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Please read the instruction carefully before answering the questions:

The exam consists of 50 multiple-choice questions. All questions are equally weighted and there is a single best answer for each question. The exam is worth 100 points. Please number the question you are answering; otherwise, no points will be given.

Multiple Choice Questions (100 points, 2 points each)

Identify ONE best answer for each question.

1. When determining the sample size necessary for estimating the true population mean, which factor is not of our concern when sampling with replacement?
   A) The population size.
   B) The population standard deviation.
   C) The allowable or tolerable sampling error.
   D) The level of confidence desired in the estimate.

2. How do you determine whether two interval variables have a positive linear relationship?
   A) Most of the points fall close to a straight line with positive slope.
   B) The scatter diagram shows a linear pattern that is going uphill.
   C) As the X variable increases, the Y variable increases in a linear way.
   D) All of these choices are true.

3. Which of the following is not a characteristic for a normal distribution?
   A) The mean, median, and mode are all equal.
   B) The mean is always zero.
   C) It is symmetrical.
   D) It is a bell-shaped distribution.

4. We have created a 95% confidence interval for population mean μ with the results (10, 25). What conclusion will we make if we test H_0: $\mu = 26$ vs. H_1: $\mu \neq 26$ at the significance level $\underline{\alpha = 0.025}$?
   A) Accept H_0 in favor of H_1
   B) Reject H_0 in favor of H_1
   C) Fail to reject H_0 in favor of H_1
   D) We cannot tell from the information given.

（背面仍有題目，請繼續作答）

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5. In a negatively skewed distribution, which of the following is the correct statement? (The lower or first quartile is labeled Q_1, the second quartile is labeled Q_2, the upper or third quartile is labeled Q_3)
   A) The distance from the smallest observation to Q_2 is smaller than the distance from Q_2 to the largest observation
   B) The distance from Q_1 to Q_2 is smaller than the distance from Q_2 to Q_3
   C) The distance from Q_1 to Q_3 is twice the distance from the Q_1 to Q_2
   D) The distance from the smallest observation to Q_1 is larger than the distance from Q_3 to the largest observation

6. A high school has 150 word processors. The probability that any one of them will require repair on a given day is 0.025. To find the probability that exactly 25 of the word processors will require repair, one will use what type of probability distribution?
   A) Normal distribution
   B) Poisson distribution
   C) Binomial distribution
   D) None of these choices.

7. In testing the hypothesis for the population mean μ, H_0: $\mu = 100$ vs. H_1: $\mu > 100$, the p-value is found to be 0.074, and the sample mean is 105. Which of the following statements is true?
   A) The probability of observing a sample mean at least as large as 105 from a population whose mean is 100 is 0.074.
   B) The probability of observing a sample mean smaller than 105 from a population whose mean is 100 is 0.074.
   C) The probability that the population mean is larger than 100 is 0.074.
   D) None of these choices.

