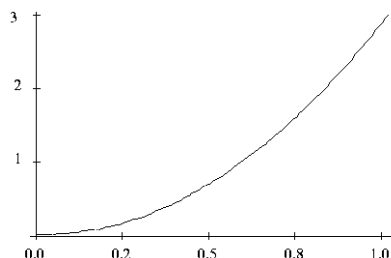


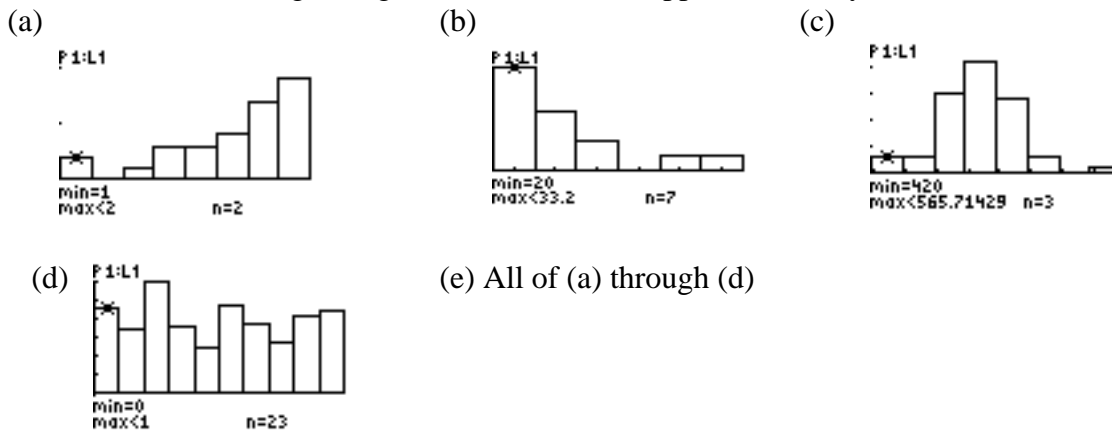
Directions: *Work on these sheets. A standard Normal table is attached.*

Part 1: Multiple Choice. *Circle the letter corresponding to the best answer.*

- The heights of American men aged 18 to 24 are approximately Normally distributed with mean 68 inches and standard deviation 2.5 inches. Half of all young men are shorter than
 - 65.5 inches
 - 68 inches
 - 70.5 inches
 - can't tell, because the median height is not given
 - none of the above
- Use the information in the previous problem. Only about 5% of young men have heights outside the range
 - 65.5 inches to 70.5 inches
 - 63 inches to 73 inches
 - 60.5 inches to 75.5 inches
 - 58 inches to 78 inches
 - none of the above
- For the density curve shown to the right, which statement is true?
 - The area under the curve between 0 and 1 is 1.
 - The density curve is symmetric.
 - The density curve is skewed right.
 - The density curve is Normal.
 - None of the above is correct.
- For the density curve shown in Question 3, which statement is true?
 - The mean and median are equal.
 - The mean is greater than the median.
 - The mean is less than the median.
 - The mean could be either greater than or less than the median.
 - None of the above is correct.
- The area under the standard Normal curve corresponding to $-0.3 < Z < 1.6$ is
 - 0.3273
 - 0.4713
 - 0.5631
 - 0.9542
 - none of the above



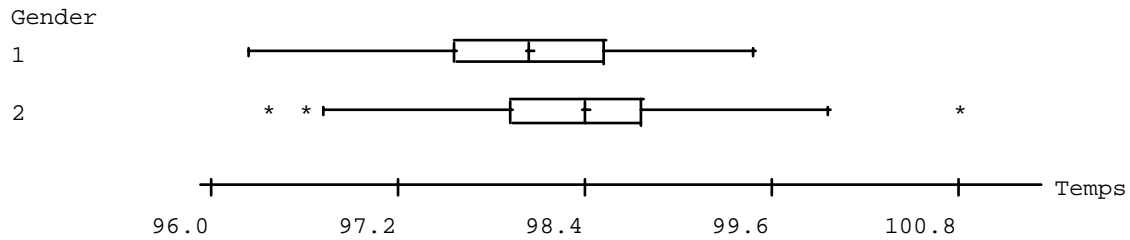
6. A Normal density curve has which of the following properties?
- It is symmetric.
 - It has a peak centered above its mean.
 - The spread of the curve is proportional to its standard deviation.
 - All of the properties (a) to (c) are correct.
 - None of the properties (a) to (c) is correct.
7. Many professional schools require applicants to take a standardized test. Suppose that 1000 students take the test, and you find that your mark of 63 (out of 100) is the 73rd percentile. This means that
- at least 73% of the people scored 63 or better.
 - at least 270 people scored 73 or better.
 - at least 730 people scored 73 or better.
 - at least 27% of the people scored 73 or worse.
 - at least 270 people scored 63 or better.
8. The yield of a variety of wheat was measured on a series of small plots and was found to be approximately Normal. The 2nd and 98th percentile were found to be 29 bushels/acre and 41 bushels/acre respectively. The standard deviation (bushels/acre) is approximately
- 12
 - 6
 - 4
 - 3
 - 2
9. Which of the following histograms would be best approximated by a Normal distribution?



