Math4310/6317
Problem Set 11, due Thursday Dec 1

Problem 1. Refer to the data from Problem 2 in Set 10. Re-use your computations for the tables there and some additional ones to perform Fisher's test against having an **unequal** mortality rate in the two groups (two-sided). Compare the p-value resulting from this test with that from a test based on the χ^2-statistic.

Problem 2. A small study was done to compare how well students with different majors do in an introductory statistics course. Seven majors were found: biology, psychology, sociology, business, education, meteorology and economics. At the end of the course, the students were given a special test to measure their understanding of basic statistics. Then a series of t-tests were performed to compare *every pair* of majors. Thus, biology and psychology majors were compared, biology and sociology majors, psychology and sociology majors, etc., for a total of 21 t-tests.

Simulate this study assuming all majors do about the same. Assume there are 20 students in each major, and that scores on the test have a normal distribution with mean $\mu = 12$ and standard deviation $\sigma = 2$. Use the computer to generate random test scores that are normally distributed for biology majors, then do it a second time to get a sample for psychology majors and so on, for 7 samples (one for each major).

a. List the 21 pairs of majors and perform the 21 t-tests.

b. In how many of the tests did you reject the null hypothesis at $\alpha = 0.10$?

c. Use the Bonferroni procedure to pick a significance level α^* for each comparison so that the probability of a familywise error under the null hypothesis is no larger than 0.1. Perform the tests and report.

Problem 3. Researchers comparing fMRI signals between a resting state and a active state in 10 different regions of the brain, found the following p-values resulting from a test for equal activity:

Region	1	2	3	4	5	6	7	8	9	10
P-value	.081	.011	.053	.0140	.016	.045	.046	.050	.003	.053

a. Controlling the FWE of .05, which regions would be rejected?

b. Controlling the FDR at .05, which regions would be rejected? (Interpret your results.)

Problem 4. **For students enrolled in Biol6317 only.** In the usual teams, work out the solution to Project 3, linked from the course webpage.