American University of Beirut

STAT 210

Introductory Statistics

Fall 2003-2004

Final Exam

Date: Friday, January 23, 2004 - 5:00 pm to 7:00 pm

Instructor: Dr. Mohamed Kobeissi

Name: .....

ID #: .....

Section: .....

This is **NOT** an open-book exam. You are allowed to have a formula sheet and a calculator. Your exam should have 6 pages including this one, and there are 40 questions totaling 200 points. A question with more than one answer will be counted as wrong. A correct answer is 5 points, a wrong answer is -1, and an unanswered question is 0 points. Mark your answer on the answer sheet provided at the end of this exam please.

Good Luck

I. Use the following information to answer question 1 to 3. A sample of 45 eggs yields a mean weight of 1.37 ounces. Assuming that $\sigma = 0.53$ ounces

1. Find the margin of error in estimating μ at the 95% confidence level.

   A. 0.13 B. 0.02 C. 0.15 D. 6.71 E. none of the above

2. Find a confidence interval for μ at the 95% confidence level.

   A. [1.27;1.47] B. [0.37;2.37] C. [1.22;1.52] D. [1.35;1.39] E. none of the above

3. At 95% confidence level, what sample size is needed to ensure a margin of error of 0.1?

   A. 86 B. 241 C. 95 D. 108 E. none of the above

4. The average grade for an exam is 74, and the standard deviation is 7. If 12% of the class are given A's, and the grades are curved to follow a normal distribution, what is the lowest possible A?

   A. 78.6 B. 82.225 C. 92 D. 65.775 E. none of the above

5. Die A has red on one face and blue on five faces, die B has red on two faces and blue on four faces, and die C has red on three faces and blue on three faces. These are fair balanced dice. If the three dice are rolled, find the probability that exactly two of the dice come up the same color.

A. 7/36 B. 13/36 C. 25/36 D. 11/36 E. none of the above

6. Let X have a normal distribution with $\sigma = 5$. What is the mean of X if $P(X < 10) = 0.5$.

A. 5 B. 10 C. 0.5 D. 5.5 E. none of the above

II. Use the following information to answer questions 7 and 8. Urn A contain 2 red balls and 3 blue balls, urn B contain 5 red balls and 4 blue balls. 2 balls are selected at random and without replacement from A and transferred in B. A ball is then selected at random from B.

7. What is the probability that the ball selected from B is red?

A. 15/73 B. 29/55 C. 1/2 D. 17/110 E. none of the above

8. Given that the ball selected from B is red. What is the probability that the balls transferred from A to B were both red?

A. 1/4 B. 3/50 C. 6/55 D. 7/58 E. none of the above

9. For a normal distribution with mean 41 and standard deviation 3.5, 95,44% of the population lies in what interval?

A. (41,44.5) B. (37.5,41) C. (34,48) D. (37.5,48) E. none of the above

10. Five people are in a room. Their mean age is 30, and their median age is 25. A 40 year-old man leaves the room, and a 70 year-old woman enters. What is the mean age of the people in the room now?

A. 30 B. 40 C. 70 D. 36 E. none of the above

11. Refer to previous question, what is the median age of the people in the room now?

A. 25 B. 30 C. 36 D. 40 E. none of the above

III. Use the following information to answer questions 12 to 13. Students may choose between a 3-semester-hour course in biology without labs and a 4-semester-hour course with labs. The final written examination is the same for each section. 12 students in the section with labs made an average of 84 with a standard deviation of 4 (sample 1), and 18 students in the section without labs made an average of 77 with a standard deviation of 6 (sample 2).

12. Using sample 2, what is the value of the test statistic that the mean μ is different than 80?

A. -2.12 B. 1.18 C. 0.97 D. -1.45 E. none of the above

13. What is the P-value, P, of the test?

A. $P > 0.2$ B. $0.02 < P < 0.05$ C. $P = 0.02$ D. $P < 0.005$ E. none of the above

Consider now the two samples as independent samples from different normal populations to answer questions 14 to 22.

