BioCEP - 621
Framing statistical hypothesis steps statistical test, p-value (Par 1)

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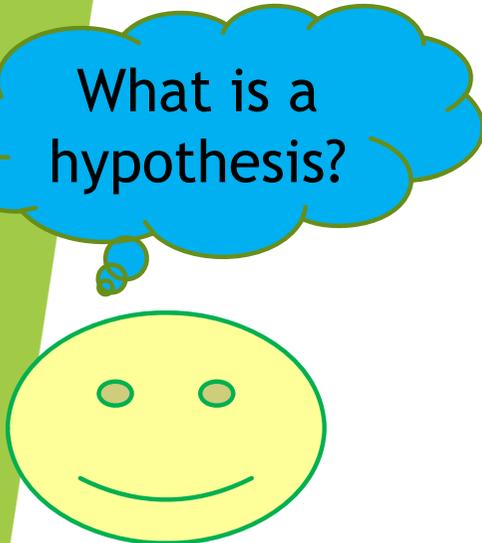
❖ A premise or claim that we want to test.

❖ Supposition or suggested explanation given based on limited evidence as a starting point for further investigations.

❖ Part of the scientific method, a prediction or explanation that is tested by an experiment.

❖ A speculation or a theory based on inadequate evidence. It lends itself to further research and experimentation.

What is a hypothesis?

Eg.   Plankton are the main source of food for almost all fish.

Hypothesis Testing

▶ A procedure, based on sample evidence and probability theory, used to determine whether the hypothesis is a reasonable statement and should not be rejected or is unreasonable and should be rejected.

Five steps of hypothesis testing

1 • State the hypotheses

2 • Collect data

3 • Perform a statistical test

4 • Assess the evidence (p value)

5 • Draw a conclusion based on findings

Step 1 — State the hypotheses

| **Ho** Null Hypothesis | - no difference between two measured phenomena or that two samples derive from the same general population. |

Eg.
Ho: The abundance of fish do not depend on the density of plankton

| **Ha** Alternative Hypothesis | -a difference between groups - a relationship between the factors/ treatments and outcomes |

Eg
Ha: The abundance of fish depend on the density of plankton.

Errors in Decision Making

	In Reality	
Decision	Ho is TRUE	Ho is FALSE
Accept *Ho*	Correct Decision (OK)	**Type II Error** **β= probability of Type II Error**
Reject *Ho*	**Type I Error** **α = probability of Type I Error**	Correct Decision (OK)

Type I Error
Rejecting the null hypothesis (**Reject** *Ho)* when it is actually true.

Type II Error
Failing to reject the null hypothesis (Accept *Ho)* when it is actually false.

▶ **Type I and Type II Errors**

▶ **Question:** How to find a sensible statistical procedure to test if *Ho* or *Ha* is true?

▶ **Answer:** A sensible statistical procedure is to make the probability of making a wrong decision as small as possible.

▶ **Type I error: wrong rejection of Ho (Ho is true but is rejected)**
  Eg.1. Carnivorous fish feed on phytoplankton.

▶ **Type II error: wrong rejection of Ha (Ha is true but is rejected)**
  Eg.2. Omnivorous fish do not feed on phytoplankton

Power Analysis

Critical value

Ho

H1

β
Type II Error

α
Type I Error
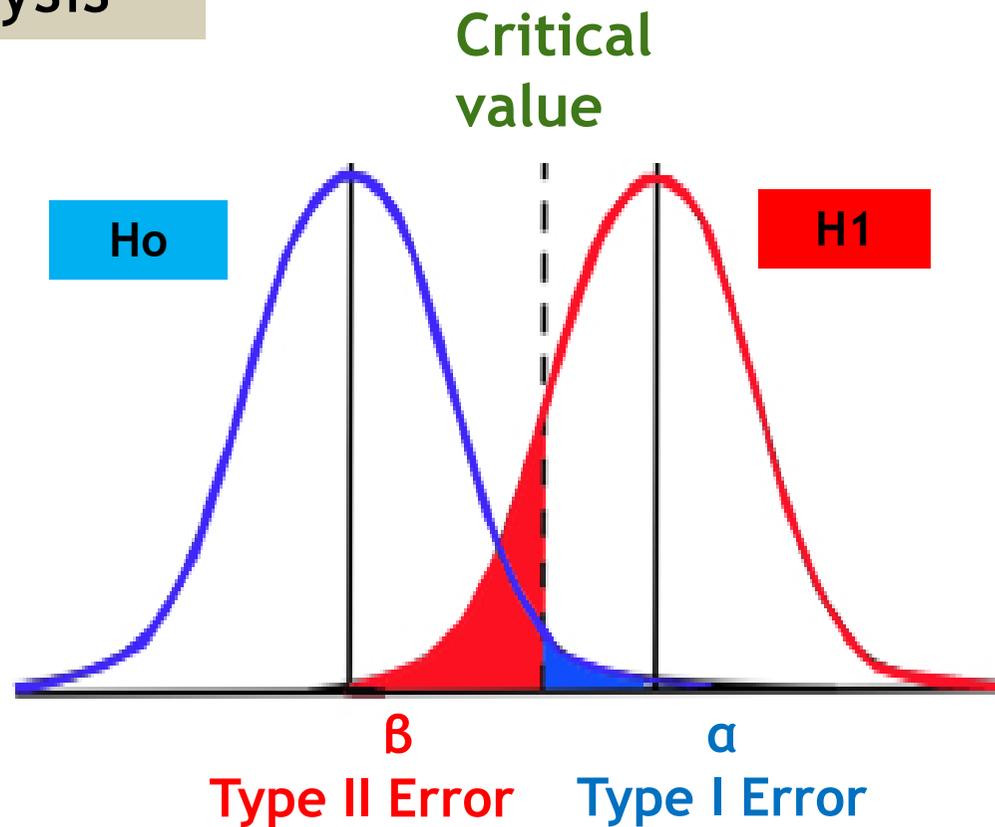
Reducing the probabilities of errors
- ❖ If **α** decreases, then **β** must increase
- ❖ If **β** increased, then power must decrease – since it's 1- **β**.
- ❖ If **α** increased, then power must decrease – since it's 1- **α**.

