

Final Exam Dec. 19, 1997 Quant II

The 36 exam questions and answer sheet are both to be turned in to your Discussion Section instructor at the end of the exam. Code your name and ID number on the answer sheet. **Code your Section number under OPTIONAL CODES in positions L M N.**

1. Five percent of the products produced by a stable process are defective. If a random sample of 40 items is selected, what is the probability that the sample contains *at least one* defective?

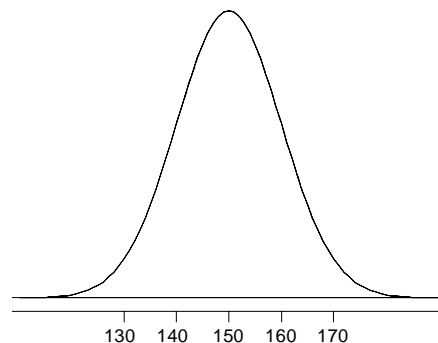
- A) $(0.95)^{40}$
- B) $1 - (0.95)^{40}$
- C) $(0.05)^{40}$
- D) $1 - (0.05)^{40}$
- E) None of the above.

2. A bank has 1000 student loans outstanding today. The distribution of outstanding loan amounts is approximately a normal distribution with mean \$3250 and standard deviation \$500. They are concerned that they have too many large student loans outstanding. About how many loans do they have that are \$4000 or larger?

- A) 43
- B) 57
- C) 67
- D) 77
- E) 82

3. The graph at the right is a normal curve. What are μ and σ for this distribution?

- A) $\mu = 0$ and $\sigma = 1$
- B) $\mu = 150$ and $\sigma = 1$
- C) $\mu = 150$ and $\sigma = 5$
- D) $\mu = 150$ and $\sigma = 10$
- E) $\mu = 150$ and $\sigma = 20$



4. Control charts reflect both the cross-sectional and longitudinal aspects of a process.

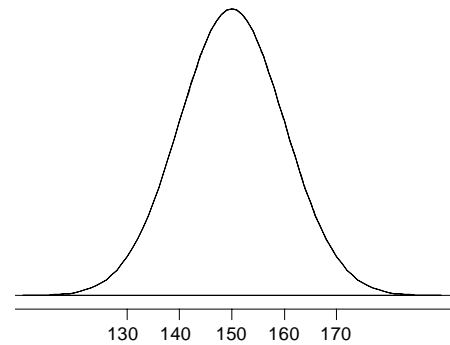
- A) True
- B) False

5. Special causes are considered to be due to chance and to remain in the system unless the process is itself altered.

- A) True
- B) False

6. Billy rolls a four-sided die 50 times. With each roll he records the number of spots on the uppermost face (i. e., 1, 2, 3, or 4). Which of the following statements is true regarding the BINS assumptions?
- A) The assumption of independence is violated as the outcome of one roll affects the outcome of the next roll.
 - B) The assumption of binary outcomes is violated as there are 4 possible outcomes on each roll.
 - C) The assumption of a fixed number of trials is violated as Billy is unsure how many times he is rolling the die.
 - D) All of the BINS assumptions are violated.
 - E) None of the BINS assumptions is violated.
7. Which of the following plots is used to assess whether a straight-line models the *shape* of the relationship between y and x ?
- I. a sequence plot of the response values
 - II. a plot of residuals versus x
 - III. a normal scores plot of residuals
- A) I only
 - B) II only
 - C) III only
 - D) I, II, and III
 - E) None of A), B), C), or D)

8. The graph at the right is the sampling distribution of \bar{y} based on random samples of size 25. Which of the following is the value of σ for the distribution of *individual values*?

