Chapter Test

1. Give a real-life example of data which could have the following probability distributions. Explain your answers.

   a) normal distribution

   b) uniform distribution

   c) exponential distribution

   d) bimodal distribution

2. The volume of orange juice in 2-L containers is normally distributed with a mean of 1.95 L and a standard deviation of 0.15 L.

   a) What is the probability that a container chosen at random has a volume of juice between 1.88 L and 2.15 L?

   b) If containers with less than 1.75 L are considered below standard, what proportion of juice containers would be rejected?

   c) Out of 500 containers, how many have a volume greater than 2.2 L?

3. According to its label, a soft-drink can contains 500 mL. Currently, the filling machine is set so that the volume per can is normally distributed, with a mean of 502 mL and a standard deviation of 1.5 mL. If too many cans contain less than 500 mL, the company will lose sales. If many cans contain more than 504 mL, the company will incur excess costs. Does the company need to recalibrate its filling machine?

4. A farmer finds the mass of the yields of 20 trees in an orchard. Here are the results in kilograms.

16.89	7.77	7.26	14.05	10.85	15.69
12.95	7.92	16.12	9.06	5.71	6.11
5.95	9.25	8.09	8.02	10.43	9.42
9.19	6.86				

   a) Find the mean and standard deviation of these data.

   b) What is the probability that a tree selected randomly from this orchard has a yield greater than 10 kg? State any assumptions you make in this calculation.

5. A manufacturer of mixed nuts promises: "At least 20% cashews in every can." A consumer-research agency tests 150 cans of nuts and finds a mean of 22% cashews with a standard deviation of 1.5%. The proportions of cashews are normally distributed.

   a) What is the probability that the population mean is less than 20% cashews?

   b) Based on the sample, what proportion of cans have between 15% and 30% cashews?

   c) The company must stop making their claim if more than 3% of the cans contain less than 20% cashews. Write a brief report to the company outlining whether they need a new motto.

   d) Suggest a better motto for the company.

6. Approximately 85% of applicants get their G-1 driver's licence the first time they try the test. If 80 applicants try the test, what is the probability that more than 10 applicants will need to retake the test?

7. A car assembly line produces 1920 cars per shift. A defect rate of 3% is considered acceptable. From the production of one recent shift, 65 cars were found to be defective.

   a) Find the probability of this occurrence.

   b) Explain to the shift supervisor, who has not studied probability theory, what your answer means and whether changes will need to be made in the production process to reduce the number of defective cars.

8. Find a 95% confidence interval for the percent of voters who are likely to vote "Yes" in a referendum if, in a sample of 125 voters, 55 said they would vote "Yes."

9. A politician asks a polling firm to determine the likelihood that he will be re-elected. The polling firm reports that of decided voters, 48% indicated they would vote for him if an election were called today. The result is accurate within plus or minus 5%, 19 times in 20.

   a) How many decided voters were polled?

   b) Should the politician be worried about his chances of re-election? Justify your answer.

   c) The polling company found a large number of undecided voters. Should this fact influence the conclusion? What action, if any, should the politician take regarding this large pool of undecided voters?

✔️ **ACHIEVEMENT CHECK**

Knowledge/Understanding	Thinking/Inquiry/Problem Solving	Communication	Application

10. Students in the first-year statistics course at Statsville College wrote a 100-point examination in which the grades were normally distributed. The mean is 60 and the standard deviation is 12. Students in the first-year calculus course also wrote a 100-point examination in which the grades were normally distributed. For the calculus examination, the mean is 68 and the standard deviation is 8.

   a) Betty has a mark of 85% in statistics and Brianna has a mark of 85% in Calculus. Who has the higher standing relative to her classmates? Justify your answer.

   b) The statistics professor has decided to bell the marks in order to match the mean and standard deviation of the calculus class. Find Betty's new mark.

   c) Suppose a subgroup of the students in this school, those on the school's honour roll, were selected. Would you still expect the distribution of their examination scores to be normally distributed? Would the distribution have the same mean and standard deviation? Explain your reasoning.