Lecture 09

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Testing of Hypotheses I (Parametric or Standard Tests of Hypotheses)

- Hypothesis is usually considered as the principal instrument in and research.
- Ordinarily, when one talks about hypothesis, one simply means a mere assumption or some supposition to be proved or disproved. But for a researcher hypothesis is a formal question that he intends

- **"Students who receive counseling will show a greater increase in creativity than students not receiving counselling"**
- **Or "the automobile *A is performing as well as automobile B.*"**
- **These are hypotheses capable of being objectively verified and tested.**

Characteristics of hypothesis:

- ***Hypothesis must possess the following characteristics:***

(i) **Hypothesis should be clear and precise.**

(ii) Hypothesis should be capable of being *tested*.

(iii) Hypothesis should state *relationship* between variables, if it happens to be a relational hypothesis.

(iv) Hypothesis should be limited in *scope* and must be specific.

(v) Hypothesis should be *stated* as far as possible in most simple terms

(vi) Hypothesis should be consistent with most known facts

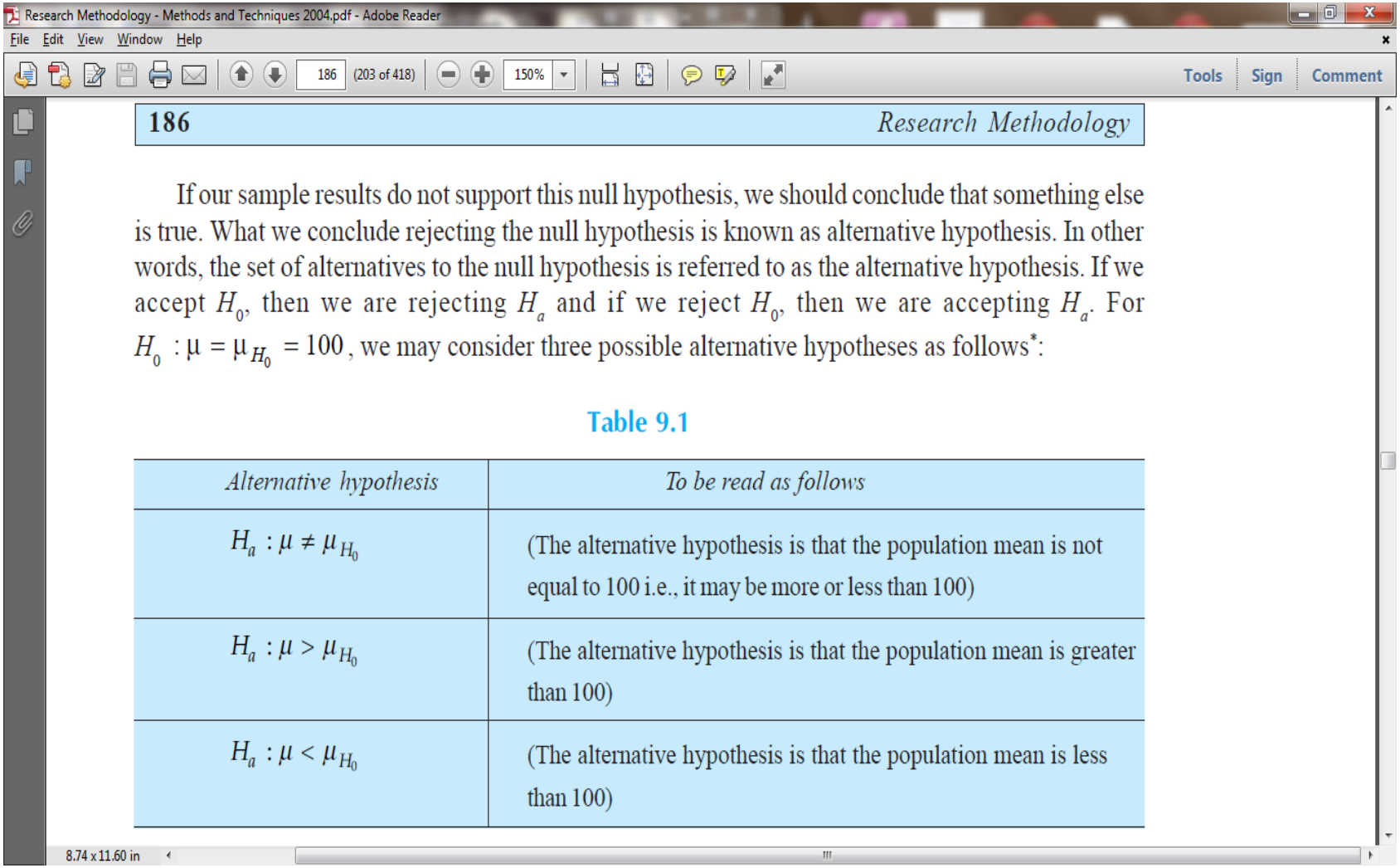
(vii) Hypothesis should be *amenable* to testing within a reasonable time.

(viii) Hypothesis must *explain* the facts that gave rise to the need for explanation.

