Algebra 2/Pre-Calculus **Name**_____

Statistics Test Review, Part 1

1. Suppose you are taking a multiple choice test with 24 questions. Each question has four possible answers (A, B, C, D). You are completely unprepared for the test, so you guess on every question.

a. Find the mean and standard deviation for the number of questions you get right. ***Hint:*** What is your probability of getting a right answer on any one question?

b. Which values are within one standard deviation of the mean?

c. What is the probability of getting exactly 6 questions right? (You may use your calculator, but do not use wolframalpha.)

d. What is the probability of getting exactly 12 questions right? (You may use your calculator, but do not use wolframalpha.)

Answers a. mean = 6, standard deviation = 2.1213 b. 4, 5, 6, 7, 8

c. $({}_{24}C_6)(0.25)^6(0.75)^{18} = 18.53\%$ d. $({}_{24}C_{12})(0.25)^{12}(0.75)^{12} = 0.51\%$

e. Use wolframalpha to find the probability that the number of wins is within 1 standard deviation of the mean. ***Hint:*** What expression should you put into wolframalpha? ***Note:*** You can use your answer from wolframalpha to check your answers for parts **c** and **d**.

f. Suppose we use the normal curve to estimate the probability that the number of wins is within one standard deviation of the mean. What do we get for this estimate? ***Note:*** Your answer to this question should be fairly close to the answer for part **e**, but they will not be exactly the same.

g. To pass the test, you need to get at least 10 questions right. Use the normal curve to estimate your probability of passing the test.

Answer e. $.1316 + .1755 + .1853 + .1588 + .1125 = 76.37\%$ (Get probabilities from wolframalpha) f. 68.27% g. $\text{normalcdf}(10, 24, 6, 2.1213) = 2.967\%$

h. Now suppose the test was 200 questions long instead. What are the mean and standard deviation for the longer test?

i. What is the probability that you will get between 45 and 55 questions right? (Use the normal curve to estimate the probability.)

j. If you get less than a 40 on the test, you will fail. Use the normal curve to estimate the probability of failing.

Answers h. mean = 50, standard deviation = 6.1237

i. $\text{normalcdf}(45,55,50,6.1237) = 58.58\%$ j. $\text{normalcdf}(0,39,50,6.1237) = 3.62\%$

2. Suppose you are flipping a bent coin that lands heads 80% of the time and tails 20% of the time. You flip the coin 9 times. ***Note:*** Do all parts of this problem **without** using wolframalpha.

a. Find the probability of getting exactly 7 heads.

b. Find the probability of getting at least 7 heads. (Give the exact probability, not an estimate from the bell curve.)

c. List the values that are within one standard deviation of the mean.

d. Find the probability of getting a value that is within one standard deviation of the mean. (Give the exact probability, not an estimate from the bell curve.)

Answers a. $({}_9C_7)(0.8)^7(0.2)^2 = 30.20\%$

b. $({}_9C_7)(0.8)^7(0.2)^2 + ({}_9C_8)(0.8)^8(0.2)^1 + ({}_9C_9)(0.8)^9 = 73.82\%$

c. 6, 7, 8 d. 78.01% (Use an approach similar to the one in part b)

3. Suppose you are flipping a slightly bent coin that lands heads 47% of the time and tails 53% of the time. You flip the coin 40 times.

a. What is the probability of getting heads exactly 21 times?

b. What is the probability of getting heads either 19, 20, 21, 22 or 23 times? (Give an exact answer using probabilities from wolframalpha, not an estimate from the bell curve.)

c. What is the probability of getting heads is between 16 and 25? (Use the bell curve to estimate the probability.)

Answers a. $({}_{40}C_{21})(0.47)^{21}(0.53)^{19} = 9.85\%$ b. 46.83%

c. $\text{normalcdf}(16,25,18.8,3.1566) = 78.77\%$

d. What is the probability that the number of heads will be 28 or more? (Use the bell curve to estimate the probability.)

e. What is the probability that the number of heads will be 10 or less? (Use the bell curve to estimate the probability.)

Answers d. $\text{normalcdf}(28,40,18.8,3.1566) = 0.18\%$ e. $\text{normalcdf}(0,10,18.8,3.1566) = 0.27\%$

4. Explain the connection between area and probability. ***Hint:*** Start with a probability histogram. If you get stuck, think about question **3** from the handout Probabilities, Histograms, and Area."

5. Explain where each of the following formulas come from:

mean = np, variance = $np(1-p)$, standard deviation = $\sqrt{np(1-p)}$

Hint: If you get stuck, think about problem **2** on the handout "Standard Deviation and Bernoulli Trials."

6. Consider the following Spinners:

Spinner A: {4, 4, 4, 7, 7}

Spinner B: {2, 2, 5, 5, 6, 6}

a. Find the mean, variance, and standard deviation for each spinner.

b. Suppose we spin both spinners at once. What is the mean, variance, and standard deviation for the sum?

c. Suppose we spin Spinner A three times and take the sum. What is the probability that the sum will be at least 18? ***Hint:*** Start by doing a polynomial multiplication. Use the binomial theorem.

Answers a. Spinner A: mean = $\frac{3}{5}(4)+\frac{2}{5}(7)=5.2$, variance = $\frac{3}{5}(4-5.2)^2+\frac{2}{5}(7-5.2)^2=2.16$, standard deviation = 1.4697

Spinner B: mean = 4.3333, variance = 2.8889, standard deviation = 1.700

b. mean = $5.2000+4.3333=9.5333$, variance = $2.1600+2.8889=5.0489$, standard deviation = 2.2470 c. $\frac{44}{125}$

d. Suppose we spin Spinner A 100 times. What are the mean, variance, and standard deviation for the sum of the 100 spins?

e. Suppose we spin Spinner A 100 times. What is the probability that that sum will be between 510 and 530.

Answers d. mean = $100(5.2) = 520$, variance = $100(2.16) = 216$,

standard deviation = 14.6969 e. $\text{normalcdf}(510,530,520,14.6969) = 50.38\%$

7. Suppose you roll at standard six-sided die 1000 times.

a. What are the mean, variance, and standard deviation for one roll of the die?

b. What are the mean, variance, and standard deviation for the sum of 1000 rolls of the die?

c. What is the probability that the sum will be between 3400 and 3600? ***Note:*** Use the bell curve to answer this question.

Answers a. mean = $\frac{1}{6}(1)+\frac{1}{6}(2)+\frac{1}{6}(3)+\frac{1}{6}(4)+\frac{1}{6}(5)+\frac{1}{6}(6)=3.5$, variance = $\frac{1}{6}(1-3.5)^2+\frac{1}{6}(2-3.5)^2+\frac{1}{6}(3-3.5)^2+\frac{1}{6}(4-3.5)^2+\frac{1}{6}(5-3.5)^2+\frac{1}{6}(6-3.5)^2=2.9167$,

Standard deviation = 1.7078 b. mean = 3500, variance = 2916.7

Standard deviation = 54.01 c. $\text{normalcdf}(3400,3600,3500,54.01)=93.59\%$