c. For samples of $n = 16$, what proportion of the samples will have means between 75 and 85?

17. For random samples of size $n = 25$ selected from a normal distribution with a mean of $\mu = 50$ and a standard deviation of $\sigma = 20$, find each of the following:

a. The range of sample means that defines the middle 95% of the distribution of sample means.

b. The range of sample means that defines the middle 99% of the distribution of sample means.

18. The distribution ages for students at the state college is positively skewed with a mean of $\mu = 21.5$ and a standard deviation of $\sigma = 3$.

a. What is the probability of selecting a random sample of $n = 4$ students with an average age greater than 23? (Careful: This is a trick question.)

b. What is the probability of selecting a random sample of $n = 36$ students with an average age greater than 23?

c. For a sample of $n = 36$ students, what is the probability that the average age is between 21 and 22?

19. At the end of the spring semester, the Dean of Students sent a survey to the entire freshman class. One question asked the students how much weight they had gained or lost since the beginning of the school year. The average was a gain of $\mu = 9$ pounds with a standard deviation of $\sigma = 6$. The distribution of scores was approximately normal. A sample of $n = 4$ students is selected and the average weight change is computed for the sample.

a. What is the probability that the sample mean will be greater than $M = 10$ pounds? In symbols, what is $p(M > 10)$?

b. Of all of the possible samples, what proportion will show an average weight loss? In symbols, what is $p(M < 0)$?

c. What is the probability that the sample mean will be a gain of between $M = 9$ and $M = 12$ pounds? In symbols, what is $p(9 < M < 12)$?

20. Jumbo shrimp are those that require 10 to 15 shrimp to make a pound. Suppose that the number of jumbo shrimp in a 1-pound bag averages $\mu = 12.5$ with a standard deviation of $s = 1$, and forms a normal distribution. What is the probability of randomly picking a sample of $n = 25$ 1-pound bags that average more than $M = 13$ shrimp per bag?

21. The average age for licensed drivers in the county is $\mu = 40.3$ years with a standard deviation of $\sigma = 13.2$ years.

a. A researcher obtained a random sample of $n = 16$ parking tickets and computed an average age of $M = 38.9$ years for the drivers. Compute the z-score for the sample mean and find the probability of obtaining an average age this young or younger for a random sample of licensed drivers. Is it reasonable to conclude that this set of $n = 16$ people is a representative sample of licensed drivers?

b. The same researcher obtained a random sample of $n = 36$ speeding tickets and computed an average age of $M = 36.2$ years for the drivers. Compute the z-score for the sample mean and find the probability of obtaining an average age this young or younger for a random sample of licensed drivers. Is it reasonable to conclude that this set of $n = 36$ people is a representative sample of licensed drivers?

22. Callahan (2009) conducted a study to evaluate the effectiveness of physical exercise programs for individuals with chronic arthritis. Participants with doctor-diagnosed arthritis either received a Tai Chi course immediately or were placed in a control group to begin the course 8 weeks later. At the end of the 8-week period, self-reports of pain were obtained for both groups. Data similar to the results obtained in the study are shown in the following table.

	Self-Reported Level of Pain	
	Mean	*SE*
Tai Chi course	3.7	1.2
No Tai Chi course	7.6	1.7

a. Construct a bar graph that incorporates all of the information in the table.

b. Looking at your graph, do you think that participation in the Tai Chi course reduces arthritis pain?

23. Xu and Garcia (2008) conducted a research study demonstrating that 8-month-old infants appear to recognize which samples are likely to be obtained from a population and which are not. In the study, the infants watched as a sample of $n = 5$ ping-pong balls was selected from a large box. In one condition, the sample consisted of 1 red ball and 4 white balls. After the sample was selected, the front panel of the box was removed to reveal the contents. In the *expected* condition, the box contained primarily white balls like the sample, and the infants looked at it for an average of $M = 7.5$ seconds. In the *unexpected* condition, the box had primarily red balls, unlike the sample, and the infants looked at it for $M = 9.9$ seconds. The researchers interpreted the results as demonstrating that the infants found the unexpected result surprising and, therefore, more interesting than the expected result. Assuming that the standard error for both means is $\sigma_M = 1$ second, draw a bar graph showing the two sample means using brackets to show the size of the standard error for each mean.