MGF2106 (Survey of Mathematics): Probability Project

Purpose: Work individually or as a group to complete various tasks related to probability, to enhance your understanding and answer the questions. Probability is a powerful tool that can be used in areas ranging from gambling to genetics.

Assignment: Complete the project, compiling the various parts into a single document which is submitted to the Dropbox in Falcon Online. The Discussion Board in Falcon Online may be used to find classmates for working as a group. If you work as a group, each student must submit the project solutions to the Dropbox in Falcon Online by the posted due date with each participants' name on the submission.

Format for Dropbox Submission:

1. The submission should be a single document formatted as .docx, .doc, .rtf, or .pdf.
2. The submission should be typed. If there are parts of the assignment that need to be drawn by hand, they should be done neatly, scanned, and included in the final submission. Please check with your instructor if you have questions about the format of the document.
3. Put your name on the document. If you worked in a group, also list the names of the other students in the group.

Part 1: Gambling

Visit www.flalottery.com and answer the following questions about the Florida Lottery. Clearly explain how each of the following probabilities is computed.

1) What is the probability of winning the jackpot if you play the Florida Lotto?
2) What is the probability of winning the jackpot if you play Mega Millions?
3) What is the probability of winning the jackpot if you play Powerball?

For each question make sure that you fully explain the reasoning behind your answers and the concept(s) from probability that are used to answer them.

Part 2: Genetics

In the nineteenth century, the Austrian monk Gregor Mendel noticed while crossbreeding plants (peas in particular) that often a characteristic of the plants would disappear in the first-generation offspring but reappear in the second generation. He theorized that the first-generation plants

contained a hidden factor (which we now call a gene) that was somehow transmitted to the second generation to enable the characteristic to reappear.

As an example, suppose we denote the gene that produces the yellow seed by Y and the gene that produces the green seed by g. The uppercase Y indicates that yellow is the dominant gene and the lowercase g indicates that green is recessive. The table below shows the possible theoretical outcomes that can occur when we cross two first-generation plants.

		First Generation Plant	
		Y	g
First Generation Plant	Y	YY	Yg
	g	gY	gg

Notice from the table that of the 4 possible outcomes, 3 of the plants will be yellow (since 3 have the dominant Y gene) while 1 of the plants (since only 1 has two recessive genes) will be green. From this we can say that the theoretical probability of the second-generation plant being green is ¼ or 0.25.

There is of course a difference between theoretical and experimental. The following table lists some of the actual results that Mendel obtained in his experiments in crossbreeding peas.

Experimental Results		
Characteristics That Were Crossbred	First-Generation Plants	Second-Generation Plants
Tall versus Short	All tall	787 tall 277 short
Smooth versus Wrinkled Seeds	All smooth seeds	5,474 smooth 1,850 wrinkled
Yellow versus Green Seeds	All yellow seeds	6,022 yellow 2,001 green

Notice from the results that tall, smooth, and yellow are all dominant genes. Also notice that based on the experimental results, the probability of a second-generation plant being green is 0.2494. This agrees fairly well with the theoretical probability.

From the tables of possible theoretical outcomes and experimental results, answer the following questions.

1) Assume that we are crossbreeding genetically tall and short plants. Create a table (just like the one for yellow and green plants) that shows the possible theoretical outcomes that can occur when we cross two first-generation plants.
2) What is the theoretical probability that a plant will be short?
3) What is the experimental probability that a plant will be short?
4) How do theoretical and experimental probabilities compare?
5) Assume that we are crossbreeding genetically smooth-seed and wrinkle-seed plants. Create a table (just like the one for yellow and green plants) that shows the possible theoretical outcomes that can occur when we cross two first-generation plants.
6) What is the theoretical probability that a plant will have smooth seeds?
7) What is the experimental probability that a plant will have smooth seeds?
8) How do theoretical and experimental probabilities compare?

Part 3: Impact Question

Provide an example, or examples, of how the concepts covered in this assignment could be applied in life or future career choices other than gambling and genetics. The answer should show sufficient thought, effort, and research.