

What's in the  
Bag?

Robb T.  
Koether

Homework  
Review

Bag A and  
Bag B

Possible  
Decision  
Rules

Decision Rule #1  
Decision Rule #2  
Decision Rule #3

Assignment

# What's in the Bag?

## Lecture 4 Sections 1.4.1-1.4.2

Robb T. Koether

Hampden-Sydney College

Tue, Sep 2, 2008

# Outline

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Homework Review

Bag A and Bag B

Possible Decision Rules

Decision Rule #1

Decision Rule #2

Decision Rule #3

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- 1 Homework Review
- 2 Bag A and Bag B
- 3 Possible Decision Rules
  - Decision Rule #1
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- 4 Assignment

# Homework Review

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## Exercise 1.8, p. 68.

An international corporation plans to institute a drug-testing plan for its employees. An employee is assumed not to be a drug user, so the null hypothesis is “not a drug user,” and the alternative hypothesis is “drug user.” The test classifies a person as a drug user 4% of the time when the person is really not a drug user.

- (a) Explain what a Type I error and a Type II error are in this situation.
- (b) What is the chance of a Type I error in this situation?

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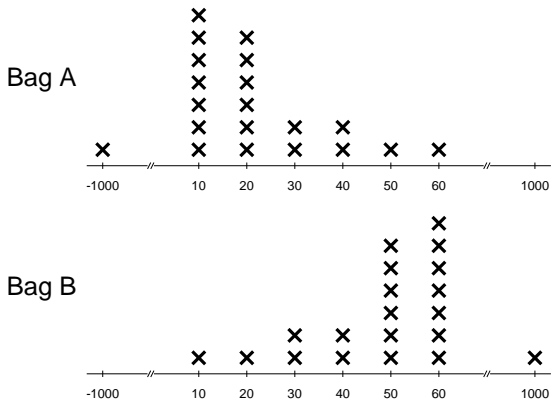
Assignment

## Solution

- (a)
- A Type I error is to conclude that the person is a drug user when he is not.
  - A Type II error is to conclude that the person is not a drug user when he is.
- (b) The chance of a Type I error (false positive) is 4%.

# Two Bags

- Two bags contain vouchers with various dollar values.



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# The Hypotheses

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Assignment

- We are shown one of the bags.
- The hypotheses are:
  - $H_0$ : The bag shown is Bag A.
  - $H_1$ : The bag shown is Bag B.
- We will choose one voucher at random from the shown bag and read its value.
- From that information, we will decide which bag we believe we are holding.
- Then we will choose which of the two bags to keep (hopefully Bag B!).

# Decisions and Their Consequences

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	It is Bag A	It is Bag B
We decide it is Bag A	Win \$1890	Lose \$560
We decide it is Bag B	Lose \$560	Win \$1890

# A Decision Rule

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Assignment

## Decision Rule #1

Reject  $H_0$  if the voucher is worth either \$60 or \$1000, i.e.,  $\geq \$60$ .

- What is  $\alpha$ ?
- What is  $\beta$ ?

# Rejection and Acceptance Regions

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## Definition (Rejection Region)

The **rejection region** is the set of possible observed values that will lead to rejection of the null hypothesis.

## Definition (Acceptance Region)

The **acceptance region** is the set of possible observed values that will lead to acceptance of the null hypothesis.

## Definition (Critical Value(s))

The **critical value(s)** is the value that separates the the two regions. The critical value itself will be included in the rejection region.

# Decision Rule #1

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Review

Bag A and  
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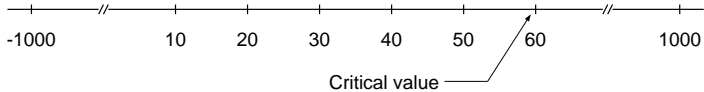
Possible  
Decision  
Rules

Decision Rule #1

Decision Rule #2

Decision Rule #3

Assignment



# Decision Rule #1

What's in the Bag?

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Homework Review

Bag A and Bag B

