Probability Project

You may work with up to three partners for this project.(You will turn in one copy of the write-up for the whole group. **No more than four groups per topic** because you will be presenting these to the class in a four to six minute presentation that includes a visual aid.

If there is a topic you want, you better come tell me quick. THE BEST PROJECT OF EACH TOPIC WILL EARN BONUS POINTS!

Your project should be done on a **powerpoint**(*probabably easier for this project*), **or typed &laminated**.

Use good English skills—complete sentences with correct grammar, spelling and punctuation. Your write-up should contain the following paragraphs (paragraphs contain several sentences and are not numbered):

1. Introduction
2. Theoretical data & probability answer
3. Description of simulation your group chose
4. Simulated data & probability answer
5. Comparison of theoretical and simulated data
6. Conclusion

CHOOSE ONE OF THE FOLLOWING LETTERS/TOPICS FOR YOUR PROJECT

A. **Families of Four**: Calculate the **theoretical probability(the meanμ)** for the births of 4 children(assume births of boys are girls are equal). Show the sample space for this and include a probability distribution table.(give probabilities for 0 girls,1 girl, 2 girls, 3 girls, and 4 girls.). Simulate the births of 4 children running at least 50 trials(families of 4 children). Suggested simulation methods: (a) a random number table, (b) your calculator (c) coin tossing, (e) dice rolling or any other appropriate random method. Using your simulated data calculate the **simulated probability(the sample mean)** and create a probability distribution table for your simulated data for 0 girls, 1 girl, 2 girls, 3 girls and 4 girls). Compare these sample probabilities to your **theoretical probabilities.**

B. **Cards:** What is the probability of drawing **exactly** 3 RED cards out of 4? Calculate the **theoretical probability** of this using a tree diagram. This must be done without replacement(shuffle the deck once and then remove all 4 cards, do not reshuffle). You must also run a simulation to come up with your **sample probabilities**. Your simulation may be done using actual cards or using a random digit table. You must run at least 100 trials of this. Comment on the accuracy of your simulation compared to the theoretical probability.

C. **Dice Rolling**: Italian gamblers used to bet on the total number of dots rolled on three six-sided dice. They believed the chance of rolling a nine ought to equal the chance of rolling a total of 10 since there were an equal number of different ways to get each sum. However, experience showed that these did *not* occur equally often. The gamblers asked Galileo for help with the apparent contradiction, and he resolved the paradox. Can you do the same? Be sure to explain both why the gamblers were confused and what the actual probabilities are. Include evidence from trials/simulations and theoretical calculations.

D: **Roulette**: Roulette is a very popular casino game all over the world. Consider a roulette wheel numbered 1-36 and a 0 spot.(just like the one in the picture to the right. Calculate the **theoretical probability** of getting a # in the first 12(1-12) OR a Red. Use a *Venn Diagram* to help show this probability. You must simulate this probability with 100 trials(rolls). This can be done using a random # generator, and actual roulette wheel or any other random method. Calculate the **simulated probability** of your 100 trials and compare to the **theoretical probability.** Make sure to show ALL simulated rolls.

E: **2004 ALCS:** The 2004 American League Championship Series between the New York Yankees and the Boston Red Sox was the first time in the history of Major League Baseball that a team had come back from a 3 games to 0 deficit to win the series. Boston scored 7,1,8,6,5,4, and 10 runs in that order to win the series in 7 games. Below is the New York Yankees runs scored table for the 2004 regular season.

Runs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	18
Prob.	.04	.05	.12	.10	.11	.13	.09	.09	.07	.04	.06	.05	.02	.01	.01	.01

Calculate the expected number of runs for a single NY Yankee game based on this table. Use this value as their **theoretical # of runs per game.** Show how the series would have gone using the Yankees **theoretical run value** vs what Boston actually scored each game. Does Boston still win the series? How many games did the series go? Remember that it is the best of 7 series(first team to win 4 games).

Run a simulation for the Yankees scoring runs for this series using their probabilities from the probability distribution table. Use a random digit table making sure to **ASSIGN YOUR DIGITS** and show your method clearly. Again show who would win the series, in how many games, and give the scores.

F: **Horse Racing:** Consider the following 5 horses who will be racing at the Vaquero race track next weekend.

#1 Tallica Monster
#2 Kona Girl
#3 Sneaky Fast
#4 Darjeeling Limited
#5 Moonrise Kingdom

Assume that all the horses have the same chance of winning the race.

Give the **theoretical probabilities** of the following(show all work):
1. Probability that Tallica Monster finishes first?
2. Probability that Tallica Monster finishes first or in front of Kona Girl?

Run a simulation of 100 races keeping track of the same two questions from above. Compare the **simulated probabilities** to the **theoretical probability.**