1. How much does the fat content of Brand X hot dogs vary? To find out, researchers measured the fat content (in grams) of a random sample of 10 Brand X hot dogs. A 95% confidence interval for the population standard deviation σ is 2.84 to 7.55.
   a. Interpret the confidence interval.

   We are 95% confident that the interval from 2.84 to 7.55 gram captures the true standard deviation of the fat content of Brand X hot dogs.

   b. Interpret the confidence level.

   If we take many samples of the same size from this population, about 95% of them will result in an interval that captures the true standard deviation of the fat content of Brand X hotdogs.

   c. True or False: The interval from 2.84 to 7.55 has a 95% chance of containing the actual population standard deviation σ. Justify your answer.

   Once the interval is calculated, it either contains σ or it does not contain σ.

For problems 2 and 3, determine the point estimator you would use and calculate the value of the point estimate.

2. How many pairs of shoes, on average, do female teens have ? To find out, an AP Statistics class conducted a survey. They selected an SRS of 20 female students rom their school. Then they recorded the number of pairs of shoes that each student reported having. Here are the data:

   | 50 | 26 | 26 | 31 | 57 | 19 | 24 | 22 | 23 | 38 |
   | 13 | 50 | 13 | 34 | 23 | 30 | 49 | 13 | 15 | 51 |

   point estimator: Sample mean used to estimate the population mean # of shoes per female student (teen)

   point estimate: $\bar{x} = \frac{607}{20} = 30.35$ shoes per female student (teen)

3. Tonya wants to estimate what proportion of the seniors in her school plan to attend the prom. She interviews an SRS of 50 of the 750 seniors in her school and finds that 36 plan to go to problem.

   point estimator: Sample proportion used to estimate the population proportion of seniors who plan to attend prom at Tonya's HS.

   point estimate: $\hat{p} = \frac{36}{50} = 0.72$
   72%

4. A New York Times/CBS News Poll asked a random sample of U.S. adults the questions, "Do you favor an amendment to the Constitution that would permit organized prayer in public schools?" Based on this poll, the 95% confidence interval for the population who favor such an amendment is (0.63, 0.69).

   a. Interpret the confidence <u>interval</u>.

   We are 95% confident that the interval from 0.63 to 0.69 captures the true proportion of US adults who favor an amendment to the constitution that would permit organized prayer in public schools.

   b. What is the point estimate that was used to create the interval? What is the margin of error?

   $$\hat{p} = \frac{0.63 + 0.69}{2} = \boxed{0.66}$$

   margin of error = 0.66 - 0.63 = $\boxed{0.03}$

   c. Based on this poll, a reporter claims that more than two-thirds of U.S. adults favor such an amendment. Use the confidence interval to evaluate this claim.

   Because the value 2/3 (0.666) and values below it are included in the interval of plausible values, there is <u>not</u> convincing evidence that more than 2/3 of US adults favor such an amendment.

5. Young people have a better chance of full-time employment and good wages if they are good with numbers. How strong are the quantitative skills of young Americans of working age? One source of data is the National Assessment of Educational Progress (NAEP) Young Adult Literacy Assessment Survey, which is based on a nationwide probability sample of households. The NAEP survey includes a short test of quantitative skills, covering mainly basic arithmetic and the ability to apply it to realistic problems. Scores on the test range from 0-500. For example, a person who scores 233 can add the amounts of two checks appearing on a bank deposit slip; someone scoring 325 can determine the price of a meal from a menu; a person scoring 375 can transform a price in cents per ounce into dollars per pound.

   Suppose that you give the NAEP test to and SRS of 840 people from a large population in which the scores have <u>mean 280</u> and standard <u>deviation $\sigma = 60$</u>. The mean $\bar{x}$ of the 840 scores will vary if you take repeated samples.

   a. Describe the shape, center and spread of the sampling distribution of $\bar{x}$.

   <u>Shape:</u> because of the Normal/Large condition✓: the shape of the sampling distribution of $\bar{X}$ is approximately Normal.
   - Samples are independent, samples are taken randomly
   - $n \geq 30$ ✓

   <u>Center:</u> the center of the distribution is the mean of 280 points $(\mu_{\bar{x}} = \mu = 280)$

   <u>Spread:</u> because of the 10% condition✓: $8400 <$ all test takers the standard deviation of the distribution is 2.07 points. $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{60}{\sqrt{840}}$

b. Sketch the sampling distribution of $\bar{x}$. Mark its mean and the values 1, 2, 3 standard deviations on either side of the mean.
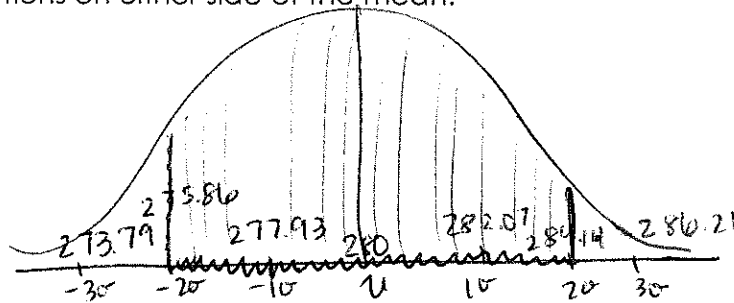
c. According to the 69-95-99.7 rule, about 95% of all values of $\bar{x}$ lie within a distance m of the mean of the sampling distribution. What is m? Shade the region on the axis of your sketch that is within m of the mean.

About 95% of the $\bar{x}$ values will be within 2 SD from the mean. m = 2·2.07 = (4.14)

d. Whenever $\bar{x}$ falls in the region you shaded, the population mean μ lies in the confidence interval $\bar{x} \pm m$. For what percent of all possible samples does the interval capture μ? ≈95%

6. A 95% confidence interval of the mean body mass index (BMI) of young American women is 26.8 $\pm$ 0.6. Discuss whether each of the following explanations is correct:

a. We are confident that 95% of all young women have BMI between 26.2 and 27.4.

NO. The interval provides plausible values for the mean BMI but not for individual BMIs.

b. We are 95% confident that future samples of young women will have mean BMI between 26.2 and 27.4.

NO. We cannot use the results of a sample to predict the results of future samples.

c. Any value from 26.2 to 27.4 is believable as the true mean BMI of young American women.

Yes, the confidence interval offers a range of plausible values for a parameter.

d. If we take many samples, the population mean BMI will be between 26.2 and 27.4 in about 95% of those samples.

NO. The population mean doesn't change and will be between 26.2 and 27.4 either 100% or 0% of the time.

e. The mean BMI of young American women cannot be 28.

NO. We are 95% confident that the population mean is between 26.2 and 27.4 but that does not absolutely rule out any other possibilities (5%!)