TRUE OR FALSE? If the statement is *false*, how could you correct it to make it true?

1. The null hypothesis typically states that there is no effect in the sample.
2. The alternative hypothesis typically states that there is some effect in the sample.
3. These are good examples of null and alternative hypotheses for a given study . . .
   * H0: µ = 10
   * H1: µ > 10
4. At its core, NHST involves asking the question: How likely is it that a sample with these statistics would come from a given population?
5. After specifying the null and alternative hypotheses, setting the significance level (alpha), and collecting our data, we need to evaluate how credible the alternative hypothesis is.
6. When engaged in NHST, we ask the question: Assuming the null hypothesis is true, what’s the probability that our observed data would have these statistics?
7. Test statistics are calculated from the population data.
8. A test statistic examines the ratio of size of the effect to size of the error; researchers hope this ratio will be large.
9. The test statistic reveals what the probability would be of obtaining the observed data if the null hypothesis were to be correct.
10. Conceptually, test statistics are computed by dividing the size of the effect *by* the error in measurement of that effect.
11. Assuming that a researcher believes in their alternative hypothesis, they would want their data to produce large test statistics.
12. High p-values (close to 1.00) are associated with small test statistics.
13. Small test statistics tend to be very common, while large test statistics tend to be rare.
14. A p-value of .01 means that there is a .99 probability that we’d obtain the observed data if the alternative hypothesis were true.
15. A p-value of .007 would suggest that our effect is significant.
16. According to the conventional rules of significance testing, if our p-value = .05, we would conclude that our effect is not significant.
17. A p-value of .051 would be non-significant, while a p-value of .048 would be significant. This fact might be pointed out by a person who criticizes NHST for encouraging “all or nothing” thinking. According to this criticism, NHST forces us to conclude that there is no effect in the first case and that there *is* an effect in the second case (black and white thinking), rather than allowing us to acknowledge areas of gray.
18. A p-value = .10 is statistically significant.
19. Statistical significance means that the null hypothesis is false.
20. Having a non-significant result means that the null hypothesis is true.
21. “Statistical significance” is not equivalent to the importance of the effect.
22. Calculating an “effect size” helps researchers understand practical importance of their results.
23. Effect sizes are standardized measures of the magnitude of an effect.
24. If, in reality, the null is false, and the researcher concludes that there is an effect, the researcher has made the correct decision.
25. An example of a type I error would be if a researcher concluded that there were gender differences in intelligence, when in reality there were no gender differences.
26. If the null hypothesis is, in reality, credible, and a researcher concludes that her variables are significantly related, she has made a type I error.
27. If a researcher’s data causes him to conclude that hours of sleep per night does *not* influence memory accuracy, when in reality sleep *does* influence memory accuracy, he has made a type I error.

Provide a written response.

1. If my alternative hypothesis is “If each night for a week you write down three things you feel grateful for, your life satisfaction will change” what is the null hypothesis (in words)?
2. Dr. Jones predicted that increasing the number of hours a person slept per night would improve memory. He ran a study to test this prediction. State the null and alternative hypotheses (in words) that he would likely use.
3. A researcher would like to investigate the effect of prenatal alcohol exposure on birth weight. A random sample of n = 16 pregnant rats is obtained. The mother rats are given daily doses of alcohol. At birth, one pup is selected from each litter to produce a sample of n = 16 newborn rats. The researcher would like to compare the sample with the general population of rats. It is known that regular newborn rats (not exposed to alcohol) have an average weight of 18 grams. State the null and alternative hypotheses in both symbols and words.
4. A group of researchers are investigating whether bad moods lead to greater creativity than neutral moods, so they design an experiment to answer this question. What are the null and alternative hypotheses (in words) that follow from this question?
5. The null hypothesis for a hypothetical study is that there is no difference in the starting salaries of psychology majors and sociology majors. The alternative hypothesis is that there is a difference in the starting salaries of psychology majors and sociology majors. After setting the alpha to .01, researchers collect salary data, calculate a test statistic and p-value, and find that the test statistic = 12.90, and *p* = .007. Should the null hypothesis be rejected or retained? And, how would you interpret this result, in everyday language?

