


Probability

3.8 Advanced Problems

1. In return for completing a dining survey at FIU, participants were entered into a raffle for two \$500 gift cards. The survey was administered to two groups: faculty and students. Twenty-five students and fifty faculty members completed the survey. What is the probability that the two winning randomly selected survey participants are both from the same group?
2. Three students take a make-up quiz together, and all three students pick the same wrong answers for problem number four on a multiple choice exam that has five answer options for each question. The professor suspects they copied off of each other. When asked separately why they chose the answer they did, the students claimed they all just took a random guess on the question because they didn't know the answer. What is the probability that if all three students guessed randomly, they would all guess the same wrong answer for problem four on the exam?
3. A box of numbered marbles has 12 red, 12 blue, 12 green, and 12 yellow marbles. The marbles for each color are numbered from 1 to 12. There is a unique number on each marble, so no marble is exactly the same as any other marble in the box. When reaching into the box to randomly draw five marbles without replacement, what is the probability of getting exactly four marbles of the same color (note: the numbers matter but the order does not)? [VS](#) 

Answers:

1. 55%

$$P(\text{both from the same group}) = P(2 \text{ students or } 2 \text{ faculty}) = P(2S) + P(2F) =$$

$$\frac{25}{75} * \frac{24}{74} + \frac{50}{75} * \frac{49}{74} = \frac{3050}{5550} = 0.550$$

2. The solution is below, but you might not understand it fully without the explanation of some of its parts. You'll notice there are three fractions of $1/5$. That is because there are three students taking the guesses so there is a fraction for each of the three students' guesses. There are four wrong answer options out of the five answer options, so we have four sets of

$1/5 * 1/5 * 1/5$. The $1/5$ is the probability they pick a particular wrong answer. For example, what is the chance they all pick wrong answer A. It is $1/5 * 1/5 * 1/5$.

$$P(\text{all 3 pick the same wrong answer}) =$$

$$P(\text{all pick first wrong answer or second wrong answer or...or fourth wrong answer})$$

$$= P(\text{all pick 1st}) + P(\text{all pick 2nd}) + \dots + P(\text{all pick 4th})$$

$$= \frac{1}{5} * \frac{1}{5} * \frac{1}{5} + \frac{1}{5} * \frac{1}{5} * \frac{1}{5} + \dots + \frac{1}{5} * \frac{1}{5} * \frac{1}{5} = 4 \left(\frac{1}{5} * \frac{1}{5} * \frac{1}{5} \right)$$

3. The best approach to solve this problem is to use combinations to solve the problem (see the answer below). The first combination picks the color from the four colors possible; then from that color we pick four numbers from the 12 numbers available; then we pick another color from the 3 remaining colors; and then we take one number from the 12 numbers of that chosen color. Finally, divide by the total number of ways to choose five marbles from 48 marbles.

$$P(4 \text{ of the same color and 1 of a different color}) =$$

$$\frac{{}_4C_1 * {}_{12}C_4 * {}_3C_1 * {}_{12}C_1}{{}_{48}C_5} = \frac{71,280}{1,712,304} = 0.0416$$