

Section 7.3 Homework / Discrete Structures II / Fall 2018

Note: You can use a calculator on problems 2(j) and 3(fg).

1. Suppose that E and F are events in a sample space so that $p(E) = 1/3$, $p(F) = 1/2$, and $p(E|F) = 2/5$. Compute $p(E \cap F)$ and $p(F|E)$.
 2. Suppose that 2% of a certain population has disease X. There's a test for the disease which satisfies the property that 99% of the people with the disease test positive, and 3% of the people who don't have the disease test positive. A person is selected at random from the population. Let D be the event that the random person has the disease, and let P be the event that the person tests positive for the disease. Compute the following:
 - (a) $p(D)$
 - (b) $p(\overline{D})$
 - (c) $p(P|D)$
 - (d) $p(\overline{P}|D)$
 - (e) $p(P|\overline{D})$
 - (f) $p(\overline{P}|\overline{D})$
 - (g) $p(P \cap D)$
 - (h) $p(P \cap \overline{D})$
 - (i) $p(P)$
 - (j) $p(D|P)$
 - (k) $p(P \cup D)$
 3. Suppose a certain test for opium use has a 2% false positive rate and a 4% false negative rate. That is, 2% of people who do not use opium test positive for opium, and 4% of people who do use opium test negative. Furthermore, suppose that 1% of people actually use opium. A person is selected at random. Let D be the event that the random person uses opium, and let N be the event that the person tests negative. Compute the following:
 - (a) $p(\overline{D})$
 - (b) $p(N|\overline{D})$
 - (c) The probability that the person doesn't use opium and tests negative.
 - (d) The probability that the person uses opium and tests negative.
 - (e) $p(N)$
 - (f) The probability that the person uses opium given that they test negative.
 - (g) $p(\overline{D}|N)$
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Answers

1. (a) $1/5$
(b) $3/5$
2. (a) 0.02
(b) 0.98
(c) 0.99
(d) 0.01
(e) 0.03
(f) 0.97
(g) 0.0198
(h) 0.0294
(i) 0.0492
(How is this related to the previous two parts?)
(j) ≈ 0.4024
(k) 0.0494
(Hint: Use inclusion-exclusion.)
3. (a) 0.99
(b) 0.96
(c) 0.9504
(d) 0.0004
(e) 0.9508
(f) ≈ 0.0004
(g) ≈ 0.9996