

# Chapter III

## Testing Hypotheses

### *Exercises*

#### **Part I:**

##### **1.**

A tire manufacturer claims that his tires will last no less than an average of 50000 km before they need to be replaced. A consumer group wishes to challenge this claim.

1. Clearly define the parameter of interest in this problem.
2. State the null and the alternative hypotheses in terms of this parameter.
3. In the context of the problem, state what it means to make a type I and type II error.
4. Suppose we set the significance level of the test at 10%, what does this number mean?

*Use the critical-value approach to solve the following problems:*

##### **2.**

The standard deviation of the life for a particular brand of ultraviolet tube is known to be 500 hr, and the operating life of the tubes is normally distributed.

The manufacturer claims that average tube life is at least 9000 hr.

Test this claim at the 5 percent level of significance against the alternative hypothesis that the mean life is less than 9000 hr, and given that for a sample of 15 tubes the mean operating life was 8800 hr.

##### **3.**

An insurance company is reviewing its current policy rates. When originally setting the rates they believed that the average claim was 1800 €. They are concerned that the true mean is actually higher than this, because they could potentially lose a lot of money. They randomly choose 40 claims, and calculate a sample mean of 1950 €.

Assuming that the standard deviation of all claims is 500 €, set the significance level at 5%, test to see if the insurance company should be concerned.

4.

A representative of a community group informs the prospective developer of a shopping centre that the average income per household in the area is 45000 €. Suppose that for the type of area involved household income can be assumed to be approximately normally distributed, and that the standard deviation can be accepted as being equal to 2000 €, based on an earlier study. For a random sample of 15 households, the mean household income is found to be 44000 €. Test the community representative's claim at 5% level of significance.

5.

A company manufactures gas bottles for industrial use and claims that the average hours of use is 500 hours. A purchaser of these bottles doubts the claims and believes the use time is less than 500 hours. To test the company's claim the purchasing agent randomly selects six of these gas bottles from the manufacturer and finds that the sample average is 493 hours with a sample standard deviation of 4 hours.

Assuming that the population is normally distributed, test if the manufacturers claim is justified at the 0.05 level of significance?

6.

A lecturer wants to know if his introductory statistics class has a good grasp of basic math. Six students are chosen at random from the class and given a math proficiency test. The lecturer wants the class to be able to score at least 70 on the test. The six students get scores of 62, 92, 75, 68, 83, and 95.

Can the lecturer be at least 95 percent certain that the mean score for the class on the test would be at least 70?

7.

A machine is programmed to produce washers with a thickness of 0.05 inches. A random sample of ten measurements yields the following thicknesses (unit = inches):

0.053 0.054 0.049 0.050 0.054 0.053 0.048 0.055 0.054 0.053

At the 5% level of significance, test the hypothesis that the machinery is functioning properly.

*Use the p-value approach to solve the following problems:*

8.

It is claimed that, in a particular population, the mean amount of money a person has with him in cash is 50 €. To test this claim a researcher is taking a sample of

36 people from this population finding a mean amount of 52 € in cash. The population standard deviation is known to be 8 €. Does this indicate that the actual amount of cash people have on them in this population is higher than the claimed 50 €? Use a 5% significance level.

**9.**

Suppose a baker claims that his bread height is more than 15 cm, on the average. Several of his customers do not believe him. To persuade his customers that he is right, the baker decides to do a hypothesis test. He bakes 10 loaves of bread. The average height of the sample loaves is 17 cm. The baker knows from baking hundreds of loaves of bread that the standard deviation for the height is 0.5 cm. Verify the customers' claim. Choose a level of significance of 0.05.

**10.**

Weight losses of 12 Persons in an experimental one-month diet programme are given below:

Weight Loss in Kg

3.0	1.4	0.2	-1.2
5.3	1.7	3.7	5.9
0.2	3.6	3.7	2.0

Test the claim that on the average there is no weight loss under this diet programme. Assume that the population is normally distributed and use a 5% significance level.

**11.**

In 2005, 5.8% of job applicants who were tested for drugs failed the test. At the 0.02 level of significance test the claim that the failure rate is now lower if a random sample of 1520 current job applicants results in 58 failures.

**12.**

The service manager for an appliance sales company asserts that 6 percent of the appliances sold are returned to the service department for repair under the warranty, and the sales manager believes that this claim is too high. Test the service manager's assertion at the 0.05 level of significance if 56 out of a random sample of 1000 appliance sales are returned to the service department for repair under the warranty.

## Part II: SPSS

### 1.

**Data Set:** *GSS2000R.sav*

Research reports from prior years on data from the General Social Survey cited the average total family income as 16.5

Using the variable total family income [*income98*] answer the following questions related to a one-sample t- test of a population mean. Use a two-tailed test with a level of significance of 0.05.

1. Does the variable total family income [*income98*] satisfy the level of measurement requirement of a one-sample t-test?
2. Is the distribution of total family income [*income98*] normal?
3. Is the distribution of total family income [*income90*] nearly normal?
4. Is the number of variable cases sufficient to support the use of Central Limit Theorem should it be needed to justify the use of probabilities based on sampling distribution?
5. Identify the mean for the sample data and the standard error of the sampling distribution.
6. Formulate the null hypothesis and the alternative hypotheses.
7. Calculate the t-test statistic.
8. Show the *p – value* . What does it mean?
9. Would you or would you not reject the null hypothesis?

### 2.

**Data File:** *normal\_data.sav* (Variable: *data*)

1. Display a histogram together with the curve of normal distribution.
2. Is the variable *data* normally distributed?

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