Example Problems: One sample z and t tests

Example 1:

A researcher is interested in the affects that a person's avatar (i.e. visual representation of oneself) has on the number of profile views on Myspace.com. The distribution of individual personal profile views (excluding bands, artists, etc.) is extremely positively skewed with a mean of 230 views/day. The researcher creates 36 fictitious profiles that contain roughly the same information but the picture (avatar) is an animated .gif of a smiling face (36 faces randomly selected from a compilation of faces judged to be of average attractiveness). The results showed that of the 36 profiles the average number of views was 250 with a standard deviation of 60. Does having an animated smile as an avatar elicit a different number of profile views than average?

1. **State Null Hypothesis** $h_0 : \mu \_\_\_\_ 230$
2. **Alternative Hypothesis** $h_1 : \mu \_\_\_\_ 230$
3. **Decide on α (usually .05) α = _____**
4. **Decide on type of test (distribution; *z*, *t*, etc.)**
   Questions to ask:
   a. Can we assume a normally distributed sampling distribution?
      In other words, do we have 30+ participants OR a normally distributed population?
         If yes, then continue.
         If no, do not continue, the test cannot be performed.
   b. Do we know the population standard deviation?
      If yes, then use σ *to estimate* $\sigma_{\bar{X}}$ *and perform a Z-test*

      $$\sigma_{\bar{X}} = \frac{\_\_\_\_}{\sqrt{\_\_\_\_}} = \_\_\_\_\_\_$$

      If no, then use s to estimate $s_{\bar{X}}$ *and perform a t-test*

      $$s_{\bar{X}} = \frac{\_\_\_\_}{\sqrt{\_\_\_\_}} = \_\_\_\_\_\_$$

5. **Find critical value & state decision rule**
   Critical Value
   Questions to ask:
   a. Is this a 1-tailed or a 2-tailed test? _________
   b. If it is a t-test what are the degrees of freedom (DF)? _________
      If this is a Z-test, find the z-value(s) that correspond to alpha (e.g. 1.96, 1.64) and that is your critical value.
      If this is a t-test, use alpha, the number of tails and the degrees of freedom to look up the critical value in a t-table.

   Decision Rule
      In words: If _____$_{observed}$ is larger than _____$_{critical}$ reject the null hypothesis

      In numbers: If _______ > ________ reject the null hypothesis.
6. **Calculate test**

   $$\_\_\_\_\_ = \frac{\bar{X} - \mu}{\sigma_{\bar{X}} \text{ or } s_{\bar{X}}} = \frac{\_\_\_\_\_ - \_\_\_\_\_}{\_\_\_\_\_} =$$

7. **Apply decision rule**
   Since, ________(i.e. observed value) _____ (i.e. >, <) _________ (critical value), ___________(i.e. **DO or DO NOT)** reject the null hypothesis.

Example 2:

John works as a “sanitation engineer” for a zoo that has only 10 elephants and 8 zebras in the whole zoo (a budgetary problem). Every day he goes to work he feels like he is shoveling a great deal of waste and he wants to know if the amount of waste that he disposes of on average is different than the normal amount elephant/zebra zoos dispose of. On any given day 1500 pounds of waste, with a standard deviation of 500 pounds, are removed from these types of facilities across the country, however John shovels 1700 pounds of waste a day. Is John shoveling significantly more crap than the average facility?

1. **State Null Hypothesis** $h_0 : \mu$ ____ 1500
2. **Alternative Hypothesis** $h_1 : \mu$ ____ 1500
3. **Decide on α (usually .05) α =** _____
4. **Decide on type of test (distribution; *z*, *t*, etc.)**
   Questions to ask:
   a. Can we assume a normally distributed sampling distribution?
      In other words, do we have 30+ participants OR a normally distributed population?
      If yes, then continue.
      If no, do not continue, the test cannot be performed.
   b. Do we know the population standard deviation?
      If yes, then use σ *to estimate* $\sigma_{\bar{X}}$ *and perform a Z-test*

