

University of Toronto Scarborough

STAB22 Midterm Examination

March 2008

For this examination, you are allowed one handwritten letter-sized sheet of notes (both sides) prepared by you, a non-programmable, non-communicating calculator, and writing implements.

This question paper has 13 numbered pages; before you start, check to see that you have all the pages. There is also a signature sheet at the front and statistical tables at the back.

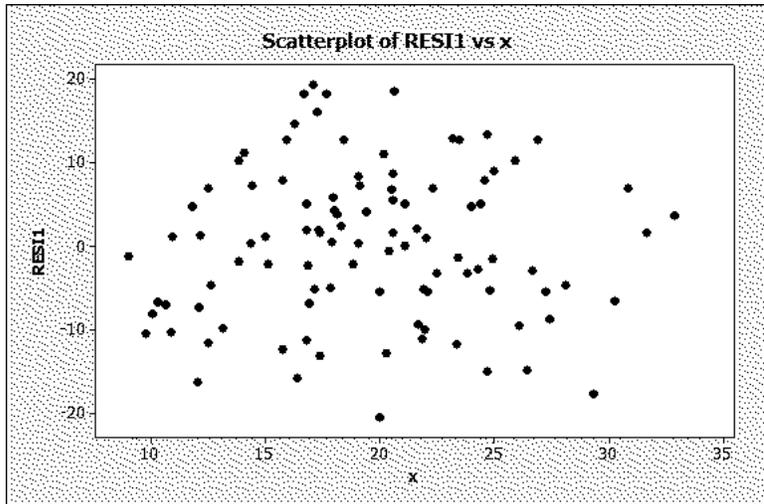
This examination is multiple choice. Each question has equal weight. On the Scantron answer sheet, ensure that you enter your last name, first name (as much of it as fits), and student number (in “Identification”).

Mark in each case the best answer out of the alternatives given (which means the numerically closest answer if the answer is a number and the answer you obtained is not given.)

Before you begin, check that the colour printed on your Scantron sheet matches the colour of your question paper. If it does not, get a new Scantron from an invigilator.

Also before you begin, complete the signature sheet, but *sign it only when the invigilator collects it*. The signature sheet shows that you were present at the exam.

1. A linear regression was carried out for predicting one variable y from another variable x . The residuals from the regression were calculated and plotted against x . The plot is shown below.



What do you conclude from this plot?

- (a) There is no evidence for a straight-line relationship at all between y and x from this graph.
 - (b) A straight-line relationship between y and x is a satisfactory fit.
 - (c) The relationship between y and x is obviously curved.
 - (d) In the relationship between y and x , y is predicted more accurately for smaller values of x than for larger values.
 - (e) To assess the strength and form of the relationship between y and x , it is enough to look at the correlation; there is no need to look at the residual plot.
2. Use the information below for this question and the following two questions.
Scores on a standardized test for children have mean 50 and standard deviation 10, and they follow a normal distribution.
What proportion of children will score above 65 on this test? (Mark the closest answer below if your answer does not appear.)
- (a) 0.50
 - (b) 0.93
 - (c) 0.20
 - (d) 0.80
 - (e) 0.07
3. Using the information in Question 2, what proportion of children will score between 45 and 65? (Mark the closest answer below if your answer does not appear.)
- (a) 0.94
 - (b) 0.31
 - (c) 0.50
 - (d) 0.08
 - (e) 0.63

4. Using the information in Question 2, the lowest 5% of children will score less than what value?

- (a) 58
- (b) 41
- (c) 67
- (d) 50
- (e) 33

5. Some people seem not to gain weight even when they overeat. This might be explained by fidgeting and other “non-exercise activity” (NEA). In an experiment, researchers deliberately overfed healthy young adults for 8 weeks. They measured fat gain (in kilograms) and the increase in energy use (in calories) from activities other than deliberate exercise (NEA).

The NEA increase values had mean 324.8 and SD 257.66 calories; the fat gains had mean 2.388 kg and SD 1.1389 kg. The correlation between fat gain and NEA increase was -0.7786 . What is the intercept of the least-squares regression line for predicting fat gain from NEA increase?

