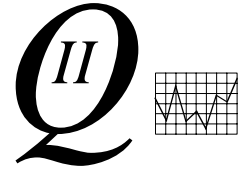


Final Exam Dec. 11, 1995, Quant II Form AB



The 40 exam questions and answer sheet are both to be turned in at the end of the exam. Code your name, ID number, and Test Form on the answer sheet. Code your Section number under OPTIONAL CODES *in positions L M N*.

1. Incomes were reported in whole thousands of dollars. The histogram of the incomes is shown below. Based on the histogram, how many incomes are **below** 18 thousand dollars?

Histogram of Income N = 10

Midpoint	Count	
10.00	1	*
15.00	5	*****
20.00	3	***
25.00	1	*

- A) 1
B) 3
C) 5
D) 6
E) Cannot be answered with the information given.
2. A survey is to be carried out using a simple random sample from a very large universe. We need to be 99.7% confident that our estimate of a certain proportion has a margin of sampling error of ± 0.02 (that is, ± 2 percentage points). How large a sample do we need?
A) 95
B) 836
C) 1190
D) 2501
E) 5626
3. The regression model $\hat{y} = b_0 + b_1x + b_2z$ where x and z are both continuous variables is best described as
A) one straight line
B) two parallel lines
C) two non-parallel lines
D) a quadratic curve
E) a regression plane
4. A **Type I error** is rejecting a true null hypothesis.
A) True B) False

5. The use of the *finite population correction* factor (*fpc*), increases the standard error of the mean to account for the effects of sampling without replacement.
- A) True B) False
6. Consider the special “quadratic” model $\hat{y} = b_0 + b_1x^2$. Let r be the correlation coefficient between x and y and let r_* be the correlation coefficient between x^2 and y . Let s_{x^2} be the standard deviation for the x^2 variable, that is, first the x 's are squared and then the standard deviation is found for the squares. If we use least squares to fit the special “quadratic” model shown above, which of the following gives the correct value for b_1 ?
- A) r
- B) r_*
- C) $r\left(\frac{s_y}{s_x}\right)$
- D) $r_*\left(\frac{s_y}{s_x}\right)$
- E) $r_*\left(\frac{s_y}{s_{x^2}}\right)$
7. We have observed 9 values of a stable normal process and obtained a sample mean of 100.5 and sample standard deviation of 0.23. We need to estimate the mean of the process. What is the value of the upper endpoint of a 95% confidence interval for the process mean?
- A) $100.5 + 2.306 \times (0.23)$
- B) $100.5 + 1.860 \times (0.23)$
- C) $100.5 + 1.860 \times (0.23/(\sqrt{9}))$
- D) $100.5 + 2 \times (0.23/(\sqrt{8}))$
- E) $100.5 + 2.306 \times (0.23/(\sqrt{9}))$
8. Multiple call-backs to nonrespondents are *not* possible in
- A) a probability survey
- B) a nonprobability survey
- C) a telephone survey
- D) a confidential mail survey
- E) an anonymous mail survey

9. A result is said to be **statistically significant** when the observed value of a test statistic is far enough away from the value implied by the null hypothesis.
- A) True B) False
10. We need to find the critical value, $t_{1-\alpha/2}$, for a t -test with 10 degrees of freedom. The alternative hypothesis is two-sided. What is the value of $t_{1-\alpha/2}$ if the significance level, α , is 5%?
- A) 1.812
B) 1.833
C) 2.228
D) 2.262
E) None of these
11. In a simple random sample, increasing the sample size will increase the margin of sampling error (other things being equal).
- A) True B) False
12. **Data design quality** is determined by answering the question, “Were the data collected with sufficient skill and care?”.
- A) True B) False
13. A simple random sample of size 100 from a large universe yielded a sample proportion of 0.40. Find the upper endpoint of the 99.7% confidence interval for the population proportion π . (to the nearest hundredth)
- A) 0.05
B) 0.25
C) 0.50
D) 0.55
E) 0.95
14. Five percent of the products produced by a certain stable process are defective. If a random sample of 4 items is taken, what is the probability that the sample contains **at most one** defective? (to the nearest hundredth)
- A) 0.17
B) 0.19
C) 0.81
D) 0.83
E) 0.99

15. In an experiment a class of students were asked to guess the age of their professor. 172 of them were given no additional information but 152 were told the year of the professor's graduation for his BA and Ph.D degrees. Here are the results:

Group	n	Mean Age Guess (years)	Standard Deviation
No information given	174	47.3	6.4
Given BA & Ph.D Years	152	54.2	6.7

What is the value of the **t-statistic** for testing the null hypothesis of no difference between the two group means? Here $H_0: \mu_{\text{info}} - \mu_{\text{noinfo}} = 0$.