      $\sigma_{\bar{X}} = \dfrac{\_\_\_\_\_}{\sqrt{\_\_\_\_\_}} = \_\_\_\_\_\_\_\_$

      If no, then use s to estimate $s_{\bar{X}}$ *and perform a t-test*

      $s_{\bar{X}} = \dfrac{\_\_\_\_\_}{\sqrt{\_\_\_\_\_}} = \_\_\_\_\_\_\_\_$
5. **Find critical value & state decision rule**
   <u>Critical Value</u>
   Questions to ask:
   a. Is this a 1-tailed or a 2-tailed test? _________
   b. If it is a t-test what are the degrees of freedom (DF)? _________
      If this is a Z-test, find the z-value(s) that correspond to alpha (e.g. 1.96, 1.64) and that is your critical value.
      If this is a t-test, use alpha, the number of tails and the degrees of freedom to look up the critical value in a t-table.

   <u>Decision Rule</u>
      In words: If $\_\_\_\_\__{observed}$ *is larger than* $\_\_\_\_\__{critical}$ *reject the null hypothesis*

      In numbers: If _______ > ________ reject the null hypothesis.
6. **Calculate test**

   $$\_\_\_\_\_ = \frac{\bar{X} - \mu}{\sigma_{\bar{X}} \text{ or } s_{\bar{X}}} = \frac{\_\_\_\_\_ - \_\_\_\_\_}{\_\_\_\_\_} =$$
7. **Apply decision rule**
   Since, ________(i.e. observed value) _____ (i.e. >, <) _________ (critical value), ___________(i.e. **DO or DO NOT)** reject the null hypothesis.

Example 3:

Sally is an undergraduate at CSUN and works as a "hair removal technician" at Touch of Class beauty salon. She began taking an intro stat course and it led her to notice that for women who regularly come in for any kind of Bikini wax (e.g. regular, Brazilian, Playboy, Lex Luther) their distribution is normal with an average of 10 waxes a year with a standard deviation of 3. A new Hormone Therapy clinic opened up next door and she wonders if the women receiving treatment there will need more waxing than the typical clientele. She randomly selects 9 of them and on average they come in 14 times over the next year. Do these women receiving hormone therapy need significantly more waxing?

1. **State Null Hypothesis** $h_0 : \mu \_\_\_\_ 10$
2. **Alternative Hypothesis** $h_1 : \mu \_\_\_\_ 10$
3. **Decide on α (usually .05) α =** _____
4. **Decide on type of test (distribution; *z*, *t*, etc.)**
   Questions to ask:
   a. Can we assume a normally distributed sampling distribution?
      In other words, do we have 30+ participants OR a normally distributed population?
         If yes, then continue.
         If no, do not continue, the test cannot be performed.
   b. Do we know the population standard deviation?
      If yes, then use σ *to estimate* $\sigma_{\bar{X}}$ *and perform a Z-test*

      $$\sigma_{\bar{X}} = \frac{\_\_\_\_}{\sqrt{\_\_\_\_}} = \_\_\_\_\_\_$$

      If no, then use s to estimate $s_{\bar{X}}$ *and perform a t-test*

      $$s_{\bar{X}} = \frac{\_\_\_\_}{\sqrt{\_\_\_\_}} = \_\_\_\_\_\_$$

5. **Find critical value & state decision rule**
   Critical Value
   Questions to ask:
   a. Is this a 1-tailed or a 2-tailed test? _________
   b. If it is a t-test what are the degrees of freedom (DF)? _________
      If this is a Z-test, find the z-value(s) that correspond to alpha (e.g. 1.96, 1.64) and that is your critical value.
      If this is a t-test, use alpha, the number of tails and the degrees of freedom to look up the critical value in a t-table.

   Decision Rule
      In words: If $\_\_\_\_\__{observed}$ *is larger than* $\_\_\_\_\__{critical}$ *reject the null hypothesis*

      In numbers: If _______ > ________ reject the null hypothesis.
6. **Calculate test**

$$\_\_\_\_\_ = \frac{\bar{X} - \mu}{\sigma_{\bar{X}} \text{ or } s_{\bar{X}}} = \frac{\_\_\_\_\_ - \_\_\_\_\_}{\_\_\_\_\_} =$$

7. **Apply decision rule**
   Since, ________(i.e. observed value) _____ (i.e. >, <) _________ (critical value), ___________(i.e. **DO or DO NOT**) reject the null hypothesis.