- (a) -1.2
- (b) 1.2
- (c) -0.003
- (d) cannot be calculated because necessary information is missing
- (e) 3.5

6. For this question and the next, what graphical display would be most appropriate for the variable described?

The number of hours per week students study during a semester?

- (a) Pie chart
- (b) Scatterplot
- (c) Bar chart
- (d) Histogram
- (e) Both pie charts and bar charts are equally good for displaying the distribution of the variable involved here.

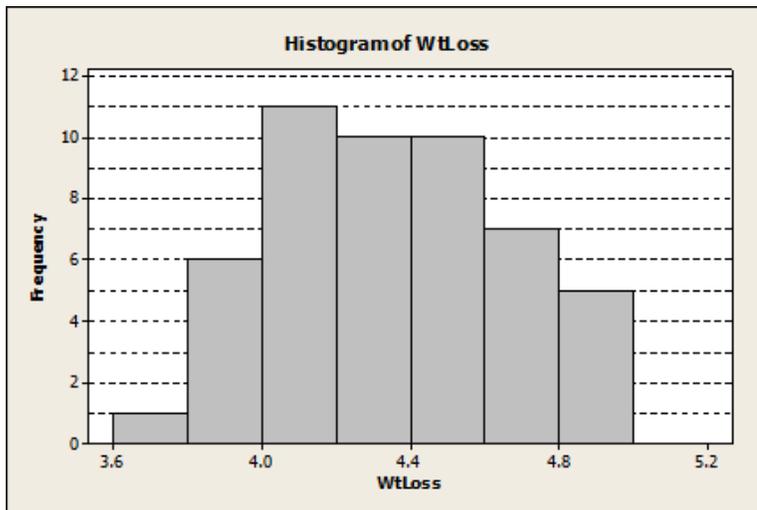
7. Which radio stations are the students favorites?

- (a) Stemplot
- (b) Bar chart
- (c) Boxplot
- (d) Scatterplot
- (e) Histogram

8. Scores on an exam are normally distributed with a mean of 68 and a standard deviation of 9. Using the 68-95-99.7 rule, what percentage of students score above 77?

- (a) 5%
- (b) 32%
- (c) 2.5%
- (d) 16%
- (e) 68%

9. The correlation between two variables x and y is 0.5. Which of these statements is true?
- A larger value of x is the cause of a larger value of y .
 - A larger value of x is the cause of a smaller value of y .
 - Larger values of x tend to go with larger values of y .
 - Larger values of x tend to go with smaller values of y .
10. Aspirin is believed to aid in the prevention of heart attacks. Much of the evidence for this belief comes from the “Physicians’ Health Study”, in which 22,000 male physicians were randomly divided into two groups. One group received aspirin, and the other group a placebo. At the end of the study, the aspirin group had fewer heart attacks than the placebo group, and the difference was statistically significant. What does “statistically significant” mean here?
- The difference in numbers of heart attacks was larger than we would expect to see by chance.
 - The difference in numbers of heart attacks seen here could easily have occurred by chance.
 - The difference in numbers of heart attacks was medically meaningful.
 - Because the groups were chosen at random, it is impossible to say whether this difference could have occurred by chance.
11. Shown below is a histogram (generated from MINITAB) for the weight losses (in grams) of laboratory rats 24 hours after they were injected with an experimental drug. Use this histogram to answer this question and the following question.



What percent of rats in the sample lost more than 4.0 grams? Choose the closest answer from the options below. You may assume that there were no data falling exactly at the class boundaries.

- 55%
- 85%
- 95%
- 65%
- 75%

12. Using the information from Question 11 above, the class that contains the median weight loss is:

- (a) (4.2, 4.4)
- (b) (4.6, 4.8)
- (c) (4.4, 4.6)
- (d) (4.0, 4.2)
- (e) (4.8, 5.0)

13. Suppose that the weights of packages of lettuce coming off a packaging line have a normal distribution with mean 8.2 ounces and standard deviation 0.16 ounces. If every package is labeled 8 ounces, what percent of the packages weigh less than the labeled amount? Choose the closest answer from the options below.

