**Due by 4pm on Friday, March 21. Please leave your homework on the table before class begins on Friday or leave it in the dropbox outside my office. Do not forget to attach the honor code.**

(1) (5 points each) The results of a large-scale test of the polio vaccine are given below.

| | Polio | No Polio | Total |
|---|---|---|---|
| Salk Vaccine | 33 | 200,712 | 200,745 |
| Placebo | 115 | 201,114 | 201,229 |

(a) Find the conditional distribution for the condition if the person is given salk vaccine.
(b) Find the conditional distribution for the condition if the person is given placebo.
(c) Is the condition independent of the vaccine received?
(d) Construct a 95% confidence interval for the difference in the proportion of people given salk vaccine compared with a placebo. Does this appear to be a significant difference? Why or why not?
(e) At the 5% level of significance, test the claim that the salk vaccine is effective at helping people cure from polio.
(f) Determine the odds ratio of people with polio when vaccinated.
(g) What is the relative risk of polio if you get vaccinated with salk vaccine?

(2) (15 points) Use the following data concerning mortality rates on the Titanic to answer the following three questions:

| | Men | Women | Boys | Girls |
|---|---|---|---|---|
| Survived | 322 | 318 | 29 | 27 |
| Died | 1360 | 104 | 35 | 18 |

(a) If we randomly select a Titanic passenger who died, what is the probability of picking an adult male?
(b) If we randomly select an adult male Titanic passenger, what is the probability that they died?
(c) Given that a randomly selected person survived the Titanic, what is the probability of getting either a boy or a girl?

(3) (15 points) Let $X$ denote the number of Canon digital cameras sold during a particular week by a certain store. The probability distribution of $X$ is

| $X$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $P(X)$ | .1 | .2 | .3 | .25 | .15 |

Sixty percent of all customers who purchase these cameras also buy an extended warranty. Let $Y$ denote the number of purchasers during this week who buy an extended warranty.

(a) What is $P(X = 4, Y = 2)$?
(b) Determine the joint probability distribution of $X$ and $Y$ and then the marginal probability distribution of $Y$. In other words, fill in a $5 \times 5$ contingency table for the joint distribution of $X$ and $Y$.
(c) Calculate $P(X = Y)$.

(4) (20 points) Do grumpy old men have a greater risk of having coronary heart disease than men who aren't so grumpy? Harvard Medical School researchers examined this question in a prospective observational study reported in the November 1994 issue of Circulation (Kawachi et al, 1994). For seven years, the researchers studied men between the ages of 46 and 90. All study participants completed a survey of anger symptoms at the beginning of the study period. Men were classified according to how many anger symptoms they exhibit and whether they have coronary heart disease or not. Among 559 men with the most anger symptoms, 59 had coronary heart disease. Among 199 men with no anger symptoms, 8 had coronary heart disease.

(a) For those with the most anger symptoms, what is the relative risk of heart disease (compared to those with no anger symptoms)
(b) For those with the most anger symptoms, what is the percent increase in risk of heart disease?
(c) Calculate the odds ratio that compare the odds of having heart disease for the men with the most anger symptoms to the odds for men with no anger symptoms.

(5) (15 points) For adults who sailed on the Titanic on its fateful voyage, the odds ratio between gender (female, male) and survival (yes, no) was 11.4. (see R. Dawson, J. Statist. Educ. 3, no. 3, 1995.)
(a) What is wrong with the interpretation, "The probability of survival for females was 11.4 times that for males?" Give the correct interpretation.
(b) The odds of survival for females equaled 2.9. For each gender, find the proportion who survived.
(c) Find the value of $X$ in the interpretation, "The probability of survival for females was X times that for males."