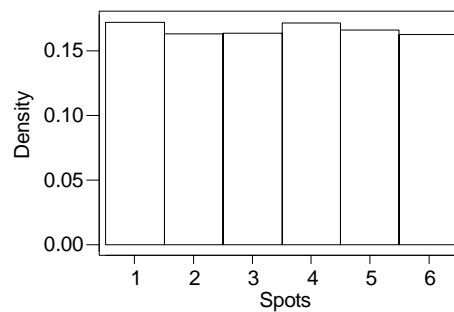
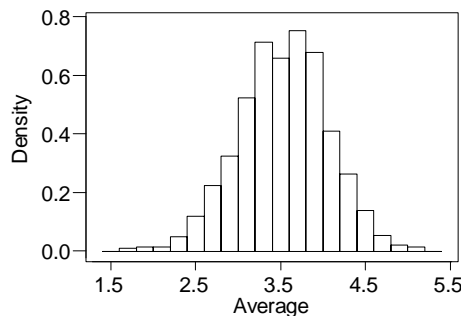


- A) 10
- B) 20
- C) 30
- D) 40
- E) 50

9. If a set of data is standardized using the mean and standard deviation of that data, the standard deviation of the standardized data will be 1. (Assume that the original numbers are not all equal to the same value.)
- A) True
 - B) False

10. An auditor must audit an inventory of 90,000 items. Unfortunately time and budget does not allow her to measure all 90,000 items so she must base her conclusions on a simple random sample of 100 items. After selecting the sample data she finds a sample mean of \$134 and sample standard deviation of \$80. What is her *margin of error* in estimating the mean value of the 90,000 items in the inventory if she uses a 95% confidence level?
- A) \$16
 B) \$80
 C) \$134
 D) \$160
 E) Cannot be determined from the information given.

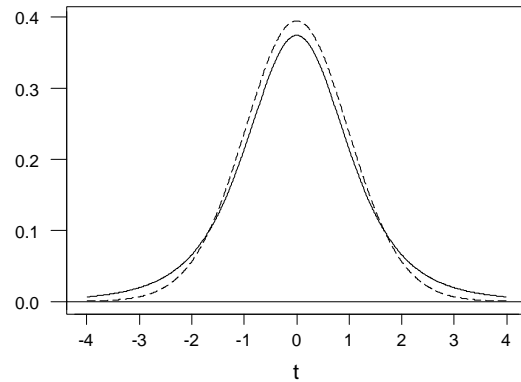
11. Ten dice were rolled and the average number of spots calculated. This process was repeated 1000 times. The density histograms for the 1000 Averages and for the 10,000 individual dice rolls are shown below. Which of the following statements are illustrated in the plots?



- I. The approximate normality of the sampling distribution of the sample mean.
 II. The fact that the expected value of the sample mean is μ .
 III. The fact that $\sigma_y = \sigma / \sqrt{n}$.
- A) I only
 B) II only
 C) III only
 D) I, II, and III
 E) None of the above.
12. Consider a t -distribution with 20 degrees of freedom. What is the value t_0 , so that 95% of the distribution area lies between $-t_0$ and $+t_0$?
- A) 1.725
 B) 1.729
 C) 2.086
 D) 2.093
 E) None of the above.

13. Our marketing manager is interested in average product usage in a particular market segment. A random sample of 16 customers from a large universe gave a mean number of units purchased of 20.81 and a sample standard deviation of 2.66 units. A competitor claims their mean number of units purchased is 19.12. Is our mean statistically significantly different from their claim? (Use a significance level of 5% and assume the population is approximately normal.) Which of the following correctly describes our conclusion?
- A) Reject the null hypothesis since the t -ratio is 2.54 and we have 15 degrees of freedom.
 - B) Reject the null hypothesis since the t -ratio is 2.54 and we have 16 degrees of freedom.
 - C) Do not reject the null hypothesis since the t -ratio is 2.54 and we have 15 degrees of freedom.
 - D) Do not reject the null hypothesis since the t -ratio is 2.54 and we have 16 degrees of freedom.
 - E) Not enough information is given to make a conclusion.
14. According to an article in the *American Banker*, last year 10% of the banking public quit their bank and took their business elsewhere. This came from a simple random sample of 1,130 American banking patrons. What is the **lower endpoint** of a 95% confidence interval for the percentage of all American banking patrons that quit their bank last year and took their business elsewhere? (Round to nearest tenth of a percent.)
- A) 8.2%
 - B) 9.1%
 - C) 10.0%
 - D) 10.9%
 - E) 11.8%
15. Consider a Binomial distribution with $n = 3$ and $\pi = 0.3$. What is the chance of **at most one** success?
- A) 0.216
 - B) 0.343
 - C) 0.441
 - D) 0.784
 - E) None of the above.
16. Suppose that we have two independent estimates, \bar{y}_1 and \bar{y}_2 , of μ_1 and μ_2 . Both means are based on 10 observations. The standard error of \bar{y}_1 is 4.0 and of \bar{y}_2 is 3.0. What is the **standard error** of $\bar{y}_1 - \bar{y}_2$?
- A) 1
 - B) 1.58
 - C) 2.5
 - D) 5
 - E) 25

17. The graph at the right shows two t -distributions, one with 4 degrees of freedom and the other with 29 degrees of freedom. Which of the following statements is correct?