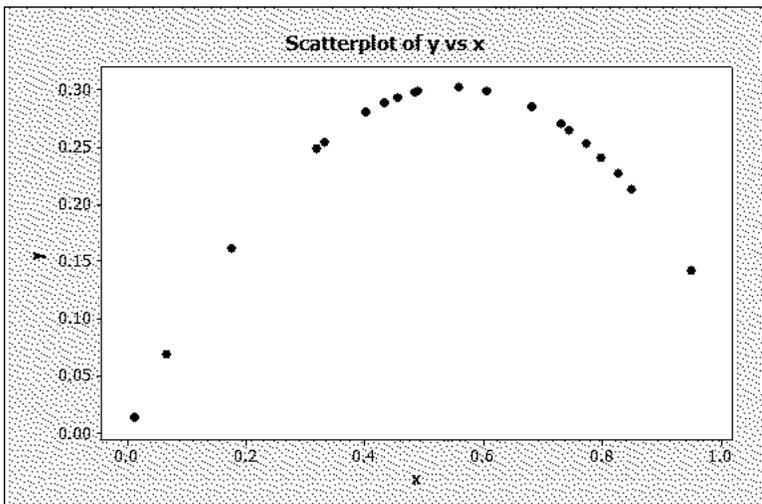
- (a) 10%
- (b) 20%
- (c) 25%
- (d) 5%
- (e) 15%

14. Using the information in Question 13 above, what is the first quartile of the distribution of the weights of packages of lettuce coming off this packaging line? Choose the closest answer from the options below.

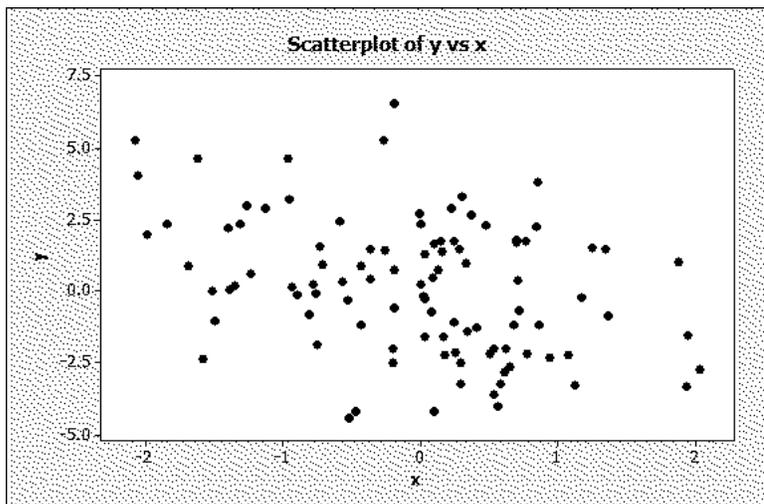
- (a) 8.1 ounces
- (b) 8.2 ounces
- (c) 8.3 ounces
- (d) 8.0 ounces
- (e) 7.9 ounces

15. Five scatterplots are shown below.

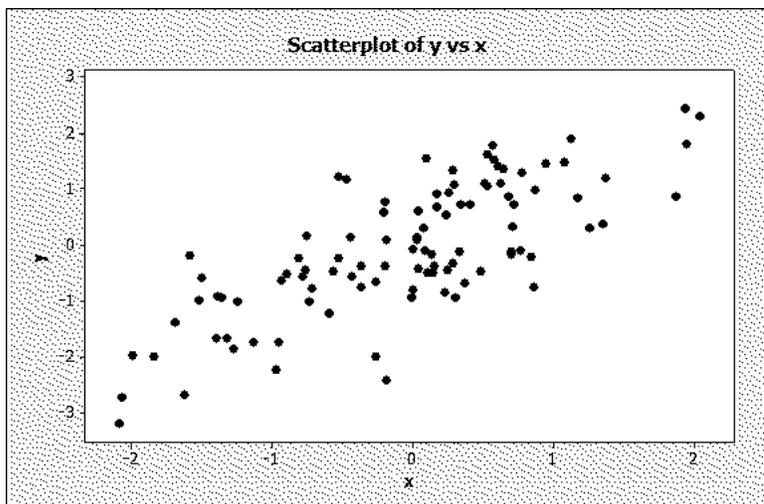
Scatterplot 1:



