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**IT 223**

**Assignment #5**

**Problem #1**:

A popular test for a certain medical condition has about a 3.8% rate of false positive results. That is, about 3.8% of people who do *not* have the disease will still have a positive test! A physician’s medical clinic administers this test to about 60 people each week. Suppose you give the test to just 10 people, what is the likelihood of finding *at least* one false positive in the result? In other words, what is the likelihood that at least 1 person in that 10 will be told *incorrectly*(!) that they have the disease? Hint: Review the in-class ‘0s in PIN numbers’ example.

In this case, event A is the event you have this disease, and event B is the event that you test positive. Thus P(B|not A) is the probability of a "false positive": that you test positive even though you don't have the disease.

P(B)=P(B|A)P(A)+P(B|not A)P(not A)

Probability of it NOT being a false positive: .962 (complement rule)

Thus n1, n2, n3 … n10 have a 96.2% chance not having false positive.

P(none are false positive) = (1-.038)^10 = 67.8%

P(1 is false positive) = (1-.678) = 32.1%

The probability of having at least 1 false positive is 32.1%

**Problem #2**:

Internet sites often vanish or move so that references to them can’t be followed. In fact, a recent study claimed that 9% of Internet sites reference in major papers are lost within two years of publication. If a paper contains six references, what is the probability that all six references are still good two years later? What assumption must you make in order to calculate this probability?

P(Site still good) = 1 - .09 = .91

🡪P(all 6 references still good) = .91^6 = 56.78%

The assumption I needed to make was the likelihood of the references still being good.

**Problem #3**:

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.

a)      Verify that the table gives a legitimate assignment of probabilities.

b)      What is P(A)

c)       Describe Bc in words and find P(Bc)

d)      Express “the person chosen is a non-Hispanic white” in terms of events A and B. What is the probability of this event?

3a) .00 + .036 + .003 + .121 + .060 + .691 + .062 + .027 = 1 or 100%

This table is a legitimate assignment of probabilities because it adds up to 100%.

3b) P(A) = .00 +.003 + .060 + .062 = .125

P(A(Hispanic)) = 12.5%

3c) B = .060 + .691 = .751

B = 75.1%

Bc is the complement of B, which is the people who DON’T identify themselves as White.

Furthermore, P(Bc) = (1-.751) = 24.9%

3d) “Person is a non-Hispanic White”: Ac and B

P(Ac and B) = .691 or 69.1%

**Problem #4**:

In addition to a small amount of number crunching, this problem also asks you to make sure you can keep track of identifiers such as ‘X’, ‘F’, or ‘D’ as specified in the problem. In other words, you must make sure that you are clear about what each of these variables represents.

The Census Bureau reports that 29% of California residents are foreign-born. Suppose that you choose three Californians at random so that each has probability 0.29 of being foreign-born and the three are independent of each other.  Let the ‘X’ represent the number of foreign-born people in your sample of three people.

F(FB) = P(F) = 0.29

P(Not F) = F(D) =1-0.29 = 0.71

P(FFF) = F + F + F = 0.29^3 = .024 = 2.4%

P(DDD) = D + D + D = 0.71^3 = .357 = 35.7%

P(FFD) = 0.29 \* 0.29 \*0.71 = .059 = 5.9%

P(FDD) = 0.29 \* 0.71 \* 0.71 = .146 = 14.6%

1. What is the sample space for the possible values of X (X represents the number of foreign-born people possible in a group of three)?

S = {0,1,2,3}

b)      Look at your three people in order. 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.

1) List all 8 arrangements

2) What is the probability of each of the 8 arrangements?

P(X = 0) = P(FFF) = 2.4%

P(X = 1) = P(FFD or FDF or DFF) = P(FFD)(5.9%) + P(FDF)(5.9%) + P(DFF)(5.9%) = 17.7%

P(X = 2) = P(FDD or DFD or DDF) = P(FDD)(14.6%) + P(DFD)(14.6%) + P(FFD)(14.6%) = 43.8%

P(X = 3) = P(DDD) = 35.7%

1. What is the probability of each possible value in the sample space for X in ‘a’ above? (Hint: consider combining like terms in ‘b’)

S = {0(2.4%), 1(17.7%), 2(43.8%), 3(35.7%)} = 100%