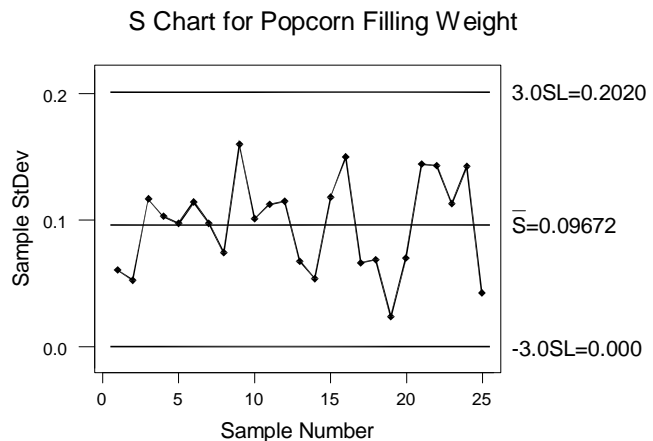


- A) The dashed line is the t -distribution with 4 degrees of freedom since it is taller at zero.
- B) The dashed line is the t -distribution with 4 degrees of freedom since it is lower in the tails.
- C) The solid line is the t -distribution with 4 degrees of freedom since it has more of its area in the tails.
- D) The solid line is the t -distribution with 4 degrees of freedom since it has more of its area piled up at zero.
- E) Cannot be determined from the information given.

18. The **significance level** of a statistical test is the probability of a Type I Error.

- A) True
- B) False

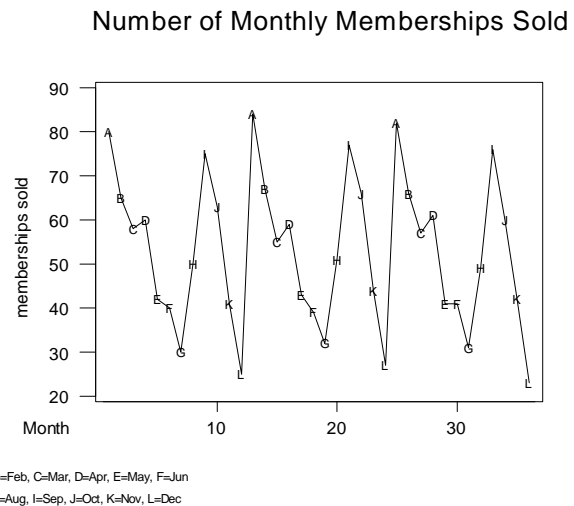
19. A food processing process produces microwave popcorn. The weight on the box is listed as 6 ounces. The graph at the right shows a control chart on the standard deviation of fill weight based on 25 subgroups of size 5. Which of the following statements gives a correct interpretation of the chart?



- A) The chart indicates that the filling process is in control both in mean level and variability.
- B) The chart indicates that the filling process is in control with respect to variability and is thus filling at the correct mean level.
- C) The chart indicates that the filling process is in control with respect to variability but the mean level is too high.
- D) The chart indicates that the filling process is in control with respect to variability but the mean level is too low.
- E) The chart indicates that the filling process is in control with respect to variability but says nothing about the mean level of the process.

20. A new marketing strategy is tested against the one in present use. The results reported that the p -value was 0.02. Which **one** of the following statements is correct? (Here the null hypothesis is that the two strategies are no different.)
- A) H_0 should be rejected at the 1% significance level.
 - B) H_0 should be rejected at both the 1% and 5% significance levels.
 - C) H_0 should not be rejected at the 5% significance level.
 - D) H_0 should not be rejected at the 10% significance level.
 - E) H_0 should not be rejected at any significance level less than 2%.

