AP STATISTICS **Name: _____ Block: ____**

Probability Models and Sampling Distributions

Partner(s) First Name(s): _____

1. A production factory in Singapore produces thousands of widgets each day, which have a mean weight of 100 ounces and a standard deviation of 15 ounces. The distribution of weights of these widgets is strongly skewed to the lower weights. A quality control engineer selects a random sample of widgets and measures their weights.
   a) If quality control were to select a large number of samples (read: maaaaaaaaaaaany samples) of size 12, describe the sampling distribution of mean weights for random samples of 12 widgets.
   (hint: you need to describe the mean, standard deviation, and likely shape)

   b) If a random sample of 80 widgets is selected, describe the likely shape of the distribution of weights for that one sample.

   c) A quality control engineer will select a random sample of 80 widgets to determine if the manufacturing process is within specifications. Describe the distribution of sample mean weights for random samples of 80 widgets.
   (hint: you need to describe the mean, standard deviation, and likely shape)

   d) If a random sample of 80 widgets has a mean weight of more than 105 ounces, then the production process will be halted and recalibrated. Based on the mean and standard deviation that were calculated in part (c), what is the probability that this will occur?

2. Providence Memorial Hospital is conducting a blood drive because its supply of group O blood is low, and it needs donors of group O blood.

   a) According to data provided by the Greater New York Blood Program, forty-five percent of adults have group O blood (which we will assume to be true). For random samples of 400 donors, describe the distribution of the sample proportion of donors that have group O blood.

   b) It is estimated that the hospital will need at least 160 units of group O blood from the 400 donors. Assuming that 45% of all adults have group O blood, use the mean and standard deviation calculated in part (a) to find the probability that at least 160 of the 400 donors will have group O blood. Be sure to verify any conditions that are necessary for your analysis.

3. X and Y are two independent random variables with the following attributes:

   E(X) = 81 SD(X) = 18

   E(Y) = 68 SD(Y) = 8

   Find the mean and standard deviation of each of these random variables:

   a) X + 5

   b) 5Y

   c) 5Y – 12

   d) X – Y

4. The weights of red delicious apples are approximately normally distributed with a mean of 9 ounces and a standard deviation of 0.85 ounce. An online gift store sells gift boxes containing 5 red delicious apples. At the time of packing, 5 red delicious apples are randomly selected and packaged in a box. Since the apples are randomly selected, their weights are independent of one another.

   a) Describe the distribution for the total weight of 5 randomly selected apples.

   b) What is the probability that the total weight of the 5 randomly selected apples will be less than 42 ounces?

5. The mean GPA for all students at Podunk High School is 3.45 (on a 4 point scale). If the distribution of GPAs is approximately normally distributed, which of the following is more likely to have a sample mean GPA of below 3.20?

   i. A random sample of 10 students
   or
   ii. A random sample of 90 students

6. Which of the following is more likely to have a sample mean GPA of between 3.40 and 3.50, given that the mean GPA of all students at the school is 3.45 and that the distribution of GPAs is approximately normally distributed?

   i. A random sample of 10 students
   or
   ii. A random sample of 90 students