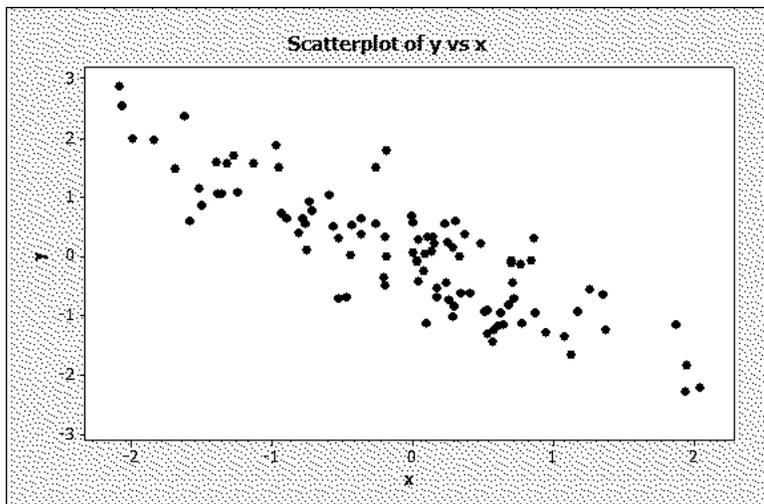
Scatterplot 2:



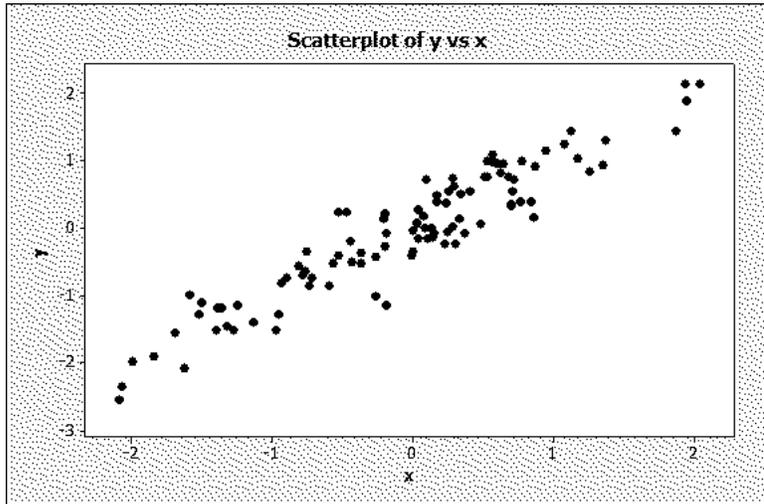
Scatterplot 3:



Scatterplot 4:



Scatterplot 5:



Which of the scatterplots above shows a correlation of -0.85 ?

- (a) Scatterplot 1
 - (b) Scatterplot 3
 - (c) Scatterplot 4
 - (d) Scatterplot 5
 - (e) Scatterplot 2
16. Look again at the scatterplots shown in Question 15. Which scatterplot shows a correlation of 0.75?
- (a) Scatterplot 5
 - (b) Scatterplot 3
 - (c) Scatterplot 1
 - (d) Scatterplot 4
 - (e) Scatterplot 2
17. Look again at the scatterplots shown in Question 15. Which scatterplot shows a correlation of 0.4?
- (a) Scatterplot 1
 - (b) Scatterplot 2
 - (c) Scatterplot 5
 - (d) Scatterplot 4
 - (e) Scatterplot 3
18. A small university has 150 male and 100 female faculty members. The Human Resources department is commissioning a survey on working conditions, and wants to sample 70 faculty members. It is believed that males and females will have similar opinions. It is intended to contact the sampled faculty members in their offices (using an interviewer who will walk around campus). What kind of sampling method would be most appropriate?
- (a) Simple random sample
 - (b) Stratified sample
 - (c) Multistage sample