21. The following graph shows the number of monthly memberships sold at Barbell Bob's Gym over the last three years. How would the graph best be described?



22. Consider the stem-and-leaf plot shown below. Based on the plot, which of the following statements is true?

Stem-and-leaf N = 10
 Leaf Unit = 1.0

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0 5
1 02
1
2
2 5
3 3
3 5568
4 0

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- A) The data are skewed toward the higher values.
- B) The median is 34.
- C) The mean is 34.
- D) The range is 45.
- E) The most common value is 36.

23. If Nancy flips a fair coin 5 times, what is the chance she gets at least one head?

- A) 0.03125
- B) 0.15625
- C) 0.50000
- D) 0.84375
- E) 0.96875

24. Suppose employees' salaries at a local company have a mean of \$20,000 and a standard deviation of \$3,800. A random sample of 25 employees is taken. What is the chance that the sample mean is above \$21,000?

- A) 0.0934
- B) 0.2632
- C) 0.3974
- D) 0.6026
- E) 0.9066

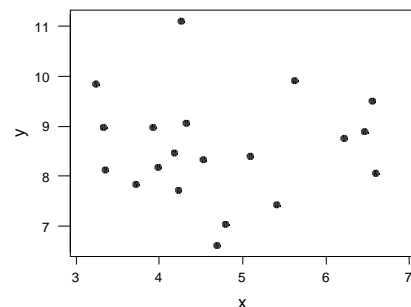
25. The following table displays data collected from the QuantII class at the beginning of the semester. What percent of the males are conservative (rounded to the nearest percent)?

	Political Affiliation		
Gender	Conservative	Moderate	Liberal
Male	65	106	47
Female	24	72	29

- A) 7%
- B) 19%
- C) 26%
- D) 30%
- E) 64%

26. Consider the scatterplot at the right. Estimating from the graph, which of the following is the correlation coefficient between the variables?

- A) -0.999
- B) -0.635
- C) -0.006
- D) 0.598
- E) 0.845



27. Which of the following is not affected by outliers?

- A) mean
- B) standard deviation
- C) correlation coefficient
- D) median
- E) least-squares regression line

28. Suppose we are interested in the Quant II survey data obtained earlier in the semester.

Specifically, we want to investigate the influence of age and gender on a student's GPA. We obtain the following regression equation: $\text{College GPA} = 3.18 - 0.0204 \text{ Age} + 0.224 \text{ Gender}$ (note that Gender is 0 for males and 1 for females). If Allison is a 19-year-old Quant II student and she has a GPA of 3.12, what is the residual associated with her GPA?

- A) -0.10
- B) 0.10
- C) -0.33
- D) 0.33
- E) 3.02

29. From the regression in the previous question, we have the following partial analysis of variance table. Based on the table, what is the standard deviation of the residuals?

Analysis of Variance

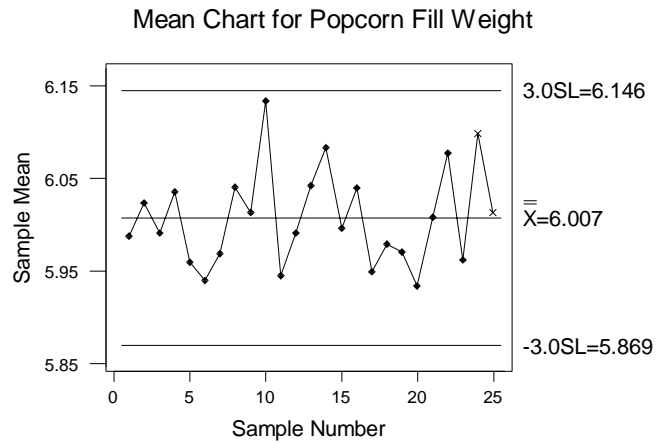
Source	DF	SS	MS
Regression	2	4.6130	2.3065
Error			
Total	323	87.5456	

- A) 1.92
- B) 3.69
- C) 0.26
- D) 0.51
- E) 2.31

30. Suppose you have drawn a random sample of 16 observations from a stable normal process with mean μ . The sample mean is 55.2 and the sample standard deviation is 12.8. What is the 99% confidence interval for μ ?