Part 2: Free Response

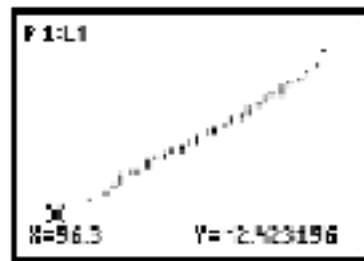
Answer completely, but be concise. Show your thought process clearly.

10. We all “know” that the body temperature of a healthy person is 98.6°F. In reality, the actual body temperature of individuals varies. Here are boxplots, produced by Minitab, for the body temperatures of 130 individuals (65 males and 65 females).



- (a) What do the boxplots suggest about the Normality of the distributions of temperatures for males (Gender = 1) and females (Gender = 2)? Give specific evidence to justify your answer.

- (b) Here’s a Normal probability plot of the temperatures of the males. Explain how it justifies assuming that the population distribution of male temperatures is Normally distributed.



- (c) According to Minitab, $\mu = 98.103$ and $\sigma = 0.700$ for the male temperatures. If we assume that the males’ temperatures are Normally distributed, what percent would have temperatures at 98.7 degrees or above? Show your work.

11. The best male long jumpers for State College since 1973 have jumped an average of 263.0 inches with a standard deviation of 14.0 inches. The best female long jumpers have averaged 201.2 inches with a standard deviation of 7.7 inches. This year Joey jumped 275 inches and his sister, Carla, jumped 207 inches. Both are State College students.

(a) Find the standardized values for Joey's and Carla's jumps. Which athlete had the more impressive performance? Explain briefly.

(b) Assume that male and female jumps are Normally distributed. Find the percentiles for Joey's and Carla's jumps. Interpret these percentiles in context.

12. The length of pregnancies from conception to natural birth among a certain female population is Normally distributed with mean 270 days and standard deviation 10 days.

(a) According to the 68–95–99.7 rule, what percent of pregnancies last more than 300 days? Show your method.

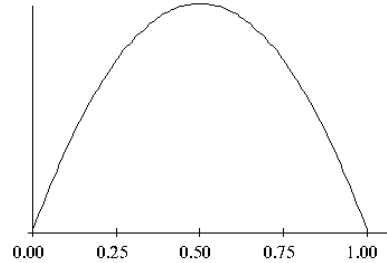
(b) How short must a pregnancy be in order to fall in the shortest 10% of all pregnancies? Show your method.

*I pledge that I have neither given nor received aid on this test.*_____

Directions: *Work on these sheets. A standard Normal table is attached.*

Part 1: Multiple Choice. *Circle the letter corresponding to the best answer.*

1. For the density curve shown, which statement is true?
 - (a) The density curve is symmetric.
 - (b) The density curve is skewed right.
 - (c) The density curve is skewed left.
 - (d) The density curve is Normal.
 - (e) None of the above is correct.

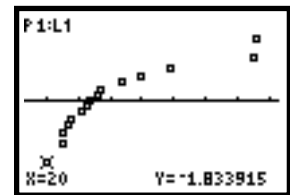


2. For the density curve shown in Question 1, which statement is true?
 - (a) The mean is greater than the median.
 - (b) The mean is less than the median.
 - (c) The mean and median are equal.
 - (d) The mean could be either greater than or less than the median.
 - (e) None of the above is correct.

