Exam

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

For the given hypothesis test, explain the meaning of a Type I error or a Type II error, as specified.

1) In the past, the mean running time for a certain type of flashlight battery has been 9.2 hours. The   1) _____
manufacturer has introduced a change in the production method and wants to perform a
hypothesis test to determine whether the mean running time has increased as a result. The
hypotheses are:
$H_0 : \mu = 9.2$ hours
$H_A : \mu > 9.2$ hours
Explain the result of a Type I error.

   A) The manufacturer will decide the mean battery life is less than 9.2 hours when in fact it is
      greater than 9.2 hours.

   B) The manufacturer will decide the mean battery life is 9.2 hours when in fact it is greater than
      9.2 hours.

   C) The manufacturer will decide the mean battery life is greater than 9.2 hours when in fact it is
      greater than 9.2 hours.

   D) The manufacturer will decide the mean battery life is greater than 9.2 hours when in fact it is
      9.2 hours.

   E) The manufacturer will decide the mean battery life is greater than 9.2 hours when in fact it is
      less than 9.2 hours.

2) In the past, the mean running time for a certain type of flashlight battery has been 8.0 hours. The   2) _____
manufacturer has introduced a change in the production method and wants to perform a
hypothesis test to determine whether the mean running time has increased as a result. The
hypotheses are:
$H_0 : \mu = 8.0$ hours
$H_A : \mu > 8.0$ hours
Explain the result of a Type II error.

   A) The manufacturer will decide the mean battery life is less than 8.0 hours when in fact it is
      greater than 8.0 hours.

   B) The manufacturer will decide the mean battery life is greater than 8.0 hours when in fact it is
      8.0 hours.

   C) The manufacturer will decide the mean battery life is 8.0 hours when in fact it is 8.0 hours.

   D) The manufacturer will decide the mean battery life is greater than 8.0 hours when in fact it is
      greater than 8.0 hours.

   E) The manufacturer will decide the mean battery life is 8.0 hours when in fact it is greater than
      8.0 hours.

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3) A man is on trial accused of murder in the first degree. The prosecutor presents evidence that he hopes will convince the jury to reject the hypothesis that the man is innocent. This situation can be modeled as a hypothesis test with the following hypotheses:

H_0 : The defendant is not guilty.

H_A : The defendant is guilty.

Explain the result of a Type II error.

A) The jury will conclude that the defendant is not guilty when in fact he is guilty.

B) The jury will conclude that the defendant is guilty when in fact he is guilty.

C) The jury will conclude that the defendant is not guilty when in fact he is not guilty.

D) The jury will conclude that the defendant is guilty when in fact he is not guilty.

E) The jury will fail to reach a decision.

3) _____

Use a hypothesis test to test the given claim.

4) A large software company gives job applicants a test of programming ability, and the mean score for the test has been 160 in the past. Twenty–five applicants are randomly selected from one large university and they produce a mean score of 165, with a standard deviation of 13. At a significance level of 0.05, does this indicate that the sample comes from a population with a mean score greater than 160?

A) Yes. With a P–value of 0.0024, we reject the null hypothesis of $\mu=160$.

B) No. With a P–value of 0.9668, we fail to reject the null hypothesis of $\mu=160$.

C) Yes. With a P–value of 0.0332, we reject the null hypothesis of $\mu=160$.

D) No. With a P–value of 0.0664, we fail to reject the null hypothesis of $\mu=160$.

E) No. With a P–value of 0.9336, we fail to reject the null hypothesis of $\mu=160$.

4) _____

Provide an appropriate response.

5) A researcher found that a 98% confidence interval for the mean hours per week spent studying by college students was (13, 17). Which is true?
I.   There is a 98% chance that the mean hours per week spent studying by college students is between 13 and 17 hours.
II. 98% of college students study between 13 and 17 hours a week.
III. Students average between 13 and 17 hours per week studying on 98% of the weeks.

A) none   B) II only   C) I and III   D) I only   E) III only

5) _____

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6) A coffee house owner knows that customers pour different amounts of coffee into their cups. She samples cups from 10 costumers she believes to be representative of the customers and weighs the cups, finding a mean of 12.5 ounces and standard deviation of 0.5 ounces. Assuming these cups of coffee can be considered a random sample of all cups of coffee which of the following formulas gives a 95% confidence interval for the mean weight of all cups of coffee?

A) $12.5 \pm 2.262\left(\dfrac{0.5}{\sqrt{10}}\right)$

B) $12.5 \pm 2.228\left(\dfrac{0.5}{\sqrt{9}}\right)$

C) $12.5 \pm 2.228\left(\dfrac{0.5}{\sqrt{10}}\right)$

D) $12.5 \pm 1.969\left(\dfrac{0.5}{\sqrt{10}}\right)$

E) $12.5 \pm 2.262\left(\dfrac{0.5}{\sqrt{9}}\right)$

7) An elementary school principal wants to know the mean number of children in families whose children attend this school. He checks all the families using the school's registration records, and we use the TI–83 to create a 95% confidence interval based on a t–distribution. This procedure was not appropriate. Why?

A) Since these families are from only one school, the family sizes may be skewed.

