9.1 Hypothesis Testing

GOALS:

1. Recognize that hypothesis testing uses sample data to make inferences about a population.
2. Understand that Hypothesis Testing provides a reliable way of predicting outcomes by comparing data to known distributions (snc,t-curve), and assigning confidence levels.
3. Learn the basic terminology used in hypothesis testing.
4. Understand that sampling error can cause conclusions to be incorrect. These incorrect conclusions are defined as Type I and Type II Errors.

Study Ch. 9.1, # 1-23

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9.1 Hypothesis Testing

. Energy Use

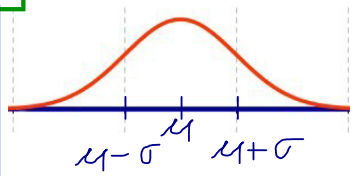
G: BTUs consumed/household/year in US:
$\mu = 92.2$ mill BTU n.d., $\sigma = 15$ mill BTU

n = 20 households in West US (mill BTUs)

104	84	72	95	69
80	78	74	76	81
82	61	94	65	100
70	65	83	76	84

F: Do households in the West US use a different amount of energy?

U.S. popul.



$\mu = 92.2$ mil BTUs
$\sigma = 15$ mil BTUs

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9.1 Hypothesis Testing

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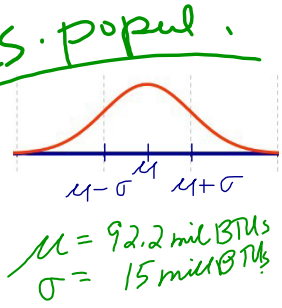
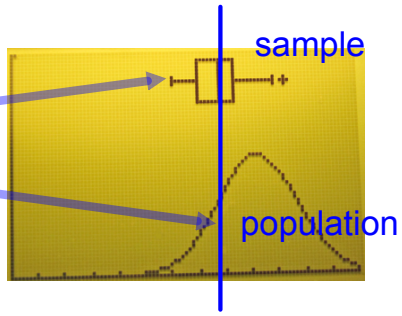


F: Do households in the West US use a different amount of energy?

Investigate: Compare all US to Weston calculator.
1. **all US:** y_1 = normalpdf(X,92.2,15)
2. window: x_{min}=0, x_{max}=130, y_{min}=0, y_{max}=0.07
3. **West:** STAT/EDIT. L1 enter data above
4. STAT PLOT (2nd y=) 1 ON
   Type: row 2, col 1 Box Plot
   Xlist: L1

window: xmin:25, xmax:150, ymin:0, ymax: .04



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9.1 Hypothesis Testing

DEFINITIONS:

Null Hypothesis, H_0: Hypothesis to be tested.

$$H_0: \quad \mu = \mu_0$$ numerical value

Alternative Hypothesis, H_a: Alternative to null hypothesis

$$H_a: \quad \mu \neq \mu_0$$
$$H_a: \quad \mu < \mu_0$$
$$H_a: \quad \mu > \mu_0$$

Hypothesis Test: Should $\mathbf{H_0}$ be rejected in favor of $\mathbf{H_a}$?

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9.1 Hypothesis Testing

For the Energy Problem:

G: BTUs consumed/household/year in US:
μ = 92.2 mill BTU, n.d., σ = 15 mill BTU
n = 20 household in West US (mill BTUs)

104	84	72	95	69
80	78	74	76	81
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F: Do households in the West US use a different amount of energy?

H_0: $\mu = \mu_0$ H_0: $\mu =$ ____

H_a: $\mu \neq \mu_0$ H_a: μ ? ____

H_a: $\mu < \mu_0$

H_a: $\mu > \mu_0$

Logic: If we take a random sample from a population, and:

- data is consistent with H_0, do NOT reject H_0.
- data is NOT consistent with H_0, REJECT H_0

So, we need to decide just what is meant by: "consistent with H_0"

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9.1 Hypothesis Testing

Test Statistic: z or t generated by the sample data

Rejection Region: in tail(s) where probability of occurrence would be low, if H_o is true

Critical Value: boundary of rejection region (z or t value)

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9.1 Hypothesis Testing

Types of Errors

	H_0 True	Error
Action	accept	No Error
	reject	**Type I**

	H_0 False	Error
Action	accept	**Type II**
	reject	No Error

9.1 Hypothesis Testing

Errors	Smaller α | Larger α
Type I: reject a true H_0	lower | higher
Type II: not reject a false H_0	higher | lower

9.1 Hypothesis Testing

Type I: reject a true H_0

Type II: not reject a false H_0

G: steel plant workers exposed to stress.
normal resting heart rate is 72 bpm
A hypothesis test is to be performed to determine if the post work heart rate of workers exceeds normal resting rate. A sample of 29 workers was obtained.

What would constitute a Type I error?
a Type II error?
a correct decision?

H_O : _____

Type I error? reject _____ when _____

Type II error? accept _____ when _____

Type I: reject a true H_0 : Decide that heart rates > 72bpm even though the rates = 72

Type II: not reject a false H_0 : Decide that the heart rates = 72 even though the rates actually > 72

9.1 Hypothesis Testing

G: steel plant workers exposed to stress.
normal resting heart rate is 72 bpm
A hypothesis test is to be performed to determine if the post work heart rate of workers exceeds normal resting rate. A sample of 29 workers was obtained.

$H_0: \mu = 72$
$H_a: \mu > 72$

What would constitute a Type I error?
a Type II error?
a correct decision?

Type I: reject a true H_0

Type II: not reject a false H_0

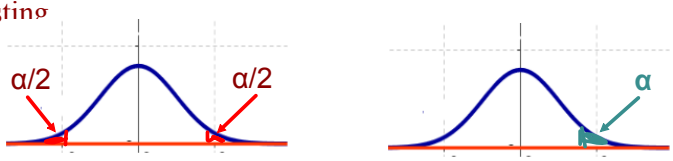
Action	H_0 True	Error
	accept	No Error
	reject	Type I

Action	H_0 False	Error
	accept	Type II
	reject	No Error

Type I: reject a true H_0 : Decide that heart rates > 72bpm even though the rates = 72

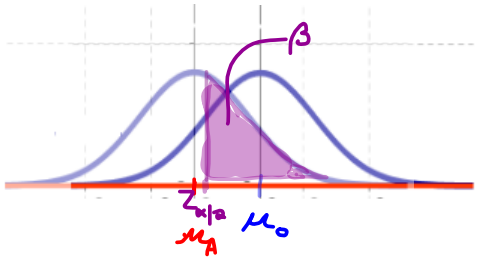
Type II: not reject a false H_0 : Decide that the heart rates = 72 even though the rates actually > 72

9.1 Hypothesis Testing



Significance Level, α: The Probability of making a Type I Error (rejecting a true H_O)

Probability, β: The Probability of making a Type II Error (not rejecting a false H_O)



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