Name _____ Date _____ Class _____

LESSON 11-6

Problem Solving

Binomial Distributions

Sales records for the snack machines show that 1 out of every 6 students buys a bag of trail mix. There are 5 students waiting to use the machines. Melanie uses the formula for binomial probability, $P(r) = {}_nC_r p^r q^{n-r}$, to determine the number of students expected to buy trail mix.

1. What is the probability of exactly 3 students buying a bag of trail mix?
   a. What is the probability of each student buying a bag of trail mix? _____
   b. Define each variable used in the formula and give its value.
   _____
   c. Write the binomial formula using these values. _____
   d. Solve the equation to give the probability of exactly 3 students buying a bag of trail mix. _____
2. What is the probability of at least 1 student buying a bag of trail mix?
   a. Describe a method to solve involving the sum of probabilities.
   _____
   b. Describe a method to solve that uses the formula $P(E) + P(\text{not } E) = 1$.
   _____
   c. Use either method to determine the probability of at least 1 student buying a bag of trail mix. _____
3. After school, 4 students line up to buy snacks from the machine. What is the probability that they will all buy a bag of trail mix? _____

Sports drinks are purchased by 3 out of 4 students using the snack machines. There are 3 students at the machines now. Choose the letter for the best answer.

4. Which expression gives the probability of exactly 2 students buying an energy drink?

   A $P(2) = {}_3C_2\left(\frac{3}{4}\right)^2\left(\frac{1}{4}\right)^1$

   B $P(2) = {}_4C_3\left(\frac{2}{3}\right)^2\left(\frac{1}{3}\right)^1$

   C $P(3) = {}_3C_2\left(\frac{3}{4}\right)^1\left(\frac{1}{4}\right)^2$

   D $P(3) = {}_4C_3\left(\frac{2}{3}\right)^1\left(\frac{1}{3}\right)^2$

5. What is the probability that at least 2 of the students will buy an energy drink?

   F 42%

   G 50%

   H 75%

   J 84%

B

5. Of the new cars in a car dealer's lot, 1 in 6 are white. Today, 4 cars were sold.
   a. What is the probability that 3 of the cars sold were white?

   _____

   b. What is the probability that at least 2 of the cars sold were white?

   _____

6. At a small college, $\frac{1}{3}$ of all of the students are vegetarians. There are 5 students in line at the cafeteria.
   a. What is the probability that all 5 students are vegetarians?

   _____

   b. What is the probability that just 1 of the students is a vegetarian?

   _____

7. Ellen plays 8 hands of a card game with her friends. She has a 1 in 3 chance of winning each hand. What is the probability that she will win exactly half of the hands played?

   _____

8. In a lottery, each ticket buyer has a 1 in 10 chance of winning a prize. If Chip buys 10 tickets, what is the probability that he will win at least 1 prize?

   _____

C

5. At Hopewell High School, 1 in 7 students is on a sports team. There are 4 student council representatives in the school.
   a. What is the probability that 2 of the student council representatives are also on a sports team?

   _____

   b. What is the probability that at least 3 of the student council representatives are on a sports team?

   _____

6. Two in every 5 donuts in a package of donuts have a jelly filling. There are 5 donuts left in the package.
   a. What is the probability that all 5 donuts have a jelly filling?

   _____

   b. What is the probability that none of the donuts has a jelly filling?

   _____

7. Andrew is choosing CDs from a bag of free CDs without looking. He has a 1 in 5 chance of choosing a CD that he likes. He chooses 8 CDs in all. What is the probability that he will get 3 CDs that he likes?

   _____

8. In a game of Bingo, the contestants have a 1 in 12 chance of winning each round. If Shirley plays 6 rounds, what is the probability that she will win at least half of them?