B) At a given school families are not randomly selected.

C) The entire population of families was gathered so there is no reason to do inference.

D) The recent record–setting family with twelve children is probably an outlier.

E) The population standard deviation is known, so he should have used a z–model.

8) Food inspectors need to estimate the level of contaminants in food products packaged at a certain factory. Initial tests were based on a small sample but now the inspectors double the sample size for a follow–up test. The main purpose of the larger sample is to

A) decrease the standard deviation of the sampling model.

B) reduce confounding due to other variables.

C) reduce response bias.

D) reduce non–response bias.

E) decrease the variability in the population.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

9) A father is concerned that his teenage son is watching too much television each day, since   9) _____
his son watches an average of 2 hours per day. His son says that his TV habits are no
different than those of his friends. Since this father has taken a stats class, he knows that he
can actually test to see whether or not his son is watching more TV than his peers. The
father collects a random sample of television watching times from boys at his son's high
school and gets the following data:

1.9   2.3   2.2   1.9   1.6   2.6   1.4   2.0   2.0   2.2

Is the father right? That is, is there evidence that other boys average less than 2 hours of
television per day? Conduct a hypothesis test, making sure to state your conclusions in the
context of the problem.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Interpret the given confidence interval.

10) A researcher wishes to determine whether people with high blood pressure can reduce their blood   10) _____
pressure by following a particular diet. Subjects were randomly assigned to a treatment group
and a control group. The mean blood pressure was determined for each group, and a 98%
confidence interval for the difference in the mean for the treatment group and the control group,
$\mu_t - \mu_c$, was found to be (–27, –4).

A) We are 98% confident that a randomly selected subject in the treatment group had a blood
pressure between 4 and 27 points lower than a randomly selected subject in the control
group.

B) We know that 98% of all people who follow the particular diet will have a blood pressure
between 4 and 27 points lower than people who do not follow the diet.

C) With 98% confidence, people who follow the diet have an average blood pressure between 4
and 27 points lower than people who do not follow the diet.

D) With 98% confidence, people who follow the diet have an average blood pressure between 4
and 27 points higher than people who do not follow the diet.

E) We know that 98% of all experiments done on the population will show that the average
blood pressure for people who follow the diet is between 4 and 27 points lower than the
average blood pressure for people who do not follow the diet.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

11) Every year Educational Services (ETS) selects readers for the Advanced Placement Exams.   11) _____
Recently the AP Statistics exam has been graded in Lincoln, Nebraska. One objective of
ETS is to achieve equity in grading by inviting teachers to be readers from all parts of the
nation. However budgets are a consideration also. The accountants at ETS wonder if the
flights from cities west of Lincoln are the same as flight costs from cities east of Lincoln. A
random sample of the expense vouchers from last year was reviewed for the cost of airline
tickets. Costs (in dollars) are shown in the table.

East	265	298	340	219	199	398	359	309	105	253
West	257	320	295	288	366	275	430	397	253	366

Indicate what inference procedure you would use to see if there is a significant
difference in the costs of airline flights between the west and east coasts to Lincoln,
Nebraska, then decide if it is okay to actually perform that inference procedure. (Check the
appropriate assumptions and conditions and indicate whether you could or could not
proceed. You do not have to do the actual test.)

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

12) A philosophy professor wants to find out whether the mean age of the men in his large lecture   12) _____
class is equal to the mean age of the women in his classes. After collecting data from a random
sample of his students, the professor tested the hypothesis $H_0: \mu_m - \mu_W = 0$ against the alternative
$H_A: \mu_m - \mu_W \neq 0$. The P–value for the test was 0.003. Which is true?

  A) There is a 0.3% chance that the mean ages for the men and women are equal.

  B) There is a 0.3% chance that another sample will give these same results.

  C) It is very unlikely that the professor would see results like these if the mean age of men was
    equal to the mean age of women.

  D) There is a 99.7% chance that another sample will give these same results.

  E) There is a 0.3% chance that the mean ages for the men and women are different.

Indicate the correct test procedure and reasoning.

13) A teacher is interested in performing a hypothesis test to compare the mean math score of the girls   13) _____
and the mean math score of the boys. She randomly selects 10 girls from the class and then
randomly selects 10 boys. She arranges the girls' names alphabetically and uses this list to assign
each girl a number between 1 and 10. She does the same thing for the boys.

  A) Paired t–test. Since the boys and girls are in the same class, and are hence dependent
    samples, they are can be linked.

  B) 1–sample t–test. The teacher should compare the sample mean for the girls against the
    population mean for the boys.

  C) Two–sample t–test. There is no natural pairing between the two populations.

  D) Paired t–test. Since there are 10 boys and 10 girls, we can link the two samples.

  E) Either two–sample or paired t–test will work.

14) A researcher is interested in investigating whether people perform better at dexterity tests while listening to classical music or to no music. He designs a dexterity test, and first gives it to his participants while classical music is playing, and then while no music is playing.

    A) 1–sample t–test, since there is only one sample of subjects taking the dexterity tests.

    B) Not enough information is given to determine the best type of test.

