Math 465 CLASS EXERCISES **15 March 2017**

1. It is known that 2 out of every 1000 adult Americans is afflicted with a particular disease. There is a test to determine whether a person has the disease, but it is not perfect. In 99% of the cases where a person has the disease, the test will say that they have it. (We will say the person "tests positive.") It is also known to give a positive result for 3% of the people who do not have the disease.

   (a) Suppose that a person is selected at random and given the test. Let X be the random variable that assigns one if they have the disease and zero if they don't. Let Y be the random variable that assigns one they test positive for the disease and zero if they don't. Create a table for the joint probability distribution, **giving all values as exact decimals**.

   (b) Suppose now that you test positive for the disease. What is the probability that you really do have the disease?

2. A small manufacturing operation employs three people Ann, Bob and Cathy for assembly of Widgets. The three work at different speeds, so out of every 1000 Widgets assembled, Ann assembles 355, Bob assembles 314 and Cathy assembles 331. Based on past data, it is known that each of the three assembles the following percentage incorrectly: Ann, 4.7%, Bob 3.1% and Cathy 2.5%.

   (a) Suppose that a Widget is selected at random. Let X be the random variable that assigns a zero if the Widget is assembled incorrectly and a one if it is assembled correctly. Let Y be the random variable that assigns a one if the Widget was assembled by Ann, two if it was assembled by Bob and three if it was assembled by Cathy. Create a joint distribution table with all probabilities as exact decimals.

   (b) What is the probability that a Widget is assembled incorrectly?

   (c) Given that a Widget is assembled correctly, what is the probability that it was assembled by Bob?