3. Suppose that 16-ounce bags of chocolate chip cookies are produced with weights that follow a Normal distribution with mean weight 16.1 ounces and standard deviation 0.1 ounce. The percent of bags that will contain between 16.0 and 16.1 ounces is about
 - (a) 10
 - (b) 16
 - (c) 34
 - (d) 68
 - (e) none of the above

4. This is a continuation of Question 3. Approximately what percent of the bags will likely be underweight (that is, less than 16 ounces)?
 - (a) 10
 - (b) 16
 - (c) 32
 - (d) 64
 - (e) none of the above

5. The plot shown at the right is a Normal probability plot for a set of data. The data value is plotted on the x axis, and the standardized value is plotted on the y axis. Which statement is true for these data?
 - (a) The data are clearly Normally distributed.
 - (b) The data are approximately Normally distributed.
 - (c) The data are clearly skewed to the left.
 - (d) The data are clearly skewed to the right.
 - (e) There is insufficient information to determine the shape of the distribution.



6. Which of the following is (are) a true statement?
- I. The area under a Normal curve is always 1, regardless of the mean and standard deviation.
 - II. The mean is always equal to the median for any Normal distribution.
 - III. The interquartile range for any Normal curve extends from $\mu - 1\sigma$ to $\mu + 1\sigma$.
- (a) I and II
 - (b) I and III
 - (c) II and III
 - (d) I, II, and III
 - (e) None of the above gives the correct set of true statements.
7. Which of the following is NOT CORRECT about a standard Normal distribution?
- (a) The proportion of scores that satisfy $0 < Z < 1.5$ is 0.4332.
 - (b) The proportion of scores that satisfy $Z < -1.0$ is 0.1587.
 - (c) The proportion of scores that satisfy $Z > 2.0$ is 0.0228.
 - (d) The proportion of scores that satisfy $Z < 1.5$ is 0.9332.
 - (e) The proportion of scores that satisfy $Z > -2.5$ is 0.4938.
8. In some courses (but certainly not in an intro stats course!), students are graded on a “Normal curve.” For example, students within ± 0.5 standard deviations of the mean receive a C; between 0.5 and 1.0 standard deviations above the mean receive a C+; between 1.0 and 1.5 standard deviations above the mean receive a B; between 1.5 and 2.0 standard deviations above the mean receive a B+, etc. The class average on an exam was 60 with a standard deviation of 10. The bounds for a B grade and the percent of students who will receive a B grade if the marks are actually Normally distributed are
- (a) (65, 75), 24.17%
 - (b) (70, 75), 18.38%
 - (c) (70, 75), 9.19%
 - (d) (65, 75), 12.08%
 - (e) (70, 75), 6.68%

Part 2: Free Response

Answer completely, but be concise. Show your thought process clearly.

9. Scores on the Wechsler Adult Intelligence Scale for the 20 to 34 age group are approximately Normally distributed with mean 110 and standard deviation 25. Scores for the 60 to 64 age group are approximately Normally distributed with mean 90 and standard deviation 25.

Sarah, who is 30, scores 135 on this test. Sarah's mother, who is 60, also takes the test and scores 120. Who scored higher relative to her age group, Sarah or her mother? Use raw data, percentiles, and z -scores to help answer this question.

10. A study recorded the amount of oil recovered from the 64 wells in an oil field. Here are descriptive statistics for that set of data from Minitab.

Descriptive Statistics: Oilprod

Variable	N	Mean	Median	TrMean	StDev	SE Mean
Oilprod	64	48.25	37.80	43.50	40.24	5.03

Variable	Minimum	Maximum	Q1	Q3
Oilprod	2.00	204.90	21.40	60.75

Does the amount of oil recovered from all wells in this field seem to follow a Normal distribution? Give appropriate statistical evidence to support your answer.

11. When Tiger Woods is on the driving range, the distance that golf balls travel when he hits them with a driver follows a Normal distribution with mean 310 yards and standard deviation 8 yards.

(a) Sketch the distribution of Tiger Woods's drive distances. Label the points one, two, and three standard deviations from the mean.

(b) What proportion of Tiger's drives travel between 300 and 325 yards? Shade the appropriate area under the curve you drew in (a). Then show your work.

(c) Find the 33rd percentile of Tiger's drive distance distribution. Show your method.

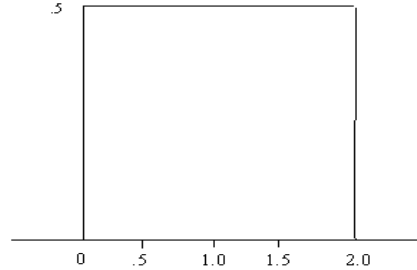
I pledge that I have neither given nor received aid on this test. _____

Directions: *Work on these sheets. A standard Normal table is attached.*

Part 1: Multiple Choice. *Circle the letter corresponding to the best answer.*

1. The density curve shown to the right takes the value 0.5 on the interval $0 \leq x \leq 2$ and takes the value 0 everywhere else. What percent of the observations lie between 0.5 and 1.2?