**KEY**

1. False. The null (and alternative) hypotheses are *always* about the broader populations that the samples represent, not about the samples themselves. To correct this statement, replace *sample* with *general population.*
2. False. The alternative (and null) hypotheses are *always* about the broader populations that the samples represent. To correct this statement, replace *sample* with *general population.*
3. False. To make this true, you’d need to alter the alternative hypothesis to convey a hypothesis that the mean will not be equal to ten: H0: µ = 10 and **H**1**: µ ≠ 10**. This is an example of a *non-directional* hypothesis, and most psychologists use hypothesis testing involving non-directional hypotheses.
4. True
5. False. After specifying the null and alternative hypotheses, setting the significance level, and collecting our data, we need to evaluate how credible the ***null*** hypothesis is by calculating a test statistic and its corresponding p-value, and, finally, comparing the p-value to the significance level to make a decision about the null hypothesis’ credibility (reject or retain).
6. True.
7. False. Test statistics are calculated from the observed data, in other words, from the sample data that the researcher actually collected.
8. True.
9. True.
10. True
11. True. A large test statistic tells us that the null hypothesis is not particularly credible. It tells us that, if the null hypothesis *were* true, there is a low probability that we would have obtained the observed data. Given that this probability is so low, it makes us doubt that the null hypothesis is true. It seems more likely that the alternative hypothesis is true, which is what the researcher predicted (although we can never claim that either hypothesis IS true or false).
12. True
13. True
14. False. A p-value of .01 is properly translated as: there is a ***.01*** probability that we’d obtain the observed data if the ***null*** hypothesis were true.
15. True. Conventional NHST rules state that any p-value less than 0.05 suggests that there is a significant effect. .007 is less than .05.
16. True. The conventional rules state that p-values .05 or greater do *not* represent statistically significant effects. The p-value should be less than .05
17. True.
18. False. .10 is greater than .05. A p-value of .10 is not significant.
19. False. We can never know whether the null hypothesis is false. You could change this statement to be: Statistical significance means that the null hypothesis is unlikely to be true. OR, Statistical significance means that it's unlikely we’d have obtained the data we have if the null hypothesis were true.
20. False. We can never know whether the null hypothesis is true. Having a non-significant result simply means that there’s a high probability that our observed data could have come from the population described by the null hypothesis. In other words, given our sample data, the null seems credible; we don’t have good evidence that it is *not* credible.
21. True. “Statistical significance” essentially tells us that there is a high probability that there IS an effect, but it does not tell us whether the size of the effect is large or whether the effect is meaningful and important in a broader or practical sense.
22. True.
23. True. This is the definition of effect size.
24. True.
25. True.
26. True.
27. False. He has made a type II error (a false negative), because he claimed no effect when there was one.
28. H0: Life satisfaction is not influenced by an exercise in which, each night for a week, you write down three things you feel grateful for.
29. H0: There is no change in memory. H1: There is a change in memory. NOTE: Even though he predicted that sleeping more would *improve* memory, usually researchers test an alternative hypothesis that specifies that there will be *a* difference, rather than specifying the nature of the difference (i.e., they use non-directional hypotheses for NHST).
30. H0: µalcohol exposure = 18 (Even with alcohol exposure, the rats still average 18 grams at birth) and H1: µalcohol exposure  ≠18 (Alcohol exposure will change birth weight.)
31. H0: Bad moods and neutral moods lead to equal amounts of creativity (There is no difference between the two types of moods on creativity.)

H1: Bad moods and neutral moods lead to different amounts of creativity.

1. If alpha = .01, and the p-value = .007, then *p* < α, meaning we should *reject* the null hypothesis. Given that the null hypothesis is that there is no difference in the starting salaries of psychology majors and sociology majors, and given that we *rejected* this null hypothesis, we should interpret the result as: *There is a significant difference in the starting salaries of psychology majors and sociology majors.*