

CS8750 HW #1 (20 points)

Spring 2017

(Due 1/31)

1. (4 points) Given a fair 6-sided die. Each time the die is rolled, the probabilities of rolling any of the numbers from 1 to 6 are all equal.
 - 1) If it is rolled once and let A be the event of rolling a 2 and B be the event of rolling an odd number. What is $P(A \vee B)$?
 - 2) If it is rolled twice, what is the probability that the first time is an odd number and the second time is a number larger than 4?
 - 3) If it is rolled twice, what is the probability that the sum of the two numbers is a multiple of 3 or less than 5?
 - 4) If it is rolled three times, what is the probability that the sum of the three numbers is a multiple of 3 or less than 5?
2. (1 point) Given a 6-sided die that each time the die is rolled, the probabilities of rolling any of the numbers from 1 to 4 are all equal, but the probability of rolling a 5 or 6 is 3 times the probability of rolling a 1. What is the probability of throwing a number 6?
3. (1 point) Consider an experiment with events A and B , for which $P(A)=0.3$, and $P(B)=0.6$. A and B are independent. What is $P(A \vee B)$?
4. (3 points) For a disease D and testing positive (+) or negative (-), suppose $P(D) = 0.2$, $P(+|D) = 0.7$, and $P(+|\neg D) = 0.4$.
 - 1) What is $P(+, D)$?
 - 2) What is $P(+)$?
 - 3) What is $P(D|+)$?
5. (2 points) Suppose the lung cancer rate is 0.02% of all people. Among all people, 4% are smokers, who have 0.2% chance of having lung cancer. What is the probability that a nonsmoker has lung cancer?
6. (7 points) Consider customer purchases of bread (R), bagels (A), and Butter (U). The probabilities of how they are bought together are shown in the table below. R, A, U are Boolean random variables. r refers to $R = 1$ and $\neg r$ for $R = 0$. a and u have similar meaning.
 - 1) What is $P(R|a, \neg u)$, i.e. $P(r|a, \neg u)$ and $P(\neg r|a, \neg u)$?

Name:

Student ID (Last 4 digits):

- 2) Are R and U independent? Explain.
- 3) Are R and U independent given A ? Explain.
- 4) Are R and A independent? Explain.
- 5) Are R and A independent given U ? Explain.

R	A	U	P(R,A,U)
0	0	0	0.24
0	0	1	0.06
0	1	0	0.10
0	1	1	0.08
1	0	0	0.12
1	0	1	0.18
1	1	0	0.06
1	1	1	0.16

7. (2 points) Consider an experiment with events A , B , and C , for which $P(a)=0.2$, $P(b)=0.3$, and $P(c)=0.4$. Suppose that events A and B are mutually exclusive and events B and C are independent.
 - 1) What is $P(A \vee B)$?
 - 2) What is $P(C \vee B)$?