14. What are the null and alternative hypotheses to test that the lab has improved exam scores?

i) $H_0 : \mu_1 = \mu_2$ vs. $H_a : \mu_1 < \mu_2$

ii) $H_0 : \mu_1 = \mu_2$ vs. $H_a : \mu_1 > \mu_2$

iii) $H_0 : \mu_1 = \mu_2$ vs. $H_a : \mu_1 \neq \mu_2$

iv) $H_0 : \mu_1 - \mu_2 = 84$ vs. $H_a : \mu_1 - \mu_2 \neq 84$

A. (i) B. (ii) C. (iii) D. (iv) E. none of the above

15. Assuming equal population variances, what is the pooled standard deviation?

A. 3.28 B. 4.85 C. 5.3 D. 0.96 E. none of the above

16. Assuming equal population variances, what is the value of the test statistic for $H_0 : \mu_1 = \mu_2$?

A. 1.9 B. -2.12 C. 4.7 D. 3.54 E. none of the above

17. Assuming equal population variances, what is the P-value, P, of the test?

A. $P > 0.2$ B. $0.05 < P < 0.1$ C. $P = 0.02$ D. $P < 0.005$ E. none of the above

18. For testing that the curriculum has improved the exam scores, at what significance level would the null hypothesis be rejected?

i) At the 0.5% significance level

ii) At the 0.2% significance level

iii) At the 0.1% significance level

iv) At any significance level

A. (i) B. (ii) C. (iii) D. (iv) E. none of the above

19. Assuming equal population variances, find a 99% confidence interval for the difference between the two means $\mu_1 - \mu_2$.

A. [2.12;3.26] B. [1.54;12.45] C. [-1.3;2.6] D. [0;1.72] E. none of the above

20. Assuming unequal population variances, what is the degree of freedom for $H_0 : \mu_1 = \mu_2$?

A. 14 B. 28 C. 15 D. 27 E. none of the above

21. Assuming unequal population variances, what is the value of the test statistic for $H_0 : \mu_1 = \mu_2$?

A. -1.56 B. 4.75 C. 2.63 D. 3.85 E. none of the above

22. Assuming unequal population variances, what are the critical values for testing $H_0 : \mu_1 = \mu_2$ vs $H_a : \mu_1 \neq \mu_2$, with $\alpha = 0.1$?

A. ± 1.753 B. ± 1.697 C. ± 1.314 D. ± 1.310 E. none of the above

IV. Use the following information to answer questions 23 to 25. Scores on an aptitude test are normally distributed with a mean of 220 and a standard deviation of 30.

23. For a random sample of size 50, what is the mean of the variable $\overline{x}$?

A. 30 B. 170 C. 50 D. 220 E. none of the above

24. For a random sample of size 50, what is the standard deviation of the variable $\overline{x}$?

A. 50 B. 30 C. 4.24 D. 212.13 E. none of the above

25. What is the probability that the sampling error made in estimating the population mean by the mean of a random sample of 50 test scores will be at most 5 points?

A. 0.135 B. 0.762 C. 0.999 D. 0.881 E. none of the above

26. For the population of one town, the number of siblings is a random variable whose relative frequency histogram is left-skewed. Let $\overline{x}$ denote the mean number of siblings for a random sample of size 45. For samples of size 45, which of the following statements concerning the sampling distribution of the mean is true?

i) $\overline{x}$ is normally distributed.

ii) The distribution of $\overline{x}$ is left-skewed.

iii) $\overline{x}$ is approximately normally distributed.

iv) The distribution of $\overline{x}$ is approximately left-skewed.

A. (i) B. (ii) C. (iii) D. (iv) E. none of the above

27. Suppose you have obtained a 95% confidence interval for μ. Which of the following statements is/are true regarding the relationship between precision and confidence level? Assume the sample size is fixed.

i) Increasing the confidence level to 99% will result in a narrower interval.

ii) Decreasing the confidence level to 90% will result in a greater precision.

iii) Decreasing the precision will result in a higher confidence level.

iv) Increasing the precision will result in a higher confidence level.

A. (ii) and (iii) B. (i) and (iv) C. (ii) and (iv) D. (i) and (iii) E. none

28. Suppose that scores for men on an aptitude test has greater standard deviation than scores for women on the same test. Based on a sample of size 50, a 95% confidence interval form the mean score, μ, of all women has a margin of error of 2.2. Which of the following confidence intervals will have a smaller margin of error?

i) A 99% confidence interval for the mean score of women. Sample size 50.

ii) A 95% confidence interval for the mean score of women. Sample size 100.

iii) A 95% confidence interval for the mean score of men. Sample size 50.

