1. A randomly selected sample \( (n = 9) \) had a mean of \( \bar{Y} = 17 \) with an estimated variance of \( s^2_Y = 36 \). The estimated value of the standard error of the mean was \( s_Y = 2 \).

We wish to evaluate the Null Hypothesis that the population from which our sample was taken had the same mean as a population with a mean of \( \mu = 20 \).

We conducted a statistical hypothesis test at \( \alpha = .05 \) that returned a calculated \( p = .172 \).

1.01. What decision should we make about the Null Hypothesis?
- Reject the Null Hypothesis that \( \mu_Y = 20 \).
- Do not reject the Null Hypothesis that \( \mu_Y = 20 \).
- There is not sufficient evidence to make a decision about the population mean.

1.02. Explain why you decided to reject or not reject the Null Hypothesis. Discuss what the values for \( p \) and \( \alpha \) each stand for and how the relationship between the values for \( p \) and \( \alpha \) justifies your decision. Please limit your answer to no more than 125 words.

1.03. Is the difference between the sample mean of \( \bar{Y} = 17 \) and the population mean of \( \mu_Y = 20 \) statistically significant? Why or why not?

2. We randomly selected \( n = 16 \) client families at our agency who had problems with parent-adolescent conflict. Each family met privately with a social worker once a week. They worked with the social worker using a program designed to help them acquire improved communication and negotiation skills. We administered the 25-item Index of Family Relationships (IFR, Hudson) to each family member at their first meeting with their social worker (before treatment) and at their last meeting social worker (before treatment).

The IFR is a 25-item questionnaire. We obtain a total IFR score by summing the 25 item scores. Higher scores indicate higher levels of intra-family conflict. We calculated the difference between before and after treatment IFR scores for each family member. We averaged the change scores for each family to develop an overall measure for the family.

The mean IFR change score was \( \overline{Y}_d = -12.33 \); the median change score was \( Y_{.50} = -12 \); and the mode change score was \( Y_{\text{Mode}} = -12 \). We have reason to believe that change scores for the IFR are normally distributed.
We used the five category model developed by Prochaska and DiClemente (1986, 1992) to evaluate each family member’s readiness to change category prior to treatment. The stages on the scale are ordered: (1) precontemplation – no intention to change in the immediate future; (2) contemplation – awareness of problem, but no commitment to take action; (3) preparation – intention to take action in the next month or have unsuccessfully taken action in the previous year; (4) action – currently taking action; and (5) maintenance – working to consolidate gains and prevent relapse. The worker evaluated the level of commitment and the degree of congruence in commitment level among family members to decide how to begin treatment.

2.01. The independent variable in this study refers to which of the following.
- (1) before treatment, (2) after treatment.
- IFR score.
- (1) problem with intra-family conflict, (2) other problem.
- five category scale: (1) precontemplation, (2) contemplation, (3) preparation, (4) action, (5) maintenance.
- parent-adolescent conflict.
- presenting problem.
- program participation status.
- readiness to change level.

2.02. Levels of the independent variable in this study refer to which of the following.
- (1) before treatment, (2) after treatment.
- IFR score.
- (1) problem with intra-family conflict, (2) other problem.
- five category scale: (1) precontemplation, (2) contemplation, (3) preparation, (4) action, (5) maintenance.
- parent-adolescent conflict.
- presenting problem.
- program participation status.
- readiness to change level.

2.03. The dependent variable in this study refers to which of the following.
- (1) before treatment, (2) after treatment.
- IFR score.
- (1) problem with intra-family conflict, (2) other problem.
- five category scale: (1) precontemplation, (2) contemplation, (3) preparation, (4) action, (5) maintenance.
- parent-adolescent conflict.
- presenting problem.
- program participation status.
- readiness to change level.

2.04. The dependent measure in this study refers to which of the following.
- anxiety.
- (1) before participation, (2) 8 weeks of participation.
- CAS score.
- (1) employed, (2) unemployed.
- employment status.
- meeting time.
- program participation status.

2.05. Identify the level of measurement (Nominal, Ordinal, Interval, or Ratio) for the dependent measure in this study.
2.06 What type of research design did this study use?

- single sample comparison
  [Uses a single sample. Evaluates difference between sample dependent measure values and known or theoretical population dependent measure values.]
- \( j = 2 \) dependent samples comparison: pre-post
  [Uses a single sample. Evaluates change between pre-test and post-test dependent measure values for sampling units.]
- \( j = 2 \) dependent samples comparison: matched pairs
  [Uses two samples of matched sampling units (pairs). Evaluates difference between dependent measure values for matched pairs of sampling units.]
- \( j = 2 \) independent samples comparison:
  [Uses samples formed by assigning sampling units to two different levels of the independent variable or uses samples selected from two different populations. Evaluates difference between dependent measure values for the two samples.]
- two variable correlation:
  [Uses a single sample. Evaluates correlation between ordered pairs of dependent measure values \((X,Y)\).]
- \( j > 2 \) independent samples comparison:
  [Uses samples formed by assigning sampling units to each of the \( j > 2 \) levels of the independent variable or uses samples selected from each of the \( j > 2 \) populations. Evaluates differences among dependent measure values for all samples.]

2.07 Please evaluate this research vignette using the assumptions for statistical hypothesis tests to determine which, if any, statistical hypothesis test would be appropriate to evaluate the data from this research. Begin by briefly discussing whether the design and data meet the two basic (and most important) assumptions for all statistical hypothesis tests. Fully discuss how the design meets or does not meet the criteria for each of these assumptions. Unequivocally state whether or not each of these assumptions are met. Based upon this brief discussion, unequivocally state whether or not any statistical hypothesis test would be appropriate.

If you decide that some test would be appropriate, evaluate how this study meets or does not meet the additional assumptions for a specific statistical test. Otherwise, go to the next question. Identify the tests appropriate for the research design used in this study. Then identify which of these tests would be ruled out due to the type of distribution of the dependent measure scores. Your discussion of the assumptions must support your conclusion about which, if any, test is appropriate. Your entire explanation should contain fewer than 200 words.

2.08 Which, if any, of these statistical test(s) would be appropriate?

- dependent samples Student \( t \) test
- independent samples Student \( t \) test
- One-way analysis of variance
- single sample Student \( t \) test
- Student \( t \) test for the Pearson correlation
- none of these tests are appropriate.
3. The following chart shows the results of an experimental analysis of an intervention (B) for an individual with a concern about anxiety.

The data line shows reliable and valid scores from an anxiety scale where higher scores are associated with more anxiety. The scale for the horizontal axis depicts weeks.

![Figure 1.01](image)

3.01. Do these data adequately support a conclusion that intervention B was effective in reducing the subject’s level of anxiety?

3.02. Give the reason for your decision.