- A) [17.5, 92.9]
- B) [21.9, 88.5]
- C) [45.8, 64.6]
- D) [46.9, 63.5]
- E) [48.4, 62.0]

31. A food processor produces and packages microwave popcorn. The weight on the box is listed as 6 ounces. The graph at the right shows a control chart on the mean of fill weight based on 25 subgroups of size 5. Which of the following statements gives a correct interpretation of the chart?



- A) The chart shows that the mean filling weight is in control and meeting customer (and FDA) requirements.
- B) The chart shows that the mean filling weight is in control but about half of the boxes are being underfilled.
- C) The chart shows that the variability in filling weight is out of control in the 10th subgroup.
- D) The chart shows that the variability in filling weight is in control and meeting customer (and FDA) requirements.
- E) The chart shows that both the mean filling weight and the variability in filling weight are in control.

32. Suppose the heights of male students at a local school follow a normal distribution with a mean of 69 inches and a standard deviation of 4 inches. A student can only play on the basketball team if his height is in the top 10% of all the students. What is the minimum height a student must be to make the team (round to the nearest inch)?

- A) 72 inches
- B) 73 inches
- C) 74 inches
- D) 75 inches
- E) 76 inches

33. In a light bulb factory, it is known that 10% of the light bulbs produced are defective. A random sample of 100 light bulbs is taken. Using the normal approximation, what is the estimated chance that 15 or more are defective?

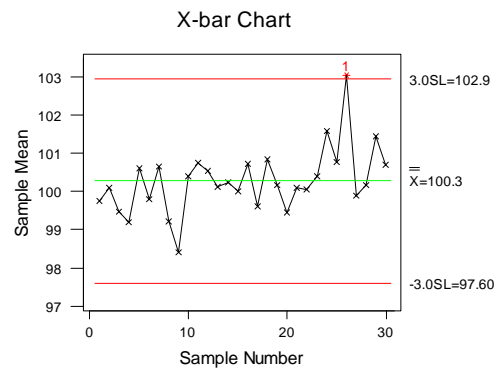
- A) 0.0475
- B) 0.1000
- C) 0.2877
- D) 0.7123
- E) 0.9525

34. Halon 1301 is an extinguishing agent for fires resulting from flammable vapors and liquids. A chemical company producing fire-extinguishing mixtures involving Halon 1301 is interested in the mean concentration by volume of Halon 1301. Specifically, they are interested in testing the hypotheses: $H_0: \mu = 5.7$ versus $H_1: \mu \neq 5.7$. They sampled 20 batches and found the sample mean concentration to be 5.68 and the sample standard deviation to be 0.30. The test is conducted at the 5% significance level. Which of the following statements is correct?

- A) We would not reject H_0 , as the test statistic, $t = -0.30$, is between -2.093 and 2.093 .
- B) We would not reject H_0 , as the test statistic, $t = -0.07$, is between -2.093 and 2.093 .
- C) We would not reject H_0 , as the test statistic, $t = -0.30$, is between -1.729 and 1.729 .
- D) We would reject H_0 , as the test statistic, $t = -0.30$, is between -2.093 and 2.093 .
- E) We would reject H_0 , as the test statistic, $t = -0.30$, is between -1.729 and 1.729 .

35. Consider the following mean chart from a given process. Based on the chart, which one of the following statements is *false*?

- A) The overall mean for the data is 100.3.
- B) From the chart, we cannot tell if the process is in control with respect to variability.
- C) The process is in control with respect to the mean level.
- D) For the chart, the upper control limit is 102.9.
- E) For the chart, the lower control limit is 97.60.



36. A city bus has a capacity of 36 people. The weights of the passengers have a distribution with a mean of 163 pounds and a standard deviation of 24 pounds. If the bus is full, what is the chance that the total weight in the bus is less than 5,500 pounds?

- A) 0.0000
- B) 0.0052
- C) 0.3336
- D) 0.6664
- E) 0.9948

Defective Question Report

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Section: _____

ID: _____

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Question number: _____ Your choice of answer on answer sheet: _____

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