

## SAT PREP

### AP STATISTICS / Hypothesis Test / Z-distribution

1. A statistician believes that a population which has a standard deviation of 12.9, has a mean that is greater than 80. To test this, he takes a random sample of 200 measurements, and the sample mean is 83.1 . He then performs a hypothesis test with significance level = 0.01 .
  - a. Write down the null and alternative hypotheses.
  - b. State the null distribution.
  - c. Find the value of the test statistic.
  - d. State the decision rule.
  - e. Find and illustrate the critical region.
  - f. Make a decision to reject or not reject  $H_0$ .
  - g. State the conclusion for the test.
  
2. A population has known variance  $\sigma^2 = 15.79$  . A sample of size 36 is taken and the sample mean  $\bar{x} = 23.75$  . We are required to test the hypothesis  $H_0: \mu = 25$  against  $H_1: \mu < 25$ .
  - a. Find:
    - i. the test statistic
    - ii. the null distribution
    - iii. the p-value.
  - b. What decision should be made at a 5% level using:
    - i the test statistic
    - ii the p-value?

3. A statistician believes that a population which has a standard deviation of 12.9, has a mean that is greater than 80. To test this, he takes a random sample of 200 measurements, and the sample mean is 83.1 . He then performs a hypothesis test with significance level = 0.01 .

- a. Write down the null and alternative hypotheses.
- b. State the null distribution.
- c. Find the value of the test statistic.
- d. State the decision rule.
- e. Find and illustrate the critical region.
- f. Make a decision to reject or not reject  $H_0$ .
- g. State the conclusion for the test

4. Bags of salted cashew nuts display net contents 100 g. The manufacturer knows that the standard deviation of the population is 1.6 g. A customer claims that the bags have been lighter in recent purchases, so the factory the quality control manager decides to investigate. He samples 40 bags and finds that their mean weight is 99.4 g.

Perform a hypothesis test at the 5% level of significance, using critical regions, to determine whether the customer's claim is valid.

5. An alpaca breeder wants to produce fleece which is extremely fine. In 2008, his herd had mean fineness 22.3 microns with standard deviation 2.89 microns. The standard deviation remains relatively constant over time. In 2012, a sample of 80 alpacas from the herd was randomly selected, and the mean fineness was 21.2 microns.
- Perform a two-tailed hypothesis test at the 5% level of significance, using p-values to determine whether the herd's fineness has changed.
  - Use a 95% confidence interval to check the result of your test.
6. A machine packs sugar into 1 kg bags. It is known that the masses of the bags of sugar are normally distributed with a variance 2.25 g. A random sample of eight filled bags was taken and the masses of the bags measured to the nearest gram. Their masses in grams were: 1001, 998, 999, 1002, 1001, 1003, 1002, 1002. Perform a test at the 1% level, to determine whether the machine overflows the bags.