8. Which of the following represents a difference between continuous and discrete random variables?
   A) Probability for continuous random variables means finding the area under a curve, while for discrete random variables it means summing individual probabilities.
   B) The probability for any individual value of a continuous random variable is zero, but for discrete random variables it is not.
   C) Continuous random variables assume an uncountable number of values, and discrete random variables do not.
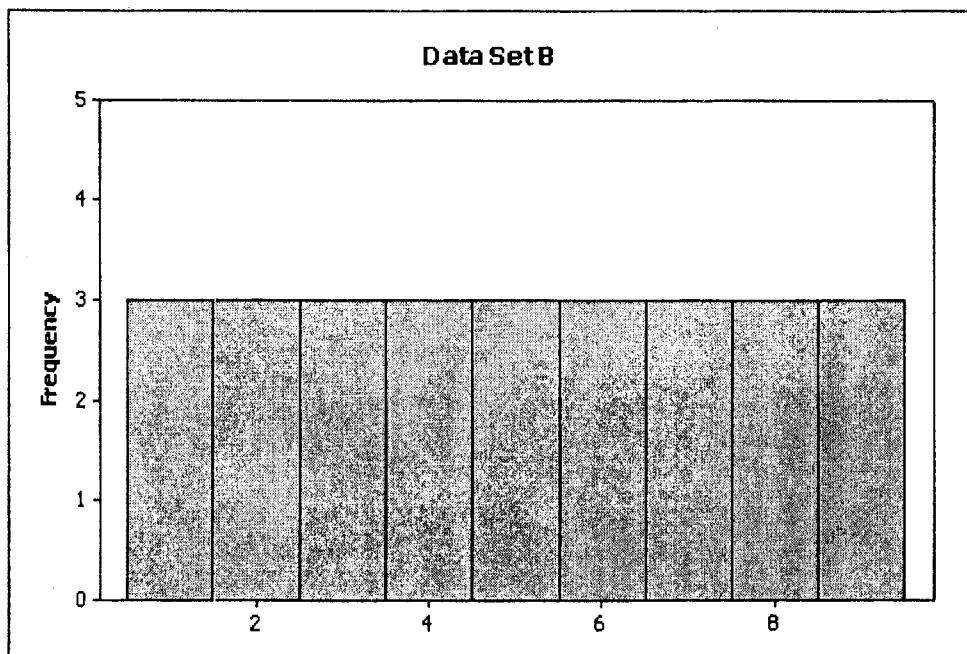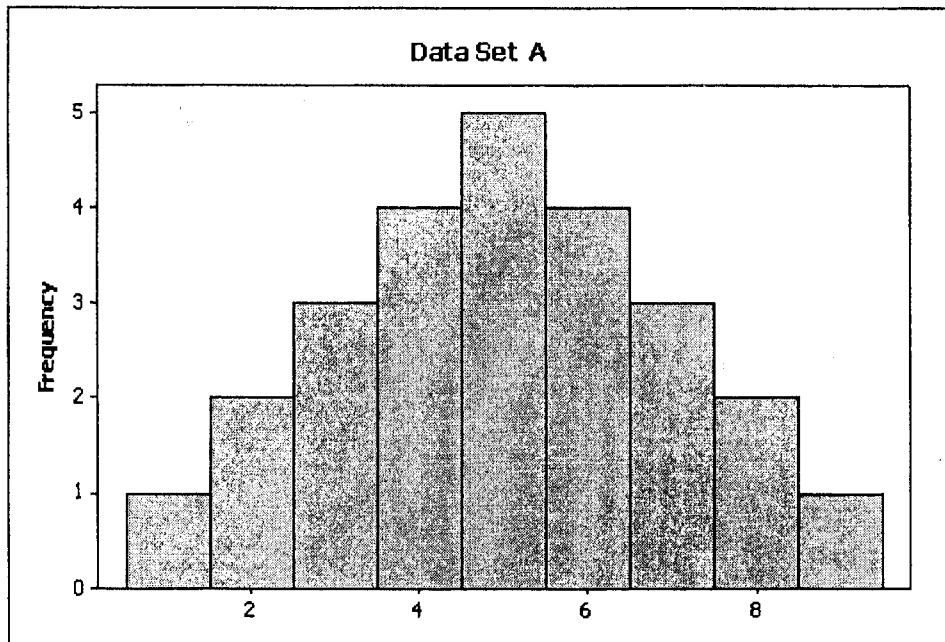   D) All of these choices are true.

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9. The problem with relying on a point estimate of a population parameter is that:
   A) it doesn't have the capacity to reflect the effects of larger sample sizes.
   B) it doesn't tell us how close or far the point estimate might be from the parameter.
   C) it is virtually certain to be wrong.
   D) All of these choices are true.

10. A councilman who is running for the office of senator of a state with 3.5 million registered voters commissions a survey. In the survey, 46% of the 8,000 registered voters interviewed say they plan to vote for him. The population of interest is:
    A) the 46% who plan to vote for her.
    B) all the residents of the state.
    C) the 3.5 million registered voters in the state.
    D) the 8,000 registered voters interviewed.

11. Which of the following causes sampling error?
    A) Making a mistake in the process of collecting the data.
    B) Nonresponse bias.
    C) Taking a random sample from a population instead of studying the entire population.
    D) All of these choices are true.

（背面仍有題目，請繼續作答）

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12. Compare the spread of the two histograms below. Which of the following is true?

Data Set A

Data Set B

A) You cannot compare the spreads of these histograms without the original data.
B) Data Set A has a smaller spread than Data Set B.
C) Data Set A has a larger spread than Data Set B.
D) Data Set A has the same spread as Data Set B.

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13. Which of the following is a measure of variability?
    A) The interquartile range
    B) The coefficient of variation
    C) The variance
    D) All of these choices are true.

(Distribution of Cars) Answer Questions 14 and 15 based on the information given below:

Suppose X = the number of cars owned by a family in Taiwan. The probability distribution of X is shown in the table below.