- (a) 25%
- (b) 35%
- (c) 50%
- (d) 68%
- (e) 70%



2. The proportion of observations from a standard Normal distribution that take values greater than 1.15 is about

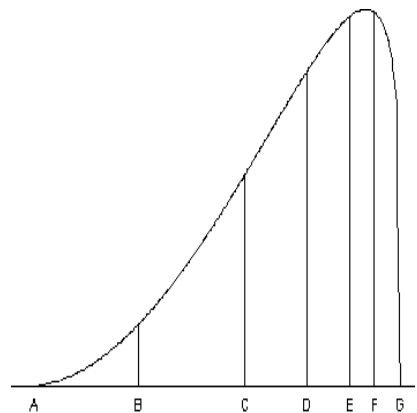
- (a) 0.1251
- (b) 0.8531
- (c) 0.8729
- (d) 0.8749
- (e) 0.8770

3. If the median of a set of data is equal to the mean, then

- (a) The data are Normally distributed.
- (b) The data are approximately Normally distributed.
- (c) The distribution is skewed.
- (d) The distribution is symmetric.
- (e) One can't say anything about the shape of the distribution with any certainty.

4. The figure at the right is the density curve of a distribution: Five of the seven points marked on the density curve make up the five-number summary for this distribution. Which two points are *not* part of the five-number summary?

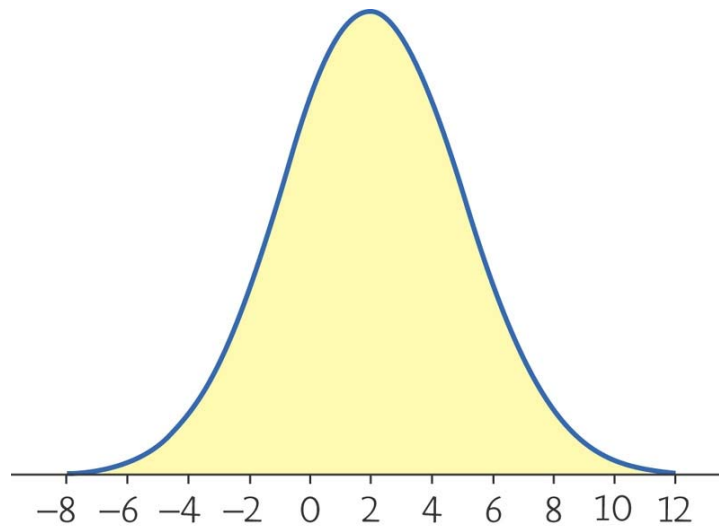
- (a) B and E.
- (b) C and F.
- (c) C and E.
- (d) B and F.
- (e) A and G.



5. If the heights of American men follow a Normal distribution, and 99.7% have heights between 5'0" and 7'0", what is your estimate of the standard deviation of the heights of American men?

- (a) 1"
- (b) 3"
- (c) 4"
- (d) 6"
- (e) 12"

The figure below shows a Normal curve. Questions 6 and 7 refer to this figure.



6. The mean of this distribution is
(a) 0 (b) 1 (c) 2 (d) 3 (e) 5
7. The standard deviation of this Normal distribution is
(a) 0 (b) 1 (c) 2 (d) 3 (e) 5
8. The average yearly snowfall in Chillyville is Normally distributed with a mean of 55 inches. If the snowfall in Chillyville exceeds 60 inches in 15% of the years, what is the standard deviation?
(a) 4.83 inches (b) 5.18 inches (c) 6.04 inches (d) 8.93 inches
(e) The standard deviation cannot be computed from the given information.

Part 2: Free Response

Answer completely, but be concise. Show your thought process clearly.

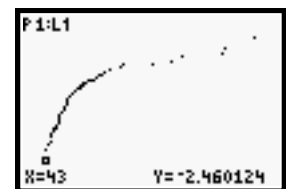
9. As part of the President's Challenge, students can attempt to earn the Presidential Physical Fitness Award or the National Physical Fitness Award by meeting qualifying standards in five events: curl-ups, shuttle run, sit & reach, one-mile run, and pull-ups. The qualifying standards are based on the 1985 School Population Fitness Survey. For the Presidential award, the standard for each event is the 85th percentile of the results for a specific age group and gender among students who participated in the 1985 survey. For the National award, the standard is the 50th percentile. To win either award, a student must meet the qualifying standard for all five events.