Ho

H1

ß = 0.20   α = 0.05

ß = 0.12   α = 0.10
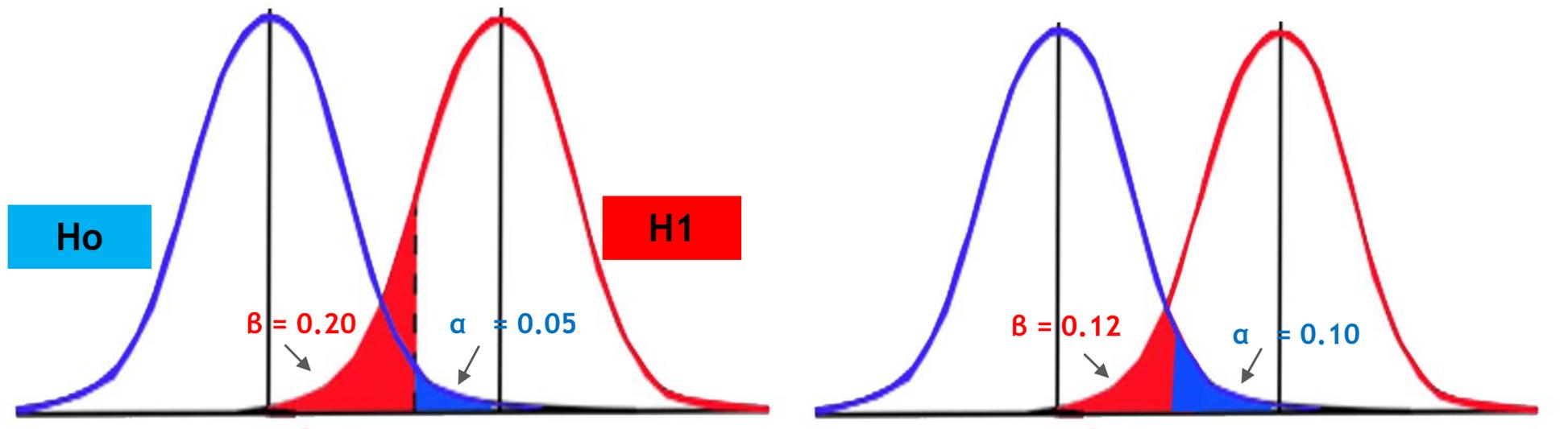
▶ Type I error -α (alpha) known as α error, also called **the level of significance of test**

▶ The probability of Type I Error = α

▶ Eg - A) The power of the test p = 1- α = 1-0.05 = 0.95

▶   B) The power of the test p = 1- α = 1-0.10 = 0.90

▶ Type II error - ß (beta) known as ß error

▶ The probability of Type II Error = ß

▶ Eg - A) The power of the test p = 1- ß = 1-0.20 = 0.80

▶   - B) The power of the test p = 1- ß = 1-0.12 = 0.88

9

Read and Study

▶ Let's see the link http:// www. pdf drive engine and look for the references of statistics books **below as:**

1. **Maurice A. G. 2018.** Inferential Statistics and Probability. A Holistic Approach. De Anza College department of mathematics. 324pp.

2. **Dharmaraja Selvamuthu and Dipayan Das. 2018.** Introduction to Statistical Methods, Design of Experiments and Statistical Quality Control. SBN 978-981-13-1735-4 ISBN 978-981-13-1736-1 (eBook). https://doi.org/10.1007/978-981-13-1736-1.

3. **Kothari, C. R. 2004.** Research methodology, methods and techniques. Published by New Age International (P) Ltd., Publishers. **ISBN (13) : 978-81-224-2488-1.**

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Homework

Instruction
- Read the statistics books showed from the previous slide.
- Take a note.

- Download the file under the topics of Assignment from Google classroom.
- **(File name – Hypothesis testing)**

- Do your assignment and submit it before deadline.
- When you submit your assignment, you have to type **your full name** in your assignment folder.

Part 2

Step 2

Step 3

Step 4

Step 5

See you
next class

12