**Shaan Barkat**

**IT-223 Assignment #6**

**Problem #1**(10 points)

You ask your graduate student to roll a die 10,000 times and record the results.

1. Give the probability model, expected mean and standard deviation of the outcome.

P is the probability of success

q is the probability of failure

q = 1 – p

probability of getting a 6 is 1/6 and probability of not getting a 6 is 5/6

p = 1/6 and q = 5/6

with 10,000 rolls, mean is np = 10,000 \* 1/6 = 10,000/6

standard deviation is sqrt(n\*p\*q) = sqrt(10,000 \* 1/6 \* 5/6) = sqrt(50,000/36)

Mean = 1666.67

SD = 37.27

1. The die roll experiment is repeated (though with a different graduate student – for some reason your previous student went to work with a different advisor). However in this case, the die is weighted so that a 6 shows up 20% of the time and all remaining numbers show up 16% of the time. Now what is the mean and sd of 10,000 rolls? Be sure to give the probability model, expected mean and standard deviation of the outcome

P = 1/5

q = 4/5

n is still 10,000

mean = np = 10,000 \* 1/5 = 10,000/5

standard deviation = sqrt(npq) = sqrt(10,000 \* 1/5 \* 4/5) = sqrt(40,000/25)

mean = 2000

SD = 40

**Problem #2**(12 points)

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.

P(male AND binge drinker) = 0.11

P(Female AND binge drinker) = 0.12

1. 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.

P(binge drinker | male) = 0.11/0.43 = 0.2558

P(binge drinker | female) = 0.12/0.57 = 0.2105

1. Your answer for 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.

Part (a) asks the question to the entire sample sample space. Now look at the totals: women make up 57% of the sample space while men make up 43% of the sample space. Thus, just by having a larger number of women in this population, the result from (a) which is shown in the table above, say that there are more women binge drinkers in this population, because there are more women. But question (b) breaks apart that sample space according to gender. Now, while the male population is smaller than the women, it has a larger proportion of binge drinkers, which is what the probabilities:

P(binge drinker | male) = 0.11/0.43 = 0.2558

P(binge drinker | female) = 0.12/0.57 = 0.2105; This displays that a little more than ¼ of males are binge drinkers, while a little more than 1/5 of females are binge drinkers.

**Problem #3**(7 points)

Call a household prosperous if its income exceeds $225,000. Call the household educated if the householder completed college. Select an American household at random, and let *A* be the event that the selected household is prosperous and *B* the event that it is educated. According to the Current Population Survey,*P*(*A*) = 0.122, *P*(*B*) = 0.204, and the probability that a household is both prosperous and educated is *P*(*A* and *B*) = 0.074. What is the probability *P*(*A* or *B*) that the household selected is either prosperous or educated?

P(A or B) = P(A) + P(B) – P(A and B)

= 0.122 + 0.204 – 0.074

= 0.252

**Problem #4**(6 points)

You are a high-school basketball coach and the final game of the season is on the line. You must pick one of the following two players to make 3 free-throw attempts. Here are the current season’s outputs for your two best shooters, Lauren and Lisa. Which one is most likely to give you your best result?  Be sure to explain why.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Lauren** | 0 | 1 | 2 | 3 |
| Prob. | .3 | .2 | .2 | .3 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Lisa** | 0 | 1 | 2 | 3 |
| Prob. | .1 | .4 | .3 | .2 |

For Lauren our expected value is (0)(.3)+(1)(.2)+(2)(.2)+(3)(.3) = 1.5  
For Lisa our expected value is (0)(.1)+(1)(.4)+(2)(.3)+(3)(.2) = 1.6  
Thus we should pick Lisa, as it is expected she will score higher

**Problem #5** (5 points)

The cartoon on the opening slide of this week’s lecture demonstrates the famous ‘Monty Hall Problem’. This is a famous statistical puzzle. Go online and read up on the game and explanations on why the user should switch. Then describe why the user should decide to switch doors.

A key point to remember is that the game host is required to pick a door behind which is a goat. That is, the host will never pick the winning door.

This problem is very interesting for all kinds of reasons, one of which is the fact that intuitively, most people (including many mathematicians) would say that it really isn’t necessary to switch. And yet, your likelihood of winning most definitely does improve if you switch. Math and statistics can be very interesting when it comes to these sorts of things.

NOTES:

         I do NOT want you to simply paraphrase. I want you to think about the problem and show that you understand the reasoning behind why the user should switch. Then simply write it out in your own words.

         **Your response does not have to be long**! A single paragraph is just fine.

It took me a while but I figured it out. The reason I was confused was because I wasn’t accounting for the bad choices being filtered out. Furthermore, it’s a choice of a random guess and the car door that’s the best on other side. In retrospect, more information means you can re-evaluate your choices. I believe the goal isn’t to understand the puzzle, rather to realize how subsequent actions and information, challenge previous decisions. In conclusion, The Monty Hall problem is an example where the probabilities are not independent, so our intuition fails.