1. If the alternative hypothesis is set up in a non-directional fashion, this indicates that a one-tailed (one-sided) test is being conducted.

   True **False**

2. If a researcher sets a significance level to be 5% and then determines that the data are such that p-value = .03, will the null hypothesis be rejected or not? **It will be rejected since the p-value = 0.03 is less than the α-level = 0.05.**

3. A study is conducted to test the hypothesis that people with glaucoma have higher blood pressure than average. In the study, 200 people with glaucoma are recruited. The sample mean and sample standard deviation are 133 mm Hg and 25 mm Hg, respectively.

   a) Construct a 95% confidence interval for the mean systolic blood pressure among people with glaucoma.

   $$133 +/- 1.96 * 25/\sqrt{200} = (129.5, 136.5)$$

   b) The average blood pressure for the population is known to be 130. Test whether mean for the sub-population of people with glaucoma is

      1) the same as the mean of the general population

      $H_o: \mu=130$, $H_a: \mu\neq130$, $\alpha=0.05$
      $Z=(133-130)/[25*\sqrt{200}] = 1.70$
      Test statistic is approximately normally distributed
      Critical region:(126.54,133.46) do not reject H_o
      p-value=$2*P(Z>1.70)=2*0.0446=0.0892$
      Conclusion: Do not reject the null hypothesis

      2) higher than the mean of the general population

      $H_o: \mu=130$, $H_a: \mu>130$, $\alpha=0.05$
      $Z=(133-130)/[25*\sqrt{200}] = 1.70$
      Test statistic is approximately normally distributed
      Critical region: less than 132.9 do not reject H_o
      p-value=$P(Z>1.70)=0.0446$
      Conclusion: Reject the null hypothesis

3) lower than the mean of the general population

H_o: $\mu=130$, H_a: $\mu<130$, $\alpha=0.05$
$Z=(133-130)/[25*\sqrt{200}] = 1.70$
Test statistic is approximately normally distributed
Critical region: greater than 127.1 do not reject H_o
p-value=$P(Z<1.70)=0.9554$
Conclusion: Do not reject the null hypothesis

Be sure to write out the hypotheses, alpha-level, distribution of the test statistic, critical regions, the test statistic (from the sample results), p-value of your test and your conclusions.

c) How does your result in part b.1 compare to the interval constructed in part a)?

It shifts the interval precisely three units to the left (from 133 to 130).

d) Do your conclusions in part b.2 differ from the outcome in part b.1?

Yes. We reject the null hypothesis using the one-sided hypothesis test (b.2), but do not reject the null hypothesis using the two-sided (b.1) hypothesis test. Both performed 5 percent alpha-level tests.

4. The two-sample, independent t-test is appropriate when

a) the measured variable is discrete
b) the measured variable is continuous and normally distributed
c) variances are being compared

1) a, c **2) b** 3) b, c 4) a, b, c

5. A study was done to determine the effectiveness of an instruction booklet in improving nurses' knowledge of testing for glycosuria in diabetes mellitus. A sample of 12 nurses was given a pretest prior to reading the booklet. There were 24 measurements collected in total. After reading the booklet, the same nurses were given a posttest.

a) State the null hypothesis for determining if the instruction booklet was effective.

H_0: $\mu_{pretest} = \mu_{posttest}$

b) State the appropriate alternative hypothesis.

H_1: $\mu_{pretest} < \mu_{posttest}$

c) The appropriate t-statistic is:

1. Paired t-test

2. 2-sample t-test

d) The degrees of freedom associated with this test statistic are **11** .

6. One method for assessing the effectiveness of a drug is to note its concentration in blood and/or urine samples at certain periods of time after giving the drug. Suppose we wish to compare the concentrations of two types of aspirin in urine specimens at one time and measure the 1-hour urine concentration. One week later, after the first aspirin has presumable been cleared from the system, we give the same dosage of the other aspirin to the same person and note the 1-hour urine concentration. Since the order of giving the drugs may affect the results, we use a table of random numbers to decide which of the two types of aspirin to give first. We perform the experiment on 10 people. What statistical procedure would be appropriate for comparing the two types of aspirin?

   The paired t-test.