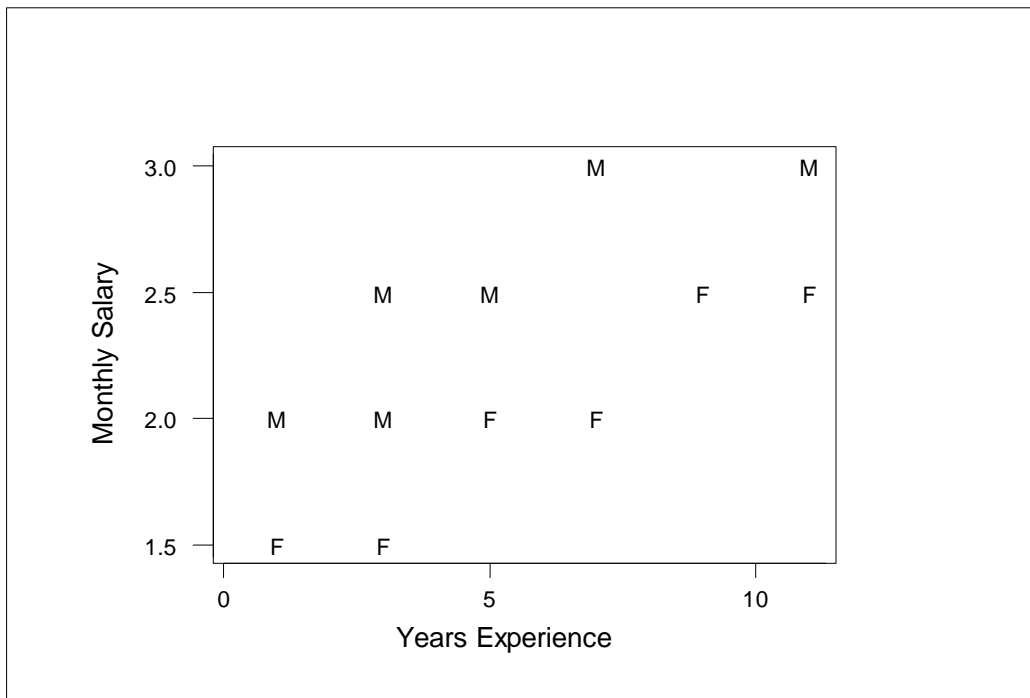
- A) 0.7
 B) 6.9
 C) 9.5
 D) 13.0
 E) 313
16. Referring to the previous problem: What is the critical t value, $t_{1-\alpha}$, for testing against a one-sided alternative (that the group with more information would have a higher mean, $H_1: \mu_{\text{info}} - \mu_{\text{noinfo}} > 0$) at the 5% significance level? (We would reject the null hypothesis if our observed two-sample t -statistic is greater than this value.)
- A) 1.282
 B) 1.645
 C) 1.960
 D) 2.326
 E) 2.576
17. The **frame** is the list of elements from which the sample is drawn.
 A) True B) False
18. The standard deviation of the distribution of a sample proportion p from n trials of a Bernoulli process is largest when $\pi = 0.5$.
 A) True B) False
19. **Nonsampling error** is the difference between the value of a sample estimate and a corresponding equal complete coverage value that is due to some cause other than the sampling process.
 A) True B) False

20. A universe consists of 350 elements. How many different samples of size 349 are possible?
- A) 1
 - B) 349
 - C) 350
 - D) 349!
 - E) 350!
21. Suppose that 30 subgroups (samples) each of size 50 are selected from a Bernoulli process. If there are 150 defectives overall, what is the value of the upper control limit (UCL) for the p -chart for fraction defective? (Rounded to the nearest hundredth.)
- A) 0.10
 - B) 0.13
 - C) 0.16
 - D) 0.23
 - E) 0.26
22. The regression model $\hat{y} = b_0 + b_1x + b_2z$ where x and z is a continuous variable, and z is a binary indicator variable is best described as
- A) one straight line
 - B) two parallel lines
 - C) two non-parallel lines
 - D) a quadratic curve
 - E) a regression plane
23. The Central Limit Effect applied to a sample proportion p from n trials of a Bernoulli process says that for large n the distribution of p is approximately normal with mean $n\pi$ and standard deviation $\sqrt{n\pi(1 - \pi)}$.
- A) True
 - B) False
24. The **equal complete coverage** is the set of measurements that would be obtained if the survey procedures were used on every element in the universe.
- A) True
 - B) False
25. Deming's Red Bead Game demonstrated that variation can be reduced in any process.
- A) True
 - B) False
26. A **parameter** is a numerical characteristic of a population.
- A) True
 - B) False

