**Assignment #3: Summer 2020**

**Question #1**:

At one point in the 1980s, a widely used test to test for HIV (the disease that causes AIDS) had a false positive rate of about 7%. That is, if you gave the test to a bunch of people, even if NONE of them actually had the disease, the test would report a positive result in 7% of them. A physician in a small rural clinic administers this test about 5 times a week. What is the likelihood of finding *at least* one false positive case?

**Question #2**:

The 2000 census allowed each person to choose from a long list of races. That is, in the eyes of the Census Bureau, you belong to whatever race you say you belong to. If we choose a resident of the United States at random, the 2000 census gives these probabilities:

|  |  |  |
| --- | --- | --- |
|  | Hispanic | Not-Hispanic |
| Asian | 0.000 | 0.036 |
| Black | 0.003 | 0.121 |
| White | 0.060 | 0.691 |
| Other | 0.062 | 0.027 |

Let A be the event that a randomly chosen American identifies himself/herself as Hispanic. Let B be the event that the person identifies as white.

1. Verify that the table gives a legitimate assignment of probabilities.
2. Describe in words and find P(A)
3. Describe Bc in words and find P(Bc)
4. Express “the person chosen is a non-Hispanic white” in terms of events A and B. What is the probability of this event?

**Question #3**:

A national study indicates that 39% of Florida residents are foreign-born. Suppose that you randomly choose three Floridians so that each has probability 0.39 of being foreign-born and the three are independent of each other. Let W be the number of foreign-born people you choose.

1. What are the possible values of W? That is, what is the sample space of W?
2. Looking at the three people in your sample, there are 8 possible arrangements of foreign (F) and domestic (D) birth. For example, FFD means the first two are foreign born and the third is not. List all 8 possible arrangements. Then provide the probability for each one.
3. Think back to the sample space for W in part ‘a’ above. For each of the 8 arrangements in part ‘b’ above, what is the value of W? For each possible value of W in the sample space, give its probability.

**Question #4**:

1. A statistics professor asks her graduate student to roll a die 10,000 times and record the results. Give the expected mean of the outcome.
2. The die roll experiment is repeated (though with a different graduate student – for some reason the previous one went to work with a different advisor). However in this case, the die is weighted so that a 6 shows up 30%, a 1 shows up 10% of the time and the remaining numbers (2,3,4,5) each show up 15% of the time. Now what is the mean of 10,000 rolls?

**Question #5**:

In a college population, students are classified by gender and whether or not they are frequent binge drinkers. Here are the probabilities:

|  |  |  |
| --- | --- | --- |
|  | Men | Women |
| Binge Drinker | 0.11 | 0.12 |
| Not Binge Drinker | 0.32 | 0.45 |

1. Find the probability that a randomly selected student is a male binge drinker, and find the probability that a randomly selected student is a female binge drinker.
2. Find the probability that a student is a binge drinker, given that the student is male and find the probability that a student is a binge drinker, given that the student is female. You can determine this with a simple calculation off of the chart, but you must confirm these values by using the conditional probabilities as discussed in lecture.
3. Your answer to part (a) gives a higher probability for females, while your answer for part (b) gives a higher probability for males. Interpret your answers in terms of the question of whether there are gender differences in binge-drinking behavior. Decide which comparison you prefer and explain the reasons for your preference.