19. A government agency in Ontario wants to know how many licensed drivers have never been in an accident. One clerk looks at the records of all the licensed drivers in the province, and finds that 40% of licenced drivers have never been in an accident. Another clerk, anxious to save time, randomly selects 200 driver records, and finds that 37% of these drivers have never been in an accident.
- Are the numbers 40% and 37% parameters or statistics?
- (a) 40% and 37% are both statistics.
 - (b) 40% is a statistic and 37% is a parameter.
 - (c) 40% and 37% are both parameters.
 - (d) 40% is a parameter and 37% is a statistic.

20. In an experiment in ecology, researchers are attempting to predict the proportion of perch (in a pen) eaten by bass, using as explanatory variable the number of perch in the pen before the bass were let in. Supposing that y is the proportion of perch eaten, and x is the initial number of perch, the regression equation turned out to be

$$y = 0.120 + 0.0086x.$$

How much would you expect the proportion of perch eaten to change if the initial number of perch increases by 1?

- (a) decrease by -0.120
 - (b) increase by 0.0086
 - (c) decrease by 0.0086
 - (d) increase by 0.120
 - (e) increase by 0.1286
21. The stemplot and some descriptive statistics (generated from MINITAB) of the grades of a statistics class (not STAB22) are given below. Use this information for this question and the two questions following.

Stem-and-Leaf Display: grade

Stem-and-leaf of grade N = 90
Leaf Unit = 1.0

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38  5  0000001111111111122233333333334444444
(21) 5  555567777777888889999
31  6  0001122233344
18  6  68899
13  7  0111233
6   7  667
3   8
3   8  69
1   9
1   9  5

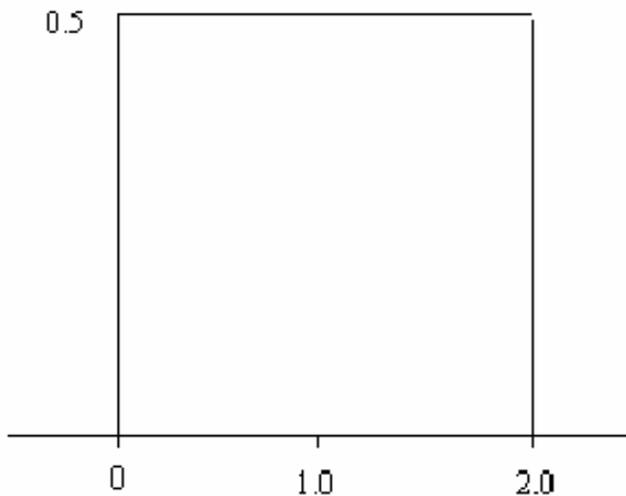
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Descriptive Statistics: grade

Variable	N	N*	Q1	Q3
grade	90	0	53.211	63.223

What is the median score of this statistics class? Choose your answer from the options below. If none of the options below is equal to the median, choose the one closest to the median.

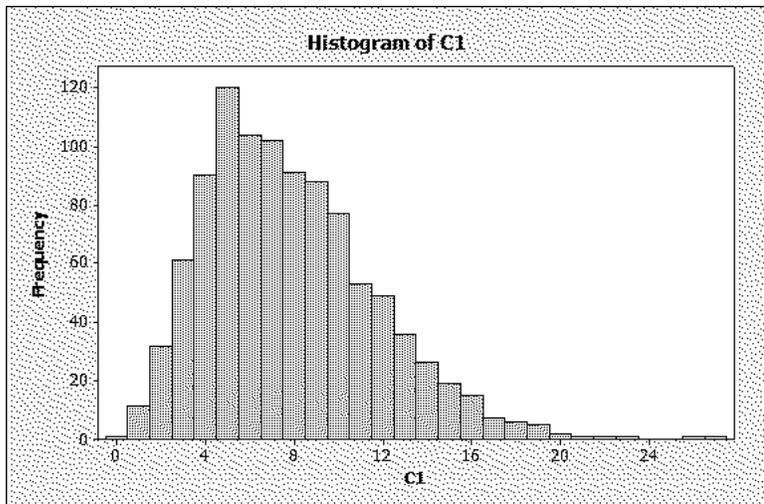
- (a) 56
 - (b) 57
 - (c) 55
 - (d) 58
 - (e) 54
22. Using the information from Question 21 above, what percent of students in this class will receive an A grade if a score of 80 or above qualifies for an A? Choose the closest answer from the options below.
- (a) 25%
 - (b) 6%
 - (c) 3%
 - (d) 10%
 - (e) 1%
23. Using the information from Question 21 above, how many of these scores are identified as outliers by the $1.5 \times IQR$ rule?
- (a) Only one outlier
 - (b) Only two outliers
 - (c) More than three outliers
 - (d) Only three outliers
 - (e) No outliers
24. The density curve of a random variable is given below.



