Chapter

13

STATISTICAL INFERENCE TESTING OF HYPOTHESES

SHORT QUESTIONS

.1 Describe the hypothesis

ns. Hypothesis is a statement which may or may not appears be true after conclusion. or

A statement about a population parameter developed for the purpose of testing.

.2 Define the hypothesis testing.

ns. A procedure based on sample evidence and probability theory to determine whether the hypothesis is a reasonable statement or not is called hypothesis testing.

.3 Explain the terms hypothesis and tests of hypothesis.

ns. Any notion that is formed about the population is called hypothesis.

The procedures which are adopted to examine whether a certain opinion or notion about the population is true or false are called tests of hypothesis e.g. Z-test, t-test and χ^2-test etc.

.4 Define a null hypothesis

ns. A null hypothesis is any hypothesis which is tested for possible rejection or acceptance under the assumption that it is true.

.5 Write down the definition of alternative hypothesis or research hypothesis.

ns. A statement specifying that the population parameter is some value other than the one specified under the null hypothesis.

.6 Define a simple hypothesis.

ns. A hypothesis is said to be a simple hypothesis if the hypothesis uniquely specifies the distribution from which the sample is taken.

.7 What is meant by composite hypothesis?

ns. A hypothesis which does not specify all values of parameters of a distribution is called composite hypothesis. or

A hypothesis is said to be a composite hypothesis if it does not completely specify the probability distribution.

Q.24 Define null hypothesis and describe the general procedure for its test.

Ans. A null hypothesis denoted by the symbol Ho is any hypothesis which is tested for possible rejection under the assumption that it is true.

General Procedure

(1) (a) $H_o : \theta = \theta_o$ (b) $H_o : \theta \geq \theta_o$ (c) $H_o : \theta \leq \theta_o$

$H_1 : \theta \neq \theta_o$ $H_1 : \theta < \theta_o$ $H_1 : \theta > \theta_o$

(2) Level of significance α is chosen.

(3) A suitable test-statistic is selected.

(4) We compute the value of test-statistic using the given information of sample.

(5) Critical region is formed according to alternative hypothesis.

(6) Conclusion whether to accept the null hypothesis or reject it.

Q.25 Write a short note on power curve.

Ans. A graph of the probability of rejecting Ho for all possible values of population parameter not satisfying the null hypothesis is known as power curve.

Q.26 Define the terms power of a test and power curve.

Ans. The power of a test is the probability that the test will lead to a rejection of the null hypothesis H_0 when, infact, the alternative hypothesis H_1 is true.

A graph of the probability of rejecting H_0 for all possible values of population parameter not satisfying the null hypothesis is known as power curve.

Q.27 Describe the procedure for testing hypothesis about mean of a population when population standard deviation is known.

Ans. **General Procedure**

(1) (a) $H_o : \mu = \mu_o$ and $H_1 : \mu \neq \mu_o$ (Two-sided)

(b) $H_o : \mu \leq \mu_o$ and $H_1 : \mu > \mu_o$ (One-sided)

(c) $H_o : \mu \geq \mu_o$ and $H_1 : \mu < \mu_o$ (One-sided)

(2) Choose the level of significance α

(3) The test-statistic to be used is $Z = \dfrac{\bar{X} - \mu_o}{\sigma / \sqrt{n}}$

(4) The critical region is defined as:

(a) $H_1 : \mu \neq \mu_o$, $|Z| > Z_{\frac{\alpha}{2}}$

(b) $H_1 : \mu > \mu_o$, $Z > Z_\alpha$

(c) $H_1 : \mu < \mu_o$, $Z < -Z_\alpha$

Q.30 Describe the procedure for testing equality of means of two populations when population standard deviations are known and sizes are large or small.

