

1. A representative of a community group informs the prospective developer of a shopping center that the average income per household in the area is \$25,000. 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 2,000, based on an earlier study. For a random sample of  $n = 15$  household, the mean household income is found to be  $\bar{x} = \$24,000$ .
  - (a) Test the null hypothesis that  $\mu = \$25,000$  by establishing critical limits of the sample mean in terms of dollars, using the 5 percent level of significance.
  - (b) Test the hypothesis by using the standard normal variable  $z$  as the test statistic.
2. The standard deviation of the tube 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 9,000 hr. Test this claim at the 5 percent level of significance by designating it as the null hypothesis and given that for a sample of  $n = 15$  tubes the mean operating life was  $\bar{x} = 8,800$  hr.
3. For a sample of 50 firms taken from a particular industry the mean number of employees per firm is 420.4 with a sample standard deviation of 55.7. There are a total of 380 firms in this industry. Before the data were collected, it was hypothesized that the mean number of employees per firm in this industry does not exceed 408 employees. Test this hypothesis at the 5 percent level of significance.
4. As a commercial buyer for a private supermarket brand, suppose that a random sample of 12 No. 303 cans of string beans at a canning plant. The average weight of the drained beans in each can is found to be  $\bar{x} = 15.97$  g, with  $s = 0.15$ . The claimed minimum average net weight of the drained beans per can is 16.0 g. Can this claim be rejected at the 10 percent level of significance?
5. An automatic soft ice cream dispenser has been set to dispense 4.00 g per serving. For a sample of  $n = 10$  servings, the average amount of ice cream is  $\bar{x} = 4.05$  g with standard deviation = 0.10 g. The amount being dispensed are assumed to be normally distributed. Basing the null hypothesis on the assumption that the process is 'in control', should the dispenser be reset as a result of a test at the 10 percent level of significance?
6. It is hypothesized that no more than 5 percent of the parts being produced in a manufacturing process are defective. For a random sample of  $n = 100$  parts, 10 are found to be defective. Test the null hypothesis at the 5 % level of significance.
7. A salesman claims that on the average he obtains orders from at least 30 percent of his prospects. From a random sample of 100 prospects he is able to obtain 20 orders. Can his claim be rejected at the (a) 5 % and (b) 1 % level of significance?
8. The sponsor of a television 'special' expected that at least 40 percent of the viewing audience would watch the show in a particular metropolitan area. For a random sample of 100 households with television sets turned on, 30 are viewing the 'special'. Can the sponsor's assumption that at least 40 percent of the households would watch the program be rejected at the (a) 10 percent and (b) 5 percent level of significance?

9. The director of a college placement office claims that at least 50 percent of the graduating seniors had finalized job arrangement by March 1. Suppose a random sample of  $n = 30$  seniors are polled, and only 10 of the students indicate that they have concluded their job arrangements by March 1. Can the placement director's claim be rejected at the 5 percent level of significance?
10. The table below shows the number of employees absent for a single day during a particular period of time.

Day	Number of absentees
Monday	121
Tuesday	87
Wednesday	87
Thursday	91
Friday	114
Total	500

- (a) Find the frequencies expected under the hypothesis that the number of absentees is independent of the day of the week.
- (b) Test at the 5% level whether the difference in the observed and expected data are significant.
11. 300 employees of a company were selected at random and asked whether they were in favour of a scheme to introduce flexible working hours. The following table shows the opinion and the departments of the employees.

	OPINION		
Department	In favour	Uncertain	Against
Production	89	42	9
Sales	53	36	11
Administration	38	12	10

Test whether there is evidence of a significant association between opinion and department at 5% significance level.

12. A survey was carried out in a firm of the smoking habits of men and women employees with the following results:

	Men	Women
Smokers	48	27
Non-smokers	58	57

It is required to test whether, at the 5% level of significance, the survey reveals any difference in the smoking habits of men and women.

13. A random sample of employees of a large company was selected and the employees were asked to complete a questionnaire. One question asked whether the employees were in favour of the introduction of flexible working hours. The following table classifies the employees by their response and gender i.e. male or female.

RESPONSE	Gender	
	Male	Female
In favour	57	83
Not in favour	33	27

Test whether there is evidence of a significant association between the response and gender.

**Answers:**

- 1) test statistics = -1.936, Do not reject  $H_0$
- 2) test statistics = -1.549, Do not reject  $H_0$
- 3) test stats = 1.686, reject  $H_0$
- 4) Test stats = -0.693, Do not reject  $H_0$
- 5) Test stats = 1.581, Do not reject  $H_0$
- 6) test statistics = 2.294, Reject  $H_0$
- 7) Test stats = -2.182, (a) Reject  $H_0$ , (b) Do not reject  $H_0$
- 8) Test statistics = -2.041, (a) Reject  $H_0$ , (b) Reject  $H_0$
- 9) Test statistics = -1.826, Reject  $H_0$
- 10) (a) 100      (b)  $\chi^2_{calc} = 10.56$
- 11)  $\chi^2_{calc} = 8.692$
- 12)  $\chi^2_{calc} = 2.8612$
- 13)  $\chi^2_{calc} = 2.9102$