

ECS 315: In-Class Exercise # 7 - Sol

Instructions

1. Separate into groups of no more than three students each. **The group cannot be the same as any of your former groups.**
2. Explanation is **not required** for this exercise. [ENRE]
3. **Do not panic.**

Date: <u>05</u> / <u>09</u> / 2019			
Name			ID (last 3 digits)
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1) Consider the following sequences of 1s and 0s which summarize the data obtained from 15 testees in a disease testing experiment.

D:	0	1	1	0	0	0	0	1	1	1	0	1	0	1	1
		1	2					3	4	5		6		7	8
TP:	0	0	0	0	1	0	1	1	0	0	1	0	0	1	1
					1		2	3			4			5	6

The results in the i -th column are for the i -th testee. The D row indicates whether each of the testees actually has the disease under investigation. The TP row indicates whether each of the testees is tested positive for the disease. Numbers “1” and “0” correspond to “True” and “False”, respectively.

Suppose we randomly pick a testee from this pool of 15 testees. Let D be the event that the selected person actually has the disease. Let T_p be the event that the selected person is tested positive for the disease.

Find the following probabilities. No explanation is needed here.

There are 15 testees; so the sample space is finite. We “randomly” pick one testee; so it makes sense to assume that each testee has equal chance of being selected. Therefore, classical probability can be applied here.

$P(D) = \frac{8}{15}$ <p style="text-align: center; color: blue;">Among the 15 testees, 8 have the disease.</p>	$P(T_p) = \frac{6}{15} = \frac{2}{5}$ <p style="text-align: center; color: green;">Among the 15 testees, 6 test positive.</p>
$P(T_p \cap D) = \frac{3}{15} = \frac{1}{5}$ <p style="text-align: center; color: purple;">Among the 15 testees, 3 have the disease and test positive.</p>	$P(T_p \cap D^c) = \frac{3}{15} = \frac{1}{5}$ <p style="text-align: center; color: orange;">Among the 15 testees, 3 test positive but do not have the disease.</p>

In each part below, additional information about the selected testee is available; this additional information is given in the condition part. With such information, find the corresponding conditional probability.

$P(T_p D) = \frac{3}{8}$ <p style="text-align: center; color: orange;">Among the 8 testees who have the disease, 3 have the disease.</p>	$P(T_p D^c) = \frac{3}{7}$ <p style="text-align: center; color: orange;">Among the 15 – 8 = 7 testees who don’t have the disease, 3 test positive.</p>
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Alternatively,

$$P(T_p | D) = \frac{P(T_p \cap D)}{P(D)} = \frac{\frac{1}{5}}{\frac{8}{15}} = \frac{3}{8}$$

$$P(T_p | D^c) = \frac{P(T_p \cap D^c)}{P(D^c)} = \frac{\frac{1}{5}}{1 - \frac{8}{15}} = \frac{\frac{1}{5}}{\frac{7}{15}} = \frac{3}{7}$$