ECS 315: In-Class Exercise # 6

Instructions

1. Separate into groups of no more than three persons. **The group cannot be the same as any of your former groups.**
2. **Write down all the steps** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
3. **Do not panic.**

Date: 04 / 09 / 2018			
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1) Consider a random experiment whose sample space is $\{a,b,c,d\}$ with outcome probabilities 0.2, 0.2, 0.3, and 0.3, respectively.

Let $A=\{a,b,c\}, B=\{c,d\},$ and $C=\{a,c\}$.

Find the following probabilities. $A\cap B=\{c\}$

$A^c\cap B = B\setminus A = \{d\}$

$P(A\cap B) = P(\{c\}) = 0.3$

$P(A|B) = \frac{P(A\cap B)}{P(B)} = \frac{0.3}{0.6} = \frac{1}{2} = 0.5$

$P(B) = P(\{c,d\}) = P(\{c\})+P(\{d\}) = 0.3+0.3 = 0.6$

$P(A^c|B) = \frac{P(A^c\cap B)}{P(B)} = \frac{P(\{d\})}{0.6} = \frac{0.3}{0.6} = \frac{1}{2} = 0.5$

$P(B^c) = 1-P(B) = 1-0.6 = 0.4$

$P(A|B^c) = \frac{P(A\cap B^c)}{P(B^c)} = \frac{P(\{a,b\})}{0.4} = \frac{0.4}{0.4} = 1$

$A\cap B^c = A\setminus B = \{a,b\}$

$P(A\cap B|C) = \frac{P(A\cap B\cap C)}{P(C)} = \frac{P(\{c\})}{0.2+0.3} = \frac{0.3}{0.5} = \frac{3}{5}$

$= 0.6$

2) Consider the following sequences of 1s and 0s which summarize the data obtained from 16 testees in a disease testing experiment.

$|\Omega| = 16$

D:	0	1	1	0	0	0	0	1	1	1	1	0	1	0	1	1
TP:	0	0	0	0	1	0	1	1	0	0	1	1	0	0	1	1

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 16 persons. Let D be the event that this selected person actually has the disease. Let T_P be the event that this selected person is tested positive for the disease.

Find the following probabilities. No explanation is needed here.

$P(D) = \frac{9}{16}$ Among the 16 testees, 9 have the

$P(T_P) = \frac{7}{16}$ Among the 16 testees, 7 test positive.

$P(T_P\cap D) = \frac{4}{16} = \frac{1}{4}$ Among the 16 testees, 4 have the disease and test positive.

$P(T_P\cap D^c) = \frac{3}{16}$ Among the 16 testees, 3 test positive but do not have the disease.

$P(T_P|D) = \frac{4}{9}$ Among the 9 testees who have the disease, 4 test positive.

$P(T_P|D^c) = \frac{3}{16-9} = \frac{3}{7}$ Among the 16-9 = 7 testees who do not have the disease, 3 test positive.