BASIC CONCEPTS CONCERNING TESTING OF HYPOTHESES

- **(a) *Null hypothesis and* alternative *hypothesis***

possible alternative *hypothesis*



If our sample results do not support this null hypothesis, we should conclude that something else is true. What we conclude rejecting the null hypothesis is known as alternative hypothesis. In other words, the set of alternatives to the null hypothesis is referred to as the alternative hypothesis. If we accept H_0, then we are rejecting H_a and if we reject H_0, then we are accepting H_a. For $H_0 : \mu = \mu_{H_0} = 100$, we may consider three possible alternative hypotheses as follows*:

Table 9.1

Alternative hypothesis	*To be read as follows*
$H_a : \mu \neq \mu_{H_0}$	(The alternative hypothesis is that the population mean is not equal to 100 i.e., it may be more or less than 100)
$H_a : \mu > \mu_{H_0}$	(The alternative hypothesis is that the population mean is greater than 100)
$H_a : \mu < \mu_{H_0}$	(The alternative hypothesis is that the population mean is less than 100)

- **b) *The level of significance:***

  This is a very important concept in the context of hypothesis testing .
  It is always some percentage (*usually 5%*) which should be chosen wit great care, thought and reason.

- **(c) *Decision rule or test of hypothesis: Given a hypothesis H0 and an alternative hypothesis Ha,***

  we make a rule which is known as decision rule according to which we accept *H0 (i.e., reject Ha) or* reject *H0 (i.e., accept Ha)*.

Acceptance and rejection regions in case of a two-tailed test (with 5% significance level)

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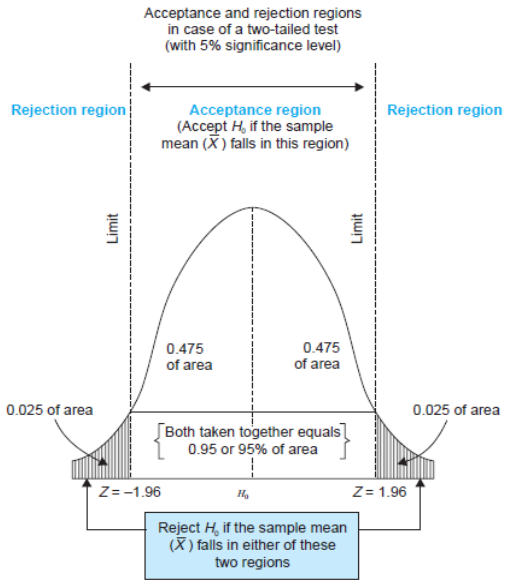

Fig. 9.1

[2] Richard I. Levin, *Statistics for Management*, p. 247–248.

*Also known as critical regions.

PROCEDURE FOR HYPOTHESIS TESTING

- **the main question is:**

  whether to *accept the null hypothesis or not to accept the null hypothesis*? Procedure for hypothesis testing refers to all those steps that we undertake for making a choice between the two actions i.e., rejection and acceptance of a null hypothesis

FLOW DIAGRAM FOR HYPOTHESIS TESTING

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FLOW DIAGRAM FOR HYPOTHESIS TESTING

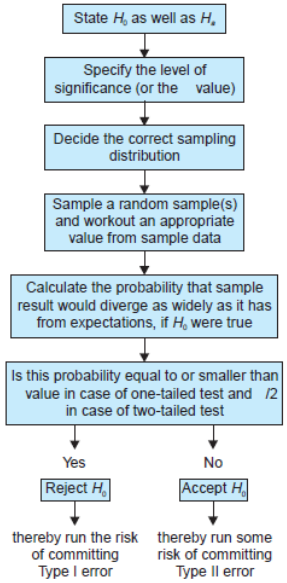

Fig. 9.4

[3] Based on the flow diagram in William A. Chance's *Statistical Methods for Decision Making*, Richard D. Irwin INC., Illinois, 1969, p.48.

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TESTS OF HYPOTHESES

- classified as:
- (a) Parametric tests or standard tests of hypotheses; (1) *z-test; (2) t-test;* x2*-test, and (4) F-test. All these tests* are based on the assumption of normality i.e., the source of data is considered to be normally distributed.
- (b) Non-parametric tests or distribution-free test of hypotheses.

The various steps involved in hypothesis testing are stated below:

- **(i) Making a formal statement: The step consists : null hypothesis is H0 : m = 10 tons**
- **Alternative Hypothesis Ha: m > 10 tons**
- **(ii) Selecting a significance level:**
- **(iii) Deciding the distribution to use: (iv) Selecting a random sample and computing an appropriate value**
- **(vi) Comparing the probability: Yet another step consists in comparing the probability thus calculated with the specified value for a , the significance level.**

Chi-Square Test

- Chi-square, symbolically written as c2 (Pronounced as Ki-square), is a statistical measure used in the context of sampling analysis for comparing a variance to a theoretical variance.
- As a *non-parametric test*, it "can be used to determine if categorical data shows dependency or the two classifications are independent. It can also be used to make comparisons between theoretical populations and actual data when categories are used."

- The test is, in fact, a technique through the use of which it is possible for all researchers to

- (i) test the goodness of fit;
- (ii) test the significance of association between two attributes, and
- (iii) test the homogeneity or the significance of population variance.

- **chi-square can be used**

  (i) as a test of goodness of fit and

  (ii) as a test of independence.

- No group should contain very few items, say less than 10. I
- n case where the frequencies are less than 10, regrouping is done by combining the frequencies of adjoining groups so that the new frequencies become greater than 10.
- Some statisticians take this number as 5, but 10 is regarded as better by most of the statisticians.