Stat 333 **Lab 1**
(Attrb I)

Lab due _____

Topics: calculating probabilities & statistical inference for binomial & multinomial.
References: Snedecor & Cochran (S&C) - 8.1 to 8.8, 9.1, 9.2;
Dixon & Massey (D&M) - 13.1, 13.2, table A-29a

James E. Liebelt* trapped spawning whitefish at the mouth of Mission Creek on the Yellowstone River and displaced them up and down the river in order to study homing behavior. This lab is based on some of his research, however, many aspects as well as data have been altered in order to emphasize particular problems.

1. Suppose that n = 10 male whitefish are trapped and marked on a particular day. These are displaced 8.5 km up river. Assume the probability of one of these fish returning to the traps is 0.40.

- **a) Find the probability that exactly 0, 1, and 2 of the fish return by use of the formula on page 204 of S&C. (1.e. find three probabilities)**
- **b) Use the three probabilities of part a) to calculate the probability that 2 or less fish return.**
- **c) Use a normal curve approximation with a continuity correction for probability that 2 or less return. How large is the error in your approximation? How large would it be if the continuity were ignored?**
- **d) Use BINPROB in MSUSTAT to check your calculation that exactly 2 return and that 2 or less return.**

2. Suppose the homing behavior of the n = 10 males in problem 1 are to be classified into the three categories:

1) **return in 5 days or less**
2) **return, but require more than 5 days**
3) **not return.**

The probabilities assumed to be associated with these categories are respectively: 0.2, 0.2, 0.6.

- **a) Find the probability that exactly 1 fish returns in 5 or less days and 1 fish returns but requires more than 5 days and 8 fish fall to return.**
- **b) Why is this probability smaller than the probabilities that exactly 2 return which was calculated in 1.a)?**

*** James E. Llebelt, *Studies on the Behavior and Life History of Mountain Whitefish* (PhD thesis, MSU, 1970).**

3. Now suppose that records for these n = 10 fish at the end of the study show that only 2 fish returned.

a) **Estimate the true probability (or proportion) for fish to return when displaced under similar conditions.**

b) **Test the conjecture that the true probability is 0.40 (vs less than 0.40) at level $\alpha = 0.10$ by use of the normal approximation method. Also find an approximate P-value.**

c) **Test the same hypothesis as b) but use an exact method based on your earlier probability calculations. Also give the exact P-value.**

d) **Obtain a 0.90 upper confidence limit for p by use of a normal approximation with continuity correction. Borrow a copy of D&M and obtain such an upper limit by use of table A-9a for 0.80 level. Do the two values agree reasonably well?**

4. Suppose that during one entire season n = 250 whitefish males were displaced to four different locations on the Yellowstone. Thirty-six of these returned in 5 days or less, 48 returned but required more than 5 days and the remainder failed to return.

a) **Test once again the conjecture that the true return rate is 0.40, but use $P \neq 0.40$ as the alternate and test at level $\alpha = 0.05$. Find a P-value. Use a normal approximation with continuity correction for the test.**

b) **Check your results in part a) by using CHISQR1 in MSUSTAT, Does your z^2 equal X^2?**

c) **Use table 1.4.1 in S&C to find a 0.95 confidence interval for the true proportion. Check that confidence interval by a normal approximation.**

d) **Are there violations of the usual assumptions for analysis of attribute data in this problem? Suppose your data suggests different return rates at different displacement sites and a lowering of the return rate in the late season.**

5. Use the sample data of problem 4 to test the three multinomial probabilities conjectured in problem 2 at level $\alpha = 0.05$. You may use CHISQR1 but show how X^2 is calculated.