Jane, who is 9 years old, did 40 curl-ups in one minute. Matt, who is 12 years old, also did 40 curl-ups in one minute. The qualifying standard for the Presidential award is 39 curl-ups for Jane and 50 curl-ups for Matt. For the National award, the standards are 30 and 40, respectively.

- (a) Compare Jane's and Matt's performances using percentiles. Explain in language simple enough for someone who knows little statistics to understand.

- (b) Who has the higher standardized value (z -score), Jane or Matt? Justify your answer.

10. A Normal probability plot of the survival times of the guinea pigs in a medical experiment is shown below. Use this plot to describe the shape of the distribution of survival times. Then explain carefully how this shape is determined from the Normal probability plot.



- 11.** The Acculturation Rating Scale for Mexican Americans (ARSMA) is a psychological test that measures the degree to which Mexican Americans are adapted to Mexican/Spanish versus Anglo/English culture. The range of possible scores is 1.0 to 5.0, with higher scores showing more Anglo/English acculturation. The distribution of ARSMA scores in a population used to develop the test is approximately Normal with mean 3.0 and standard deviation 0.8. A researcher believes that Mexicans will have an average score near 1.7 and that first-generation Mexican Americans will average about 2.1 on the ARSMA scale.
- (a) Sketch the density curve of this Normal distribution, with the scale clearly marked on the horizontal axis.
- (b) What proportion of the population used to develop the test has scores between 1.7 and 2.1? Show your work.
- (c) How high a score on this test must a Mexican American obtain to be among the 30% of the population used to develop the test who are most Anglo/English in cultural orientation? Show your method.

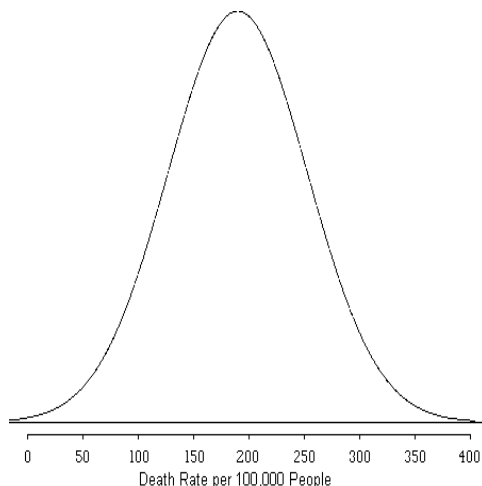
I pledge that I have neither given nor received aid on this test. _____

Directions: Work on these sheets. A standard Normal table is attached.

Part 1: Multiple Choice. Circle the letter corresponding to the best answer.

- Which of these variables is least likely to have a Normal distribution?
 - Annual income for all 150 employees at a local high school
 - Lengths of 50 newly hatched pythons
 - Heights of 100 white pine trees in a forest
 - Amount of soda in 60 cups filled by an automated machine at a fast-food restaurant
 - Weights of 200 of the same candy bar in a shipment to a local supermarket
- The proportion of observations from a standard Normal distribution that take values larger than -0.75 is about
 - 0.2266
 - 0.7704
 - 0.7734
 - 0.7764
 - 0.8023

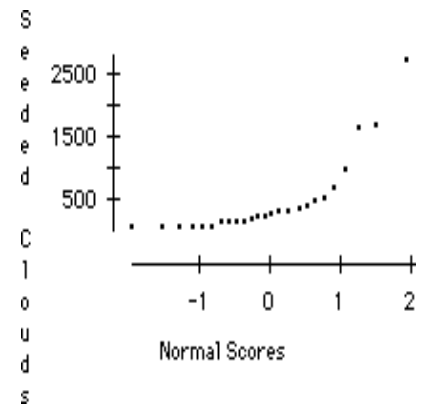
The distribution of heart disease death rates, per 100,000 people, in 19 developed Western countries is close to this Normal distribution.