Use this information to answer this question and the following question.

What is the interquartile range of the distribution of this random variable?

- (a) 1.25
 - (b) 0.50
 - (c) 1.00
 - (d) 1.50
 - (e) 0.75
25. Using the density curve given in Question 24 above, what percent of observations of this distribution lie below 0.6?
- (a) 40%
 - (b) 30%
 - (c) 20%
 - (d) 25%
 - (e) 50%
26. The histogram below is of the sampling distribution of a sample mean, based on samples of size 20.



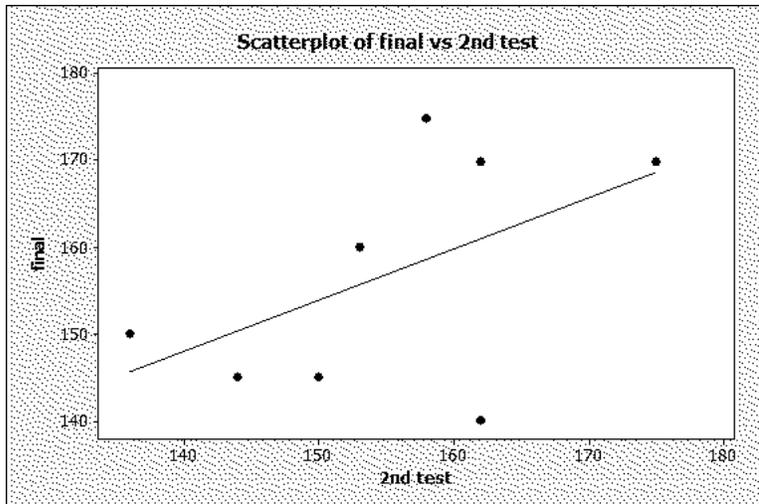
What does this sampling distribution tell you?

- (a) There is an error here because the population size is not given.
 - (b) There are no values over 40 in the population.
 - (c) This cannot be the picture of a sampling distribution because sampling distributions always have a normal shape.
 - (d) Most of the possible samples of size 20 will have a sample mean between 3 and 10.
 - (e) Most of the values in the population lie between 3 and 10.
27. What is the median of the numbers 3, 2, 0, 7, 7?
- (a) 7
 - (b) 3
 - (c) 4.4
 - (d) 0

28. A researcher believes that taking vitamin C helps to prevent a person from developing a cold. The researcher collects a number of people who have colds, and matches each person with someone else of the same sex, similar age and diet who does not have a cold. The researcher finds that for those people who have a cold, very few of them took vitamin C, and for those who do not have a cold, a large proportion had taken vitamin C.

