

STAT 140: Probability
Extra Problem

Leishmaniasis is a neglected tropical disease that places a billion people at risk each year. The most severe form of the disease is visceral, meaning that it attacks internal organs and can cause death. In Brazil, the probability of a person in the general population having disease is 10 percent. A diagnostic test is used to test for disease. If a person has the disease, the probability is 91 percent that they will have a positive diagnostic test result. If a person does not have disease, the probability is 8 percent that they will have a positive diagnostic test result.

- Let D be the event that a person has leishmaniasis.
- Let D^c be the event that a person does not have leishmaniasis.
- Let T be the event that they test positive on a diagnostic test.
- Let T^c be the event that they do not test positive on a diagnostic test (the complement of T).

Find the following probabilities. Use appropriate notation where needed.

(a) $P(D)$

(b) $P(T|D)$

(c) $P(T|D^c)$

(d) $P(T \text{ and } D)$

(e) $P(T \text{ and } D^c)$

(f) $P(T)$

(g) $P(D|T)$

What are the chances that a person who tests positive actually has leishmaniasis?