- The mean heart disease death rate per 100,000 people takes approximately what value?
 - 100
 - 150
 - 190
 - 250
 - 300
- The standard deviation of the heart disease rate per 100,000 people is approximately what value?
 - 10
 - 25
 - 60
 - 100
 - 250
- A smooth curve which approximates the shape of a histogram and describes the overall pattern of a distribution is called
 - a stemplot
 - a Normal probability plot
 - a destiny curve
 - a density curve
 - none of the above

6. The following graph is a Normal probability plot for the amount of rainfall (in acre-feet) obtained from 26 randomly selected clouds that were seeded with silver oxide. Which of the following statements about the shape of the rainfall distribution is true?

- (a) The distribution is Normal.
 (b) The distribution is approximately Normal.
 (c) The distribution is roughly symmetric.
 (d) The distribution has no potential outliers.
 (e) The distribution is skewed.



7. The distribution of the heights of students in a large class is roughly Normal. Moreover, the average height is 68 inches, and approximately 95% of the heights are between 62 and 74 inches. Thus, the standard deviation of the height distribution is approximately equal to

- (a) 2 (b) 3 (c) 6 (d) 9 (e) 12

8. If a store runs out of advertised material during a sale, customers become upset, and the store loses not only the sale but also goodwill. From past experience, a music store finds that the mean number of CDs sold in a sale is 845, the variance is 225, and a histogram of the demand is approximately Normal. The manager is willing to accept a 2.5% chance that a CD will be sold out. About how many CDs should the manager order for an upcoming sale?

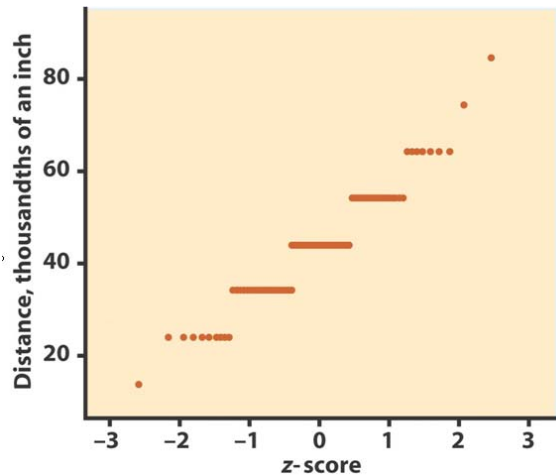
- (a) 1295 (b) 1070 (c) 935 (d) 875 (e) 860

Part 2: Free Response

Answer completely, but be concise. Show your thought process clearly.

9. Raw scores on behavioral tests are often transformed for easier comparison. A test of reading ability has mean 75 and standard deviation 10 when given to third-graders. Sixth-graders have mean score 82 and standard deviation 11 on the same test.
- (a) David is a third-grade student who scores 78 on the test. Nancy is a sixth-grade student who scores 81. Calculate the z -score for each student. Who scored higher within his or her grade?
- (b) Suppose that the distribution of scores in each grade is Normal. Determine the percentiles for David and Nancy. Interpret your results in context.
10. The Environmental Protection Agency requires that the exhaust of each model of motor vehicle be tested for the level of several pollutants. The level of oxides of nitrogen (NOX) in the exhaust of one light truck model was found to vary among individual trucks according to a Normal distribution with mean $\mu = 1.45$ grams per mile driven and standard deviation $\sigma = 0.40$ grams per mile.
- (a) Sketch the density curve of this Normal distribution, with the scale of grams per mile marked on the horizontal axis.
- (b) Give an interval that contains the middle 95% of NOX levels in the exhaust of these trucks. Justify your answer.

11. The distance between two mounting holes is important to the performance of an electrical meter. The manufacturer measures this distance regularly for quality control purposes, recording the data as thousandths of an inch more than 0.600 inches. For example, 0.644 is recorded as 44. The figure below is a Normal probability plot of the distances for the last 90 electrical meters measured.



(a) Is the overall shape of the distribution roughly Normal? Justify your answer.

(b) Why does the plot have a “stair-step” appearance?

12. The Survey of Study Habits and Attitudes (SSHA) is a common psychological test to evaluate the attitudes of students. The SSHA is used for subjects from seventh grade through college. Different groups have different distributions. To prepare to use the SSHA to evaluate future teachers, researchers gave the test to 238 college juniors majoring in elementary education. Their scores were roughly Normal with mean 114 and standard deviation 30. Take this as the distribution of SSHA scores in the population of future elementary school teachers.

How high a score on the SSHA test must an elementary education student obtain to be among the highest-scoring 30% of the population? Show your method.

I pledge that I have neither given nor received aid on this test. _____