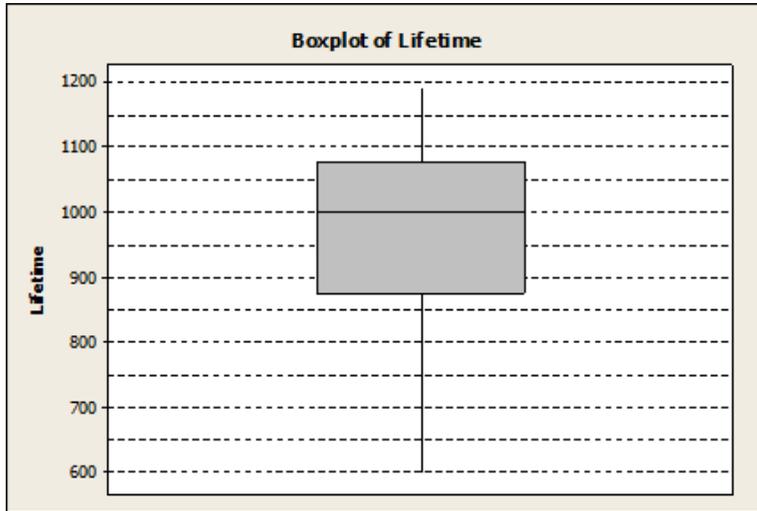
Which statement below best describes this situation?

- (a) This is not a statistical experiment, so the researcher is not allowed to conclude that vitamin C helps to prevent colds.
 - (b) This study is all mixed up, because taking vitamin C is the response and having (or not having) a cold is the factor.
 - (c) Because each person with a cold was matched with a similar person without a cold, the researcher is entitled to conclude that taking vitamin C helps to prevent colds.
 - (d) The researcher needed to randomize who took vitamin C and who did not in order to draw any valid conclusions from the study.
29. A certain course at a university has two term tests and a final exam. There are 8 students in the course. The scatterplot below shows the scores on the 2nd test and the final exam for these students. The regression line has been drawn on the scatterplot.



- The student who scored 150 on the second test scored approximately how many on the final exam?
- (a) 135
 - (b) 140
 - (c) 170
 - (d) 145
 - (e) 152
30. For the data described in Question 29, what is the residual for the student who scored 150 on the second test?
- (a) 0
 - (b) -10
 - (c) -7
 - (d) 10
 - (e) 5

31. Given below is the boxplot (generated from MINITAB) of lifetimes (in hours) of a sample of 20 incandescent lamps. Use the boxplot to answer this question and the three following.



- Which of the following numbers is the closest to the median lifetime of this sample?
- (a) 1050 hours
 - (b) 950 hours
 - (c) 850 hours
 - (d) 1000 hours
 - (e) 900 hours
32. Using the information from Question 31 above, which of the following numbers is the closest to the first quartile of the lifetimes in this sample?
- (a) 600 hours
 - (b) 1175 hours
 - (c) 875 hours
 - (d) 1000 hours
 - (e) 1075 hours
33. Using the information from Question 31 above, which of the following numbers is the closest to the interquartile range of the lifetimes in this sample?
- (a) 600 hours
 - (b) 150 hours
 - (c) 200 hours
 - (d) 400 hours
 - (e) 75 hours
34. Based on information from Question 31 above, which of the following statements is true?
- (a) The distribution of the lifetime is right skewed.
 - (b) More than 25% of the lamps in this sample had lifetimes over 1050 hours.
 - (c) The shortest lifetime observed in this sample is about 875 hours
 - (d) No lamp in this sample had a lifetime over 1100 hours.

35. Pine trees that grow in the dry forests of Arizona may be better able to resist drought if they can grow in the shade. To test this, an experiment was carried out. Investigators planted pine seedlings in a greenhouse in either full light or reduced light (light reduced to 5% of normal by shade cloth). At the end of the study, they weighed the young trees.

In this experiment, what are the experimental units or subjects?

- (a) The light conditions in the greenhouse
- (b) The pine seedlings
- (c) The weight of the young trees
- (d) Ability of the seedlings to grow in shade

36. In the experiment of Question 35, what are the treatments?

- (a) The pine seedlings
- (b) Ability of the seedlings to grow in shade
- (c) The weight of the young trees
- (d) The light conditions in the greenhouse (full light or reduced light)

37. In the experiment of Question 35, what is the response?

- (a) Full light or reduced light in the greenhouse
- (b) Whether the seedlings can grow in shade
- (c) One of the pine seedlings
- (d) The weight of the young trees