Section 5.1 Problems Name: _____

These problems accompany section 5.1; put your answers and any explanations on your own piece of paper. We will check these tomorrow.

#1.) Sometimes police use a lie detector (polygraph) to help determine whether a suspect is telling the truth. A lie detector test isn't foolproof- sometimes it suggests that a person is lying when they're actually telling the truth (false positive). Other times, the test says that the suspect is being truthful when the person is actually lying (false negative). For one brand of polygraph machine, the probability of a false positive is 0.08.

a.) Interpret this probability as a long-run relative frequency.

b.) Which is a more serious error in this case: a false positive or a false negative? Justify your answer.

#2.) In the popular Texas Hold 'Em variety of poker, players make their best five-card poker hand by combining the two cards they are dealt with three of five cards available to all players. You read in a book on poker that if you hold a pair (two cards of the same rank) in your hand, the probability of getting four of a kind is 88/1000.

a.) Explain what this probability means.

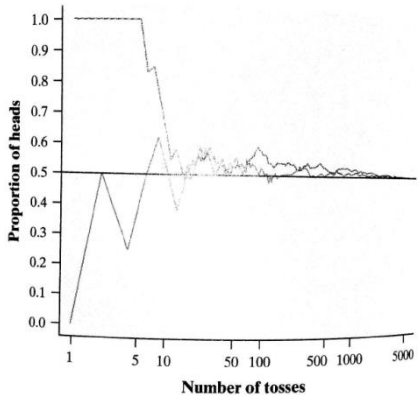
b.) Why doesn't this probability say that if you play 1000 such hands, exactly 88 will be four of a kind?

#3.) Using the PROB SIM app on your calculator, simulate flipping a coin 25 times keeping track of the number of heads your find.

a.) What's your estimate for the probability of heads? Why?

b.) Explain how you could get an even better estimate.

#4.) The figure below shows the results of two different sets of 5000 coin tosses. Explain what this graph says about chance behavior in the short run and the long run.



#5.) A very good professional baseball player gets a hit about 35% of the time over an entire season. After the player failed to hit safely in six straight at bats, a TV commentator said "He is due for a hit by the law of averages." Is this right, explain?

#6.) The Pick 4 lotteries announce a four-digit winning number each day. You can think of the winning number as a four-digit group from a table of random digits. You win (or share) the jackpot if your choice matches the winning number. The winnings are divided among all players who matched the winning number. That suggests a way to get an edge.

a.) The winning number might be, for example, either 2873 or 9999. Explain why these two outcomes have exactly the same probability.

b.) If you asked many people whether 2873 or 9999 is more likely to be the randomly chosen winning number, most would favor one of them. Use the information in this section to say which one and to explain why. How might this affect the four-digit number you would choose?

#7.) A gambler knows that red and black are equally likely to occur on each spin of a roulette wheel. He observes five consecutive reds occur and bets heavily on black on the next spin. Asked why, he explains that black is "due by the law of averages." Explain to the gambler what is wrong with this reasoning.

#8.) After hearing you explain why red and black are still equally likely after five reds on the roulette wheel, the gambler moves to a poker game. He is dealt five straight red cards. He remembers what you said and assumes that he next card dealt in the same hand is equally likely to be red or black. Is the gambler right or wrong, and why?

#9.) On her drive to work every day, Emma passes through an intersection with a traffic light. The light has probability of 1/3 of being green when she gets to the intersection. Explain how you would use each chance device to simulate whether the light is red or green on a given day.

a.) A six-sided die

b.) Table D of random digits

c.) A standard deck of playing cards

#10.) According to a recent poll, 75% of American adults regularly recycle. To simulate choosing a random sample of 100 U.S. adults and seeing how many of them recycle, roll a 4-sided die 100 times. A result of 1, 2, or 3 means the person recycles, a 4 means that the person does not. Is the following simulation valid, justify?

#11.) An archer hits the center of the target with 60% of her shots. To simulate having her shoot 10 times, use a coin. Flip the coin once for each of the 10 shots. If it lands heads, then she hits the center of the target. If the coin lands tails, she does not. Is the following simulation valid, justify?

#12.) In the game of Scrabble, each player begins by drawing 7 tiles from a bag containing 100 tiles. There are 43 vowels, 56 consonants, and 2 blank tiles in the bag. John chooses his 7 tiles and is surprised to discover that all of them are vowels. We can use a simulation to see if this result is likely to happen by chance.

a.) State the question of interest using the language of probability.

b.) How would you use random digits to imitate one repetition of the process? What variable would you measure?

c.) Use the line of random digits below to perform one repetition.

00694 05977 19664 65441 20903 62371 22725 53340

d.) In 1000 repetitions of the simulation, there were 2 times when all 7 tiles were vowels. What conclusion would you draw?

#13.) You read in a book about bridge that the probability that each of the four players is dealt exactly one ace is about 0.11. This means that

a) in every 100 bridge deals, each player has one ace exactly 11 times.

b) in one million bridge deals, the number of deals on which each player has one ace will be exactly 110,000.

c) In a very large number of deals, the percent of deals on which each player has one ace will be very close to 11%

d) none of these

#14.) If I toss a fair coin five times and the outcomes are TTTTT, then the probability that tails appears on the next toss is

a) 0.5 b) less than 0.5 c) greater than 0.5 d) 0

#15.) A basketball player makes 47% of her shots from the field during the season. To simulate whether a shot hits or misses, you would assign random digits as follows:

a) one digit simulates one shot, 4 and 7 are a hit; other digits are a miss

b) two digit simulate one shot; odd digits are a hit and even digits are a miss

c) two digit simulate one shot; 00 to 47 are a hit and 48 to 99 are a miss.

d) two digit simulate one shot; 00 to 46 are a hit and 47 to 99 are a miss.

#16.) Use the correct choice from the previous question and these random digits to simulate 10 shots.

82734 71490 20467 47511 81676 55300 94383 14893

How many of the 10 shots are hits?

a) 2 b) 3 c) 4 d) 5 e) 6