

Homework Section 12.3.

I. Read Exercise 38, page 705.

- A. The experiment in this problem is to choose a person at random from the pool of 23,824 people in the study. Each of the columns and rows in the table given in the problem represent an event in the experiment. For example, the first column, Male, is the event that the person chosen at random is male. Use this notation for each of the following events:

Event	Notation
Homosexual Contact	A
Heterosexual Contact	B
Intravenous drug use	C
Other	D
Male	M
Female	F

For each part (a)-(d) of exercise 38, write the symbol for the probability that you are supposed to calculate, using this notation. For example, if you were asked to calculate the probability that a person who was newly diagnosed with AIDS in 1998 contracted it via homosexual contact, you would write the symbol, $P(A)$.

- B. Do parts (a)-(d) of exercise 38.
- C. State the definition of independent events (see page 697).
- D. Read part (e) of exercise 38.
- To determine whether or not the two events in this exercise, event F and event B, are independent, you have to calculate two things and determine whether or not they are equal. What two things do you need to calculate? (Since the definition of independent is an “or” statement, there are two correct answers to this question.)
 - Answer part (e) of exercise 38. Show your calculations neatly, and answer the question in a sentence.
- II. Read the subsection entitled Sensitivity and Specificity, beginning on page 701, and make sure you understand Example 9 page 702. The following refers to the scenario in exercise 51 page 707.
- This problem uses the product rule for probability (blue box page 695). Copy it into your homework; include the text in the blue box as well as the formulas.
 - Use the notation given in exercise 51 to express these probabilities in symbols, and then calculate them. (So you will answer $P(\text{something})=\text{number}$ or $P(\text{something} \cap \text{something})=\text{number}$.)
 - The probability that the test is positive.
 - The probability that the test is negative. (See the Complement Rule page 681.)
 - The probability that the test is negative and the patient does not have toxemia at any time during the pregnancy. (Be careful, this is “and,” not “given.”)

- iv. The probability that the test is positive and that the patient has toxemia at some point during the pregnancy.
- C. Draw a two-circle Venn Diagram, labeling one circle N and the other circle T.
- i. Fill in the probabilities of each region in your diagram. Tip: begin with the regions that you studied in parts (B.iii.) and (B.iv.) above.
 - ii. Shade the regions that correspond to the test yielding a correct diagnosis. Write the symbol for the probability that the test yields a correct diagnosis. (Your answer will look like $P(\text{something} \cap \text{something}) + P(\text{something} \cap \text{something})$.) Calculate the probability that the test yields a correct diagnosis.
- D. Write the probabilities whose symbols are given in parts (a) and (b) of exercise 51 in words, and then calculate them. Check your answers in the back of the book, and when you get them right, write “Answers Checked” on them.
- E. Write the symbols for the conditional probabilities that you would have to calculate to get the sensitivity and specificity of this test. (Your answer will be a conditional probability symbol, like $P(\text{something}|\text{something})$). Calculate the specificity and sensitivity of the test.
- III. Read exercise 54, page 707. The experiment in this problem is to select a person at random from the people in North America in 1996 and test them for AIDS. Use T+ to denote the event that the test is positive, and T- to denote the event that the test is negative (so the complement of T+ is T-). Use D+ to denote the event that the person has the disease, and D- to denote the event that the person does not have the disease.
- A. Write the symbol and the value for the probability that the test yields a false positive. (The probability of a false positive is given in this problem to be 2%, so your answer should look like $P(\text{something} \cap \text{something}) = 0.02$).
 - B. Write the symbol and the value for the probability that the test yields a false negative.
 - C. Find the probability that a person chosen at random in North America in 1996 has AIDS. Again, write the symbol and the value.
 - D. Draw a two-circle Venn Diagram with one circle labeled T+ and one circle labeled D+. Fill in the probabilities of each region.
 - E. Answer the question from exercise 54. Again write the symbol and the value.
 - F. Find the sensitivity and specificity of this test, again writing the symbol and the value.