X	0	1	2	3
Probability	0.56	0.23	0.12	0.09

14. **(Distribution of Cars)** Suppose you choose two families at random. What is the chance that they each own one car? (That means family A owns a car and family B owns a car.)
    A) 0.46
    B) 0.4071
    C) 0.23
    D) 0.0529

15. **(Distribution of Cars)** What is the chance that a family owns more than one car?
    A) 0.44
    B) 0.21
    C) 0.23
    D) None of these choices.

16. If A and B are mutually exclusive events with $P(A) = 0.75$, then $P(B)$:
    A) cannot be larger than 0.25.
    B) can be any value between 0 and 1.
    C) can be any value between 0 and 0.75.
    D) equals 0.25.

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17. How does conducting multiple *t*-tests compare to conducting a single *F*-test?
    A) Multiple *t*-tests does not affect the chance of a Type I error.
    B) Multiple *t*-tests decreases the chance of a Type I error.
    C) Multiple *t*-tests increases the chance of a Type I error.
    D) This comparison cannot be made without knowing the number of populations.

18. Which of the following is an incorrect statement about a 90% confidence interval?
    A) 90% of the population values will lie within the confidence interval.
    B) If we repeatedly draw samples of the same size from the same population, 90% of the resulting confidence intervals will include μ.
    C) There is a 90% probability that the population mean μ will lie between the lower confidence limit (LCL) and the upper confidence limit (UCL).
    D) We are 90% confident that our sample mean equals the population mean μ.

19. It is desired to estimate the average total compensation of CEOs in the publishing industry. Data were randomly collected from 18 CEOs and 95% confidence interval was calculated to be ($2,190,000, $4,720,000). Based on the interval above, do you believe the actual average total compensation of CEOs in the publishing industry could be $3,000,000?
    A) Yes, and I am 95% confident of that.
    B) No, and I am 95% confident of that.
    C) Yes, and I am sure of that.
    D) No, and I am sure of that.

20. Which of the following statements about the sampling distribution of sample mean $\bar{X}$ is NOT true?
    A) Its mean is equal to the population mean μ.
    B) It is generated by taking all possible samples of size *n* and computing their sample means.
    C) Its standard deviation is equal to the population standard deviation σ.
    D) All of these choices are true.

21. The number of accidents that occur annually on a busy stretch of highway is an example of:
    A) a continuous random variable.
    B) a discrete random variable.
    C) expected value of a continuous random variable.
    D) expected value of a discrete random variable.

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22. If two data sets have the same range:
   A) the smallest and largest observations are the same in both sets.
   B) both sets will have the same standard deviation.
   C) the distances from the smallest to largest observations in both sets will be the same.
   D) both sets will have the same interquartile range.

23. If we want to compute the probability of a Type II error, which of the following statements is false?
   A) We need to know the alternative value of the population mean μ.
   B) We need to know the sample size n.
   C) We need to know the significance level α.
   D) All of these choices are true.

24. An estimator is said to be consistent if:
   A) it is an unbiased estimator.
   B) the variance of the estimator is zero.
   C) the difference between the estimator and the population parameter stays the same as the sample size grows larger.
   D) the difference between the estimator and the population parameter grows smaller as the sample size grows larger.

25. If $P(A) = 0.65$, $P(B) = 0.58$, and $P(A \text{ and } B) = 0.76$, then $P(A \text{ or } B)$ is:
   A) 0.11
   B) 0.47
   C) 1.23
   D) 0.18

26. Which of the following statements about the mean is not always correct?
   A) The sum of the deviations from the mean is zero.
   B) The mean is a measure of the central location.
   C) The value of the mean times the number of observations equals the sum of all observations.
   D) Half of the observations are on either side of the mean.

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27. Which of the following conclusions is not an appropriate conclusion from a hypothesis test?
   A) Reject H_0. Sufficient evidence to support H_1.
   B) Fail to reject H_0. Insufficient evidence to support H_1.
   C) Accept H_0. Sufficient evidence to support H_0.
   D) All of these choices are true.

28. The expected value of the difference of two sample means equals the difference of the corresponding population means when:
   A) the populations are normally distributed.
   B) the samples are independent.
   C) the populations are approximately normal and the sample sizes are large.
   D) All of these choices are true.

29. Suppose the value of your chi-squared test statistic in a goodness-of-fit test is equal to 0. What do you conclude?
   A) Not enough information; need the degrees of freedom for the test.
   B) Reject H_0. Conclude that at least one proportion is not equal to its specified value.
   C) Fail to reject H_0. Not enough evidence to say the proportions are different from what is listed in H_0.
   D) None of these choices.

