significant difference between survival rates for control and treatmen t, and the likelihood-ratio test indicates no difference between the model where the two groups have t he same survival versus the model where they are different.

3. Do the probability levels associated with the z-test and likelihood ratio test differ? If so, why?
   a. LR=Pr(Chi-sq, k), where Chi-sq = $-2(L_{null}-L_{trt})$ and $k=df_{null}-df_{trt}$
   b. Need R function, pchisq

   They differ in value, slightly, due to the z-test being treated as 1-tailed test and the L-R test being a two-tailed test.

Exercise 2:

1. The models with interaction between age and time and additive time + age effects were both competitive. In the interactive model, adult survival is higher in some months and young survival higher in others. Can this happen as well in the additive model? Why or why not?

   For additive model, one rate always has to be higher than another (by the amount specified by the beta for age)

2. In many species of vertebrates, young are predicted to have lower apparent survival than adults. Was this true in the example? What biological stories might explain the direction of the estimated average difference between young and adult survival?

   Not true in our example. Young survival estimates were slightly higher than those of adults. Possible explanations. First recall that young were of trappable size. Survival of young the first 2 weeks of life before they reach 6-10 grams is much lower. As for the observed difference, one story might involve costs of reproduction (physiological drain for females, increased activity by males during breeding season) faced by adults and not young.

3. The a priori hypothesis was that males would have higher capture probabilities than females. Was this true? What biology might underlie this prediction and difference?

   Yes, males do have higher p. They move around more (greater distances) and are likely to encounter more traps)

4. Some population models (such as stochastic projection matrices) require estimates of true temporal variance of vital rates such as survival. But what other source of variation is present in the monthly variation among survival estimates? How can the true temporal variance be separately estimated?

   Sampling variance is there as well. So can subtract average sampling variance from the variance of point estimates in order to estimate true temporal variance of underlying phis.

5. The CJS model permits inference about capture and apparent survival probabilities, as shown. But under the JS model, we can also estimate abundance of adults. How do we do this?

   Use the p estimated based on marked guys to apply to unmarked animals as well. Then divide numb er caught by estimated p.

6. Why can't we estimate the number of young in the same manner as for adults? What piece of information are we missing?

   Can estimate no p for young animals without robust design. Need this to estimate abundance.

Exercise 3:

(1) This grid was part of an experiment designed to test hypotheses about effects of fragmentation on meadow vole population dynamics. If the fragmentation created by the strips of bare ground really affected movement, what predictions would we make about effects of fragmentation on the 3 sets of model parameters (survival, capture and movement probabilities)?

Reduced movement. Survival would increase (reduced permanent emigration).

(2) Based on AIC, which model appears to be best supported by the data? What conclusions can you draw from this experiment based on the AIC table? Are the parameter estimates themselves relevant to conclusions or does AIC provide all of the information that you need?

AIC supports idea of different movement before and after fragmentation. Need to look at parameter estimates in order to properly check whether predictions were met

(3) Have a look at the estimates of movement probabilities from the 2 time periods, before and after fragmentation. Are they consistent with your predictions?

Movement estimates were indeed consistent with predictions.

(4) Do the results from this grid provide strong inferences about effects of fragmentation? If not, what other information would be useful in strengthening the inferences?

Inferences can't be too strong, because we have not ruled out an odd grid (no replication) or seasonal change in movement (no controls).

(5) In (1) did you make any predictions about changes in survival probability associated with fragmentation? If so, what was your rationale? The top model provided time-specific estimates of survival, so we could compute and compare means for the periods before and after fragmentation. Another way to obtain inference about this contrast is to look at estimates arising from the 3rd model, in which survival is computed for 2 time periods (before and after fragmentation). What do these look like? Are they consistent with predictions?

I predict higher survival post-fragmentation, because of reduced permanent emigration. Average survival rates pre- and post-fragmentation support this prediction.