

**School of Information Technology**

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Module : Business Statistics  
Topic : Hypothesis Testing for One Sample

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Learning Outcomes:

By the end of this lesson, you should be able to

1. Explain and formulate the procedure for testing a hypothesis
2. Explain Type I and Type II errors with reference to the possible outcomes of a hypothesis test.
3. Evaluate the hypothesis of a population mean by using the z-test or t-test.
4. Perform inferential statistics on real-life business data using statistical hypothesis tests.

## Topic: Hypothesis Testing for One Sample

### QUESTION 1

State the null and alternative hypotheses and identify which represents the claim for each of the following situations:

- a) A university publicises that the mean duration for its students who graduate in 4 years is 82%.
- b) A cereal company advertises that the mean weight of the contents of its 20-ounce size cereal boxes is more than 20 ounces.
- c) A phone company claims that the average customer pays less than \$30 a month.
- d) A marketing research firm believes that the average number of hours per week that Americans watch television differs from 15 hours a week.

### QUESTION 2

Determine the critical values for  $z$  that would be used to test the null hypothesis at the given level of significance, as described in each of the following:

- a)  $H_0: \mu = 20$        $H_a: \mu \neq 20$        $\alpha = 0.10$
- b)  $H_0: \mu \leq 24$        $H_a: \mu > 24$        $\alpha = 0.01$
- c)  $H_0: \mu \geq 10.5$        $H_a: \mu < 10.5$        $\alpha = 0.05$
- d)  $H_0: \mu = 35$        $H_a: \mu \neq 35$        $\alpha = 0.01$

### QUESTION 3

A report claims that an adult has an average of 130 Facebook friends. A random sample of 50 adults revealed that the average number of Facebook friends was 142 with a standard deviation of 38.2. At 5% significance level, is there enough evidence to reject the claim?

### QUESTION 4

The management of weight loss club claims that its members lose an average of 3 kg or more within the first month after joining the club. A consumer agency that wanted to check this claim took a random sample of 36 members of this club and found that they lost an average of 2.9 kg with a standard deviation of 0.6 kg within the first month of membership. Test, at 10% significance level, on whether the management's claim is true.

### QUESTION 5

Determine the critical values for  $t_c$  that would be used to test the null hypothesis at the given level of significance in each of the following. Assume sample size  $n = 11$ .

- a)  $H_0: \mu = 20$        $H_1: \mu \neq 20$        $\alpha = 0.10$
- b)  $H_0: \mu \leq 24$        $H_1: \mu > 24$        $\alpha = 0.01$
- c)  $H_0: \mu \geq 10.5$        $H_1: \mu < 10.5$        $\alpha = 0.05$
- d)  $H_0: \mu = 35$        $H_1: \mu \neq 35$        $\alpha = 0.01$

### QUESTION 6

A psychologist claims that the mean age at which children start walking is 12.5 months. To check this claim, you took a random sample of 18 children and found that the mean age at which these children started walking was 12.9 months with a standard deviation of 0.7 month. Using the 10% significance level, can you conclude that the mean age at which all children start walking is 12.5 months? Assume that the ages at which all children start walking have an approximately normal distribution.

### QUESTION 7

The average monthly telephone bill was reported to be more than \$50.07. A random sample of 10 people was taken and found that the average monthly telephone bill was \$56.11 with a standard deviation of \$6.97. At 5% significance level, can the claim be supported? Assume all telephone bills to be approximately normal.

### SUPPLEMENTARY QUESTIONS

#### QUESTION 8

A manufacturer of drugs and medical products claims that a new anti-inflammatory drug will be effective for 4 hours after the drug is administered in the prescribed dosage. A random sample of 50 volunteers demonstrated that the average effective time is 3.70 hours with a sample standard deviation of 0.606 hours. Determine if there is enough evidence to reject the claim the mean effective time of the drug is 4 hours. Use significance level of 0.01.

#### QUESTION 9

The manufacturer of a new drone claims that its average weight is less than 350g. A random sample of 24 drones was obtained. The average weight is found to be 340g with a standard deviation of 80g. At 5% significance level, can the claim be supported? Assume the weights of the drones to be approximately normal.

#### Answers:

Q1(a)  $H_0: \mu = 0.82$  (claim)  $H_a: \mu \neq 0.82$

Q2(a)  $z_c = \pm 1.65$

Q3 Test statistic = 2.22, reject  $H_0$

Q4 Test statistic = -1.00, do not reject  $H_0$

Q5(a)  $t_c = \pm 1.812$

Q6 Test statistic = 2.424, reject  $H_0$

Q7 Test statistic = 2.741, reject  $H_0$

Q8 Test statistic = -3.50, reject  $H_0$

Q9 Test statistic = -0.612, do not reject  $H_0$