30. Which of the following is not a required condition for one-way ANOVA?
   A) The sample sizes must be equal.
   B) The samples for each treatment must be selected randomly and independently.
   C) The populations must all be normally distributed.
   D) The population variances must be equal.

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31.　Suppose that two shipping companies, A and B, each decide to estimate the annual percentage of shipments on which a $100 or greater claim for loss or damage was filed by sampling their records, and they report the data shown below.

	Company A	Company B
Total shipments sampled	800	600
Number of shipments with a claim ≥ $100	200	100

The owner of Company B is hoping to use these data to show that her company is superior to Company A with regard to the percentage of claims filed. Which test would be used to properly analyze the data in this experiment?
A)　The ANOVA F test for main treatment effect.
B)　The z-test for the difference in two proportions.
C)　The χ^2 goodness-of-fitness test.
D)　The χ^2 test of a contingency table in a two-way contingency table.

32.　Which of the following statements is not true?
A)　The power of the test decreases as the level of significance decreases.
B)　The probability of making a Type II error increases as the probability of making a Type I error decreases.
C)　The probability of making a Type II error and the level of significance are the same.
D)　All of these choices are true.

33.　In a criminal trial, a Type II error is made when:
A)　a guilty defendant is acquitted.
B)　an innocent person is convicted.
C)　an innocent person is acquitted.
D)　a guilty defendant is convicted.

34.　In a positively skewed distribution:
A)　the mean can be larger or smaller than the median.
B)　the median is larger than the mean.
C)　the median is less than the mean.
D)　the median equals the mean.

（背面仍有題目，請繼續作答）

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35. Consider the following partial ANOVA table:

Source of Variation	SS	df	MS	F
Treatments	75	*	25	6.67
Error	60	*	3.75	
Total	135	19		

The numerator and denominator degrees of freedom for the F-test (identified by asterisks) are
A) 15 and 4
B) 3 and 16
C) 4 and 15
D) 16 and 3

36. After constructing a confidence interval estimate for a population mean, you believe that the interval is useless because it is too wide. In order to correct this problem, you need to:
A) increase the level of confidence.
B) increase the sample mean.
C) increase the sample size.
D) increase the population standard deviation.

37. Which of the following statements is true for the following observations: 9, 8, 7, 9, 6, 11, and 13?
A) Only the mean and median are equal.
B) The mean, median and mode are all equal.
C) Only the median and mode are equal.
D) Only the mean and mode are equal

38. Statisticians can translate p-values into several descriptive terms. Suppose you typically reject H_0 at level 0.05. Which of the following statements is correct?
A) If p-value > 0.10, there is no evidence to infer that the alternative hypothesis is true.
B) If the p-value < 0.001, there is overwhelming evidence to infer that the alternative hypothesis is true.
C) If $0.01 < p$-value < 0.05, there is evidence to infer that the alternative hypothesis is true.
D) All of these choices are true.

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39. Which of the following has a mean and variance that depend on degrees of freedom?
    A) F
    B) χ^2
    C) Student t
    D) All of these choices are true.

40. If X and Y are random variables, the sum of all the conditional probabilities of X given a specific value of Y will always be:
    A) 0.0
    B) the average of the possible values of X.
    C) 1.0
    D) the average of the possible values of Y.

41. The librarian at the Tainan City Public Library has asked her assistant for an interval estimate of the mean number of books checked out each day. The assistant took a sample and found the mean to be 880 books. She provides the librarian with an interval estimate of between 790 and 970 books checked out per day. An efficient, unbiased point estimate of the number of books checked out each day at the Tainan City Public Library is:
    A) 90
    B) 880
    C) 790
    D) None of these choices.

42. Which of the following is an appropriate null hypothesis?
    A) The mean of a population is not equal to 60.
    B) The mean of a population is equal to 60.
    C) The mean of a sample is equal to 60.
    D) All of these choices are true.