7. A study was performed in 1086 to relate the use of oral contraceptives with the levels of various lipid fractions in a groups 163 non-pregnant, pre-menopausal women ages 21-39. The serum cholesterol among 66 current users of oral contraceptives was 201 $\pm$ 37 (mg/dl) (Mean $\pm$ Standard deviation), whereas for 97 nonusers it was 193 $\pm$ 37 mg/dl. What statistical procedure would be appropriate for determining if cholesterol levels are affected by the use of oral contraceptive use?

   The independent two-sample t-test.

8. In a pediatric clinic a study is carried out to see how effective aspirin is in reducing temperature. Twelve 5-year-old girls suffering from influenza had their temperatures taken immediately before and 1 hour after administration of aspirin. What is the appropriate statistical procedure for determining if aspirin is reducing the temperature? State the appropriate null and alternative hypotheses.

   The paired t-test. $H_o: \mu_{before} = \mu_{after}$; $H_a: \mu_{pretest} > \mu_{posttest}$

9. A hypothesis of current clinical interest is that vitamin C prevents the common cold. A study is organized to test this hypothesis using 20 prisoners as participants. In the study 10 are randomly allocated to receive vitamin C capsules and 10 are randomly allocated to receive placebo capsules. The number of colds over a 12-month period for each participant is counted. We wish to test the hypothesis that vitamin C prevents the common cold. What statistical procedure would be appropriate for determining the effectiveness of vitamin C? State the appropriate null and alternate hypotheses.

   The independent two-sample t-test. $H_o: \mu_{vitc} = \mu_{novitc}$; $H_a: \mu_{vitc} \neq \mu_{novitc}$

10. Blood pressure measurements taken on the left and right arms of a person are assumed to be comparable. To test this assumption, 10 volunteers are obtained and systolic blood pressure readings are taken simultaneously on both arms by two different observers, Mr. Jones for the left arm and Mr. Smith for the right arm. What statistical procedure would be appropriate for determining if the two arms give comparable readings, assuming the two observers are comparable?

    The paired t-test.

11. One concern in a study of different regimens in the management of diabetes was weight loss during the course of therapy. Information was collected on each individual initial weight and the amount of weight loss at 1 year. There were 16 newly diagnosed adult diabetic patients who received Phenformin to manage their diabetic state and 9 newly diagnosed diabetic patients who received Diabinese.

    a) State the null and alternative hypotheses for determining if there was a change in weight at one year for patients using Diabinese.

    The null and alternative hypotheses are

$$H_0: \mu_{wt\ diabinese\ initial} = \mu_{wt\ diabinese\ 1\ yr}$$
$$H_a: \mu_{wt\ diabinese\ initial} \neq \mu_{wt\ diabinese\ 1\ yr}$$

    They can be equivalently written (in this paired design)

$$H_0: \mu_{change} = \mu_{wt\ diabinese\ initial} - \mu_{wt\ diabinese\ 1\ yr} = 0$$
$$H_a: \mu_{change} = \mu_{wt\ diabinese\ initial} - \mu_{wt\ diabinese\ 1\ yr} \neq 0$$

    b) What statistical test would be appropriate to test the null hypothesis in a)?

    Paired t-test.

    c) State the null and alternative hypotheses for determining if there is a difference in weight loss between Phenformin and Diabinese.

$$\mathbf{H_o: \mu_{changewtphen1yr} = \mu_{changewtdiab1yr};\ H_a: \mu_{changewtphpen1yr} \neq \mu_{changewtdiab1yr}}$$

    d) What statistical test would be appropriate to test the null hypothesis in c)?

    The independent two-sample t-test.

12. A topic of current interest in opthamology is whether or not spherical refraction is measured in both eyes of 17 people. What statistical procedure would be appropriate for comparing left and right eyes? State the appropriate null and alternate hypotheses.

$$\mathbf{Paired\ t\text{-}test;\ H_o: \mu_{left} = \mu_{right};\ H_a: \mu_{left} \neq \mu_{right}}$$

13. An investigator wishes to determine if sitting upright in a chair versus lying down on a bed will affect a person's blood pressure. The investigator decides to use each of 10 patients as his or her own control and collects systolic blood pressure data in both the sitting and lying positions. What statistical procedure would be appropriate to determine the effect of position on blood pressure?

    The paired t-test.