Ans. General Procedure

(1) (a) $H_0 : \mu_1 = \mu_2$ and $H_1 : \mu_1 \neq \mu_2$ (Two-sided)

(b) $H_0 : \mu_1 \leq \mu_2$ and $H_1 : \mu_1 > \mu_2$ (One-sided)

(c) $H_0 : \mu_1 \geq \mu_2$ and $H_1 : \mu_1 < \mu_2$ (One-sided)

(2) Choose the level of significance α

(3) The test-statistic to be used is $Z = \dfrac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{\sigma_1^2}{8} + \dfrac{\sigma_2^2}{8}}}$

(4) The critical region is defined as:

(a) $H_1 : \mu_1 \neq \mu_2$, $|Z| > Z_{\frac{\alpha}{2}}$

(b) $H_1 : \mu_1 > \mu_2$, $Z > Z_\alpha$

(c) $H_1 : \mu_1 < \mu_2$, $Z < -Z_\alpha$

(5) The calculation of the test-statistic

(6) Conclusion: Reject H_0 if Z lies in the critical region, otherwise

Q.31 Describe the procedure for testing equality of means of two populations when $\sigma_1 = \sigma_2$ but unknown for small samples.

Ans. General Procedure

(1) (a) $H_0 : \mu_1 = \mu_2$ and $H_1 : \mu_1 \neq \mu_2$ (Two-sided)

(b) $H_0 : \mu_1 \leq \mu_2$ and $H_1 : \mu_1 > \mu_2$ (One-sided)

(c) $H_0 : \mu_1 \geq \mu_2$ and $H_1 : \mu_1 < \mu_2$ (One-sided)

(2) Choose the level of significance α

(3) The test-statistic to be used is $t = \dfrac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}}$

(4) The critical region is defined as:

(a) $H_1 : \mu_1 \neq \mu_2$, $|t| > t_{\frac{\alpha}{2}(v)}$ where $v = n_1 + n_2 - 2$

(b) $H_1 : \mu_1 > \mu_2$, $t > t_{\alpha(v)}$

(c) $H_1 : \mu_1 < \mu_2$, $t < -t_{\alpha(v)}$

(5) The calculation of the test-statistic

Ans. **General Procedure**

(1) (a) $H_o : \mu_1 = \mu_2$ and $H_1 : \mu_1 \neq \mu_2$ (Two-Sided)

(b) $H_o : \mu_1 \leq \mu_2$ and $H_1 : \mu_1 > \mu_2$ (One-Sided)

(c) $H_o : \mu_1 \geq \mu_2$ and $H_1 : \mu_1 < \mu_2$ (One-Sided)

(2) The level of significance $\alpha = 0.10$

(3) The test-statistic to be used is $t = \dfrac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\frac{1}{8}+\frac{1}{8}}}$

(4) The critical region is defined as:

(a) $|t| > t_{\frac{\alpha}{2}(v)}$ or $|t| > t_{0.05(14)}$ or $|t| > 1.761$, where $v = n_1 + n_2 - 2$

(b) $t > t_{\alpha(v)}$ or $t > t_{0.10(14)}$ or $t > 1.345$

(c) $t < -t_{\alpha(v)}$ or $t < -t_{0.10(14)}$ or $t < -1.345$

(5) The calculation of the test-statistic.

(6) Conclusion: Reject H_o if t lies in the critical region, otherwise accept it.

Q.33 Describe the procedure for testing hypothesis about two means with paired observations.

Ans. **General Procedure**

(1) (a) $H_o : \mu_1 = \mu_2$ and $H_1 : \mu_1 \neq \mu_2$ (Two-sided)

(b) $H_o : \mu_1 \leq \mu_2$ and $H_1 : \mu_1 > \mu_2$ (One-sided)

(c) $H_o : \mu_1 \geq \mu_2$ and $H_1 : \mu_1 < \mu_2$ (One-sided)

(2) Choose the level of significance α

(3) The test-statistic to be used is $t = \dfrac{\bar{d} - d_o}{s_d/\sqrt{n}} = \dfrac{\sqrt{n}(\bar{d} - d_o)}{s_d}$

(4) The critical region is defined as:

(a) $H_1 : \mu_1 \neq \mu_2$, $|t| > t_{\frac{\alpha}{2}(n-1)}$ where n = number of pairs

(b) $H_1 : \mu_1 > \mu_2$, $t > t_{\alpha(n-1)}$

(c) $H_1 : \mu_1 < \mu_2$, $t < -t_{\alpha(n-1)}$

(5) The calculation of the test-statistic

(6) Conclusion : Reject H_o if t lies in the critical region, otherwise accept it

Explain the general procedure for testing of hypothesis regarding the population proportion p for a large sample.

General Procedure

(Two-sided)