43. Suppose the ages of students in your program follow a positively skewed distribution with mean of 24 years and a standard deviation of 4 years. If we randomly sampled 100 students, which of the following statements about the sampling distribution of the sample mean age is NOT true?
    A) The shape of the sampling distribution of sample mean is approximately normal.
    B) The standard deviation of the sampling distribution of sample mean is equal to 4 years.
    C) The mean of the sampling distribution of sample mean is equal to 24 years.
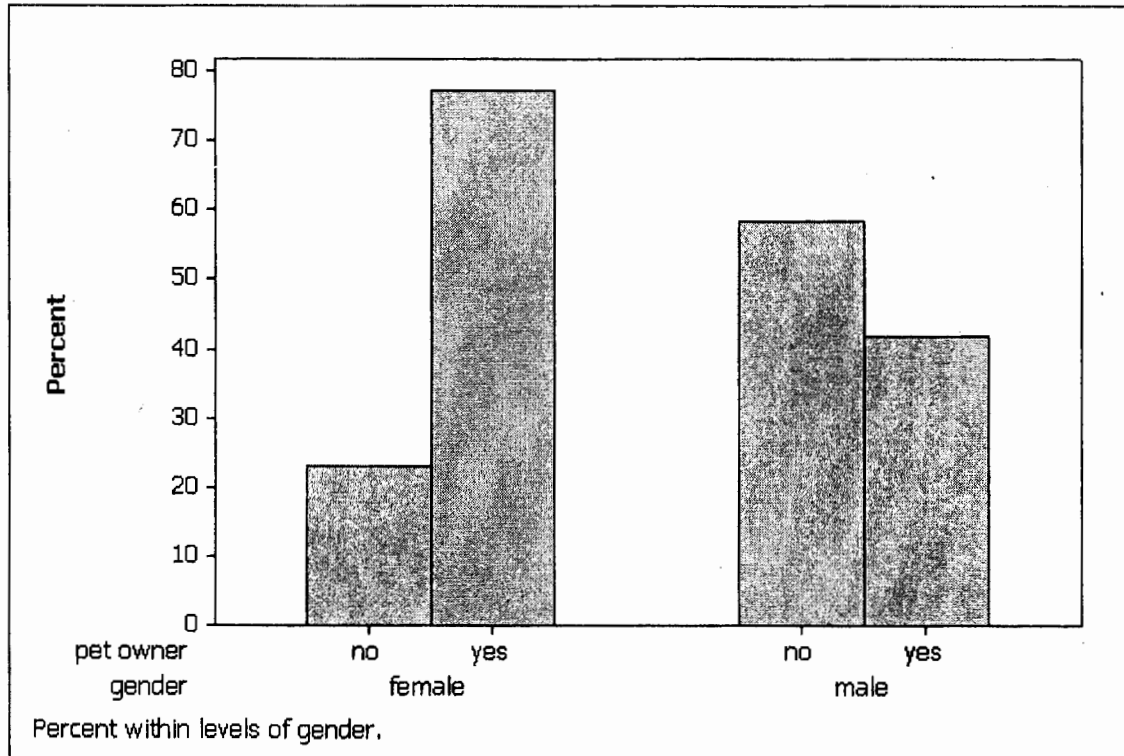   D) All of these choices are true.

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44. Which of the following best describes the concept of marginal probability?
   A) It is a measure of the likelihood that a particular event will occur, regardless of whether another event occurs.
   B) It is a measure of the likelihood of the simultaneous occurrence of two or more events.
   C) It is a measure of the likelihood that a particular event will occur, if another event has already occurred.
   D) None of these choices.

45. A scatter diagram reveals a strong positive linear relationship between oil and gasoline prices. Which of the following numerical techniques will *not* give us more detailed information about this relationship?
   A) Coefficient of determination
   B) Coefficient of variation.
   C) Coefficient of correlation
   D) All of these choices help us describe this relationship.

46. A sample of size n is selected at random from an infinite population. As n increases, which of the following statements is true?
   A) The population standard deviation increases.
   B) The standard error of the sample mean decreases.
   C) The standard error of the sample mean increases.
   D) The population standard deviation decreases.

47. The power of a test is measured by its capability of:
   A) not rejecting a null hypothesis that is true.
   B) not rejecting a null hypothesis that is false.
   C) rejecting a null hypothesis that is true.
   D) rejecting a null hypothesis that is false.

48. The shape of a distribution helps answer which question about the data?
   A) Is the distribution symmetric?
   B) Where is the approximate center of the distribution?
   C) Are the observations close to one another, or are they widely dispersed?
   D) All of these choices are true.

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49. A survey of 100 adults was conducted to see if gender is related to pet ownership. The results are summarized in the bar chart below. Which of the following statements describes the relationship?

A) Fewer males own pets than don't own pets.
B) Pet ownership and gender are not related.
C) More females own pets than don't own pets.
D) None of these choices.

50. If a hypothesis is not rejected at the 0.10 level of significance, it:
A) may be rejected at the 0.05 level.
B) will not be rejected at the 0.05 level.
C) must be rejected at the 0.05 level.
D) must be rejected at the 0.025 level.

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