27. In multiple regression modeling, the most basic residual plot is the plot of residuals versus the corresponding fitted values.
A) True B) False
28. Deming's Funnel Experiment demonstrated that tampering with a stable process usually increases the variation in process results.
A) True B) False
29. The purpose of a mean control chart is to detect changes in mean level between subgroups.
A) True B) False
30. A simple random sample of size 100 was selected from a very large universe. The sample proportion $p = 0.50$ is an estimate of the corresponding population proportion π . Based on this data, a 95% confidence interval for π is given by
A) $0.50 \pm 2\sqrt{0.50(1 - 0.50)}$
B) $0.50 \pm 2\sqrt{100(0.50)(1 - 0.50)}$
C) $0.50 \pm 2\sqrt{99(0.50)(1 - 0.50)}$
D) $0.50 \pm 2\sqrt{\frac{0.50(1 - 0.50)}{99}}$
E) $0.50 \pm 3\sqrt{100(0.50)(1 - 0.50)}$
31. A **simple random sample** ensures that the sample is representative of the universe.
A) True B) False
32. A **Type II error** is failing to reject a false null hypothesis.
A) True B) False
33. If the sampling fraction, f , is small, the **finite population correction** factor (fpc) is near one.
A) True B) False
34. In a simple random sample, increasing the sample size will decrease the **nonsampling errors**.
A) True B) False
35. A **statistic** is a numerical characteristic of a sample.
A) True B) False

36. Hawkeye Supply Inc. has randomly selected 100 steel bolts from a large shipment. Suppose that the individual bolt lengths in the shipment may be described by a distribution with mean 3 inches and standard deviation 0.1 inches. Let \bar{y} denote the average bolt length for the sample of 100 bolts. If the sampling were repeated many times, what fraction of the averages, \bar{y} , would be smaller than 2.98 inches?
- A) 0.0228
 - B) 0.4207
 - C) 0.5793
 - D) 0.9772
 - E) None of the above.
37. The time it takes for an automatic car wash to wash a car varies according to a number of factors—is it a basic wash, a wash and wax, and so forth. Suppose that the distribution of individual wash times has a mean of 5 minutes and a standard deviation of 20 seconds. You are in line behind 9 cars waiting for a car wash. The first car begins its wash. What are the chances that you will have to wait more than 46 minutes before starting your car wash?
- A) 5%
 - B) 16%
 - C) 32%
 - D) 95%
 - E) 99.7%
38. For the sequence 5, 4, 5, 7, 9, find the lag one autocorrelation. (Hint: The mean for the sequence is 6 and the standard deviation is 2.)
- A) 0.187
 - B) 0.221
 - C) 0.375
 - D) 0.442
 - E) 0.509

39. The graph below shows monthly salary versus years of experience for several employees. Salaries for males are plotted with plotting symbol M and females F. Let y be salary, x years of experience, and z an indicator variable for gender with $z = 1$ for Female and $z = 0$ for Male. Consider the regression model with equation $\hat{y} = b_0 + b_1x + b_2z$. Which one of the following statements is true?
- A) The coefficient b_0 represents the rate of increase of salary with years of experience.
 - B) The coefficient b_2 represents the rate of increase of salary with years of experience.
 - C) For employees with equal years of experience, b_0 is the difference between predicted salaries for females and for males.
 - D) For employees with equal years of experience, b_1 is the difference between predicted salaries for females and for males.
 - E) For employees with equal years of experience, b_2 is the difference between predicted salaries for females and for males.



40. Refer to the previous problem. If numerical values for the regression coefficients are obtained by least squares, which one of the following statements is true?
- A) The quantity b_0 will be negative.
 - B) The quantity b_1 will be negative.
 - C) The quantity b_2 will be negative.
 - D) The quantity $b_0 + b_1$ will be negative.
 - E) The quantity $b_0 + b_2$ will be negative.

Defective Question Report

Name: _____

Section: _____

ID: _____

Circle one: Form A B C D

If you believe that a test question is defective in some way, please list your complaint here. All complaints will be considered in our interpretation of the test results. To correctly identify the test question we must know which **form** of the test you have taken.

Turn in this sheet with your exam questions and answers to one of the instructors in the course.

Question number:

Answer choice you selected:

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