**Homework 5; Monday, March 16**

**NAME:**

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**1)** Consider each of the following distributions. Determine if it is a valid probability distribution or not, and explain your answer.

a) Distribution 1

| x | P(x) |
|---|---|
| 0 | 0.25 |
| 1 | 0.60 |
| 2 | 0.15 |

b) Distribution 2

| y | P(y) |
|---|---|
| 0 | 0.25 |
| 1 | 0.60 |
| 2 | 0.20 |

**2)** In the following problems, $p(i)$ stands for $P(X = i)$. Find the expected value $E(X)$ when:

a. $p(1) = 0.1$, $p(2) = 0.3$, $p(3) = 0.3$, $p(4) = 0.2$, $p(5) = 0.1$

b. $p(1) = 0.2$, $p(2) = 0$, $p(3) = 0.6$, $p(4) = 0$, $p(5) = 0.2$

c. $p(3) = 1$

**3)** Consider the following probability distributions. Compute the standard deviation when:

a. $p(1) = 1/3$, $p(2) = 1/3$, $p(3) = 1/3$

b. $p(1) = 1/2$, $p(2) = 1/3$, $p(3) = 1/6$

**4)** Suppose that a random variable $X$ can take on any of the values 1, 2, and 3. Find the expected value $E(X)$ and the variance $Var(X)$ if: $p(1) = 0.3$ and $p(2) = 0.5$

**5)** If $E(X) = 5$, and $E(Y) = 12$, find:

a. $E(3X + 4Y) =$

b. $E(4 + Y) =$

c. $E(2 + 5Y + X) =$

**6)** If the two teams in a World Series have the same chance of winning each game, independent of the results of the previously played games, then the probabilities that the series will end in 4, 5, 6 or 7 games are:

P(series will end in 4 games) = 1/8
P(series will end in 5 games) = 1/4
P(series will end in 6 games) = 5/16
P(series will end in 7 games) = 5/16

What is the expected number of games played in such a series?

**7)** If it rains tomorrow, you will earn $200 by doing some tutoring; if it is dry, you will earn $300 by doing construction work. If the probability of rain is 1/4 , what is the expect amount that you will earn tomorrow?

**8)** An investment has a 0.4 probability of making a $30,000 profit, and a 0.6 probability of losing $15,000. Does this investment have a positive expected gain?

**9)** Norb and Gary are playing a golf tournament. Their scores are random variables with the following means and standard deviations:

Norb, $X_1$: $\mu_1 = 115$, $\sigma_1 = 12$

Gary, $X_2$: $\mu_2 = 100$, $\sigma_2 = 8$

Assume the scores of Norb and Gary to be independent of each other.

a. The difference between their scores is $W = X_1 - X_2$. Compute the mean, variance and standard deviation for $W$.

b. The average of their scores is $A = 0.5X_1 + 0.5X_2$. Compute the mean, variance and standard deviation for $A$.

c. The tournament rules have a special handicap system for each player. For Norb, the handicap formula is $L = 0.8X_1 - 2$. Compute the mean, variance, and standard deviation for the random variable $L$.

d. For Gary, the handicap formula is $H = 0.95X_2 - 5$. Compute the mean, variance, and standard deviation for the random variable $H$.

**Binomial Probs**

**10)** A student takes a true–false test consisting of 15 questions. Assume that the student guesses at each question. Find the probability that:

a. the student gets at least 1 question correct.

b. the student gets a 60% or better on the exam.

**11)** In a state lottery, a player must choose 8 of the numbers from 1 to 40. Assuming that the choice of a player is equally likely to be any of the ${}_{40}C_8$ combinations, what is the probability that a player has:

a. All 8 of the selected numbers?

b. Seven of the selected numbers?

c. At least six of the selected numbers?

**12)** An instructor gives her class a set of 10 problems and tells the class that the final exam will consist of a random selection of 5 of the problems. If a student has figured out how to do 7 of the problems, what is the probability that he or she will correctly answer:

a. All 5 problems?

b. At least 4 of the problems?

**13)** The quality-control inspector of a production will reject a batch syringes if two or more defective syringes are found in a random sample of eight syringes taken from the batch. Suppose the batch contains 1% defective syringes.

a. Identify the values of ***n*** (number of trials) and ***p*** (probability of "success")

b. Make a plot of the distribution showing the probabilities of **k** = 0, 1, 2, 3, 4, 5, 6, 7, and 8 defective syringes in a random sample of 8.

c. What is the expected number of defective syringes the inspector will find?

d. What is the probability that the batch will be accepted?

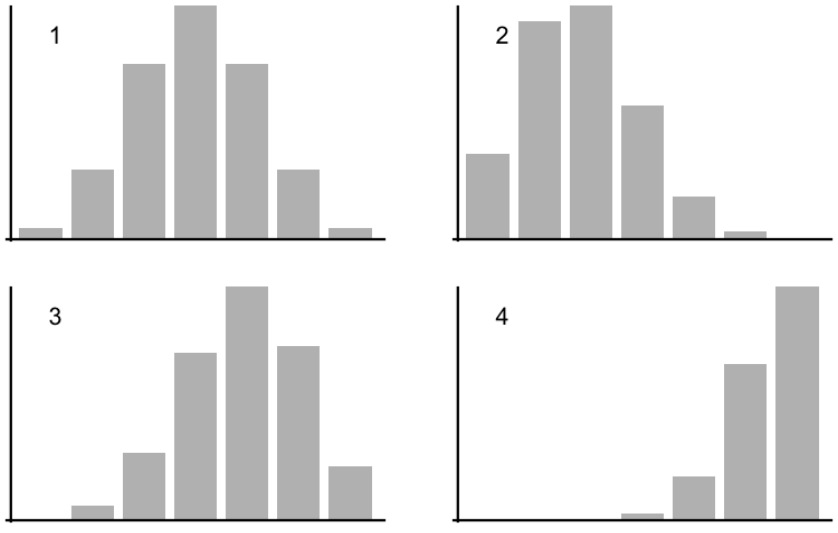
**14)** A recent audit of Los Angeles 911 calls showed that 85% were not emergencies. Suppose the 911 operators in LA have just received four calls.

a. What is the probability that all four calls are, in fact, emergencies?

b. What is the probability that three or more calls are not emergencies?

c. How many calls *n* would need to be answered to be 96% (or more) sure that at least one call is, in fact, an emergency? *Hint:* you need to find the value *n* such that $P(k \geq 1) = 0.96$

**15)** The following figure shows four binomial distributions with n = 6 trials. Match the given probability of success with the corresponding graph.




a) *p = 0.30* goes with graph _____
b) *p = 0.50* goes with graph _____
c) *p = 0.65* goes with graph _____
d) *p = 0.90* goes with graph _____