    C) Paired t–test, since there are two sets of measurements on the same subjects, providing a natural linking.

    D) z–test, since the researcher can find the standard deviation of his population.

    E) Two–sample t–test, since how a subject performs with music should have no influence on how he performs without music, creating two independent samples.

14) _____

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Use a paired t–test to perform the required hypothesis test for two population means. Assume that the conditions and assumptions for inference are satisfied.

15) Ten different families are tested for the number of gallons of water a day they use before and after viewing a conservation video. Do the data suggest that the mean amount after the viewing differs from the mean amount before the viewing? Perform a paired t–test at the 5% significance level.

15) _____

Before	33	33	38	33	35	35	40	40	40	31
After	34	28	25	28	35	33	31	28	35	33

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

16) At one SAT test site students taking the test for a second time volunteered to inhale supplemental oxygen for 10 minutes before the test. In fact, some received oxygen, but others (randomly assigned) were given just normal air. Test results showed that 42 of 66 students who breathed oxygen improved their SAT scores, compared to only 35 of 63 students who did not get the oxygen. Which procedure should we use to see if there is evidence that breathing extra oxygen can help test–takers think more clearly?

16) _____

    A) 1–proportion z–test

    B) matched pairs t–test

    C) 2–proportion z–test

    D) 1–sample t–test

    E) 2–sample t–test

17) A survey asked people "On what percent of days do you get more than 30 minutes of vigorous exercise?" Using their responses we want to estimate the difference in exercise frequency between men and women. We should use a

    A) matched pairs t–interval

    B) 1–sample t–interval

    C) 2–sample t–interval

    D) 1–proportion z–interval

    E) 2–proportion z–interva

17) _____

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

18) Many states mandate tests that have to be passed in order for the students to graduate with a high school diploma. A local school superintendent believes that after–school tutoring will improve the scores of students in his district on the state's graduation test. A tutor agrees to work with 15 students for a month before the superintendent will approach the school board about implementing an after–school tutoring program. The after–school tutoring program will be implemented if student scores increase by more than 20 points. The superintendent will test a hypothesis using $\alpha = 0.02$. In this context, which do you consider to be more serious – a Type I or a Type II error? Explain.

18) _____

Suppose you were asked to analyze each of the situations described below. (NOTE: Do not do these problems!) For each, indicate which procedure you would use (pick the appropriate test from the list below), the test statistic (z or t), and, if t, the number of degrees of freedom.

> **proportion – 1 sample**
> **difference of proportions – 2 samples**
> **mean – 1 sample**
> **difference of means – independent samples**
> **mean of differences – matched pairs**
> **none of these**

19) Among randomly selected pets, 27% of the 188 dogs and 18% of the 167 cats had fleas. Does this indicate a significant difference in rates of flea problems for these two pets?

19) _____

20) Are there more broken bones in summer or winter? We get records about the number of fractures treated in January and July at a random sample of 25 emergency rooms.

20) _____

21) A random sample of 600 high school seniors reported their grade point averages and the amount of financial aid offered them by colleges. We wonder if there is an association between academic success and college aid.

21) _____

22) The school newspaper wants a 95% confidence interval for the road test failure rate. In a random sample of 65 student drivers, 37 said they failed their driver's test at least once.

22) _____

23) A supermarket chain wants to know which of two merchandise display methods is more effective. They randomly assign 15 stores to use display type A and 15 others to use display type B, then collect data about the number of items sold at each store.

23) _____

24) Tags placed on garbage cans allow the disposal of up to 30 pounds of garbage. A random sample of 22 cans averaged 33.2 pounds with a standard deviation of 3.2 pounds. Is this strong evidence that residents overload their garbage cans?

24) _____

25) A union organization would like to represent the employees at the local market. A sample of the employees revealed 74 of 120 were in favor of the union. Does the union have the required 3 to 2 majority?

25) _____

26) An oral surgeon is interested in estimating how long it takes to extract all four wisdom teeth. The doctor records the times for 24 randomly chosen surgeries. Estimate the time it takes to perform the surgery with a 95% confidence interval.

26) _____

27) A microwave manufacturing company receives large shipments of thermal shields from two suppliers. A sample from each supplier's shipment is selected and tested for the rate of defects. The microwave manufacturing company's contract with each supplier states the shipment with the smallest rate of defect will be accepted. Do the shipments' defect rates vary from each other?

27) _____

28) The owner of a construction company would like to know if his current work teams can build room additions quicker than the time allotted for by the contract. A random sample of 15 room additions completed recently revealed an average completion time of 0.32 days faster than contracted. Is this strong evidence that the teams can complete room additions in less than the contract times?

28) _____

29) A farmer would like to know if a new fertilizer increases his crop yield. In an effort to decide this, the farmer recorded the yield for 10 different fields prior to adding fertilizer and after adding the fertilizer. The farmer assumes the crop yields are approximately normal. Does the fertilizer work as advertised?

29) _____

30) In a study to determine whether there is a difference between the average jail time convicted bank robbers and car thieves are sentenced to, the law students randomly selected 20 cases of each type that resulted in jail sentences during the previous year. A 90% confidence interval was created from the results.

30) _____