A. (iii) B. (ii) C. (i) D. (i) and (ii) and (iii) E. none of the above

V. Use the following information to answer questions 29 to 31. 3 persons are to be selected from a group of 10 married couples.

29. In how many way can this be done if there is no restrictions?

A. 180 B. 120 C. 1140 D. 960 E. none of the above

30. In how many way can this be done if a married couple cannot be selected?

A. 120 B. 960 C. 1140 D. 180 E. none of the above

31. In how many way can this be done if the group must contain a married couple?

A. 1140 B. 120 C. 960 D. 180 E. none of the above

32. Sam and Jad play a game in which Sam's chance of winning is 2/3. In a series of eight such games, supposedly independent, what is the chance that Sam will win at least six?

A. 0.35 B. 0.47 C. 0.71 D. 0.56 E. none of the above

33. Refer to previous question, what is the expectation of winning for Sam?

A. 16/9 B. 8/3 C. 16/3 D. 8/9 E. none of the above

34. If the testing of $H_0 : \mu_1 - \mu_2$ vs $H_a : \mu_1 \neq \mu_2$ at significance level α results in not rejecting H_0, then which of the following is true?

i) A one tailed test will reject H_0 at significance level α.

ii) The hypothesized value will lie in a $(1-\alpha)100\%$ confidence interval for μ?

iii) The hypothesized value will not lie in a $(1-\alpha)100\%$ confidence interval for μ?

iii) The observed value will not lie in a $(1-\alpha)100\%$ confidence interval for μ?

A. i) B. ii) C. iii) D. iv) E. none of the above

35. A variable of two populations has mean 49 and standard deviation 12 for the first and mean 18 and standard deviation 8 for the second population. For independent samples of size 5 from population 1 and 14 from population 2, determine the standard deviation of $\overline{x}_1 - \overline{x}_2$.

A. 5.78 B. 4.92 C. 1.72 D. 33.37 E. none of the above

36. Suppose that [34.2; 38.4] is a 99% z-distribution confidence interval for a population mean based on sample of size 50. What is the sample mean?

A. 38.4 B. 36.3 C. 72.6 D. 34.2 E. none of the above

37. Refer to previous question, what is the population standard deviation?

A. 7.57 B. 9.05 C. 8.9 D. 5.76 E. none of the above

38. For a right tailed one-sample z-test, the value obtained for the test statistic was 0.75. Determine the P-value, P.

A. 0.7734 B. 0.5468 C. 0.2266 D. 0.4532 E. none of the above

39. In the past, the mean running time for a certain type of flashlight battery has been 9.2 hours. The manufacturer has introduced a change in the production method and want to perform a hypothesis test to determine whether the mean running time has increased as a result. The hypothesis are $H_0 : \mu = 9.2$ hours and $H_a : \mu > 9.2$ hours. Explain the meaning of a type II error.

i) Concluding that $\mu > 9.2$ hours when in fact $\mu > 9.2$ hours.

ii) Failing to reject the hypothesis that $\mu = 9.2$ hours when in fact $\mu > 9.2$ hours.

iii) Concluding that $\mu > 9.2$ hours when in fact $\mu = 9.2$ hours.

iii) Failing to reject the hypothesis that $\mu = 9.2$ hours when in fact $\mu = 9.2$ hours.

A. i) B. ii) C. iii) D. iv) E. none of the above

40. The average weight of sardines caught at cheat lake is 35 grams with a standard deviation of 4 grams. What is the probability that the mean of a sample of 64 sardines will exceed 36 grams?

A. 0.456 B. 0.9544 C. 0.0228 D. 0.0026 E. none of the above

Answer sheet

Name: .....

ID #: .....

Section: .....

Question	Answer	Question	answer
1.	_____	21.	_____
2.	_____	22.	_____
3.	_____	23.	_____
4.	_____	24.	_____
5.	_____	25.	_____
6.	_____	26.	_____
7.	_____	27.	_____
8.	_____	28.	_____
9.	_____	29.	_____
10.	_____	30.	_____
11.	_____	31.	_____
12.	_____	32.	_____
13.	_____	33.	_____
14.	_____	34.	_____
15.	_____	35.	_____
16.	_____	36.	_____
17.	_____	37.	_____
18.	_____	38.	_____
19.	_____	39.	_____
20.	_____	40.	_____