

Math 263: Excel Assignment 8 on Hypothesis Tests with Chi-Square

Due Thursday May 1, at the start of class. Hand in a paper print-out of your work.

You must do the computer work for this assignment yourself, although you may certainly talk to other people. Answers which appear to be copied will be treated as an integrity violation.

Note: You do not need to hand in your Excel sheet with the answers to your questions.

Overview

The salmon industry in the Pacific Northwest has been remarkably successful. Each summer, chinook salmon (king salmon) swim upstream to spawn in the Yukon River, Alaska. A decade ago, fishermen on the river began to notice that some of the fish had white spots and smelled bad. These fish couldn't be smoked properly and buyers avoided them. Scientists identified the fish as diseased with *ichthyophonus* and worried that the infected females would not be strong enough to swim upstream to spawn. Between 1999-2002, Richard Kocan and Paul Hershberger at the University of Washington sampled salmon at six sites along the river and recorded the number of fish infected.¹ All fish sampled were tested for *ichthyophonus* in the lab, but not all infected fish showed clinical symptoms. (However, all fish with clinical symptoms were infected.) In the Excel file *Ichthyophonus.xlsx*, the data at each site show the

- Number of male and female fish sampled
- Number infected (as determined by the lab)
- Number in each group showing clinical symptoms.

1. Using the data in all sites and all years combined, use a hypothesis test to decide if the proportion of females infected was significantly higher than the proportion of males infected. Show all the steps in your reasoning, ending with a conclusion about salmon.
2. Decide if there is an interaction between infection rate and sites for the females. Use the totals for all years and show all the steps of your reasoning.
3. Look at the map of Alaska in the Excel file to determine the order of the six sites along the river.
 - (a) With the sites further upstream to the right, make charts of the following types to display the variation of the proportion of each gender infected at each site:
 - (i) Column chart
 - (ii) Line graphs
 - (b) What trends do you observe in the graphs as the fish move upstream? How does the proportion infected vary for each gender? How does the relationship between the genders vary?
 - (c) Do the graphs fit the following explanation? Justify your answer and note any features of the graph

At the mouth of the river, about a fifth of the fish are infected, with the females having a higher infection rate. As they move up the river, more fish get infected, but some of the infected fish become too weak to continue and die.

¹¹ "Effects of *Ichthyophonus* on Survival and Reproductive Success of Yukon River Chinook Salmon" R. Kocan, P. Hershberger
http://fish.washington.edu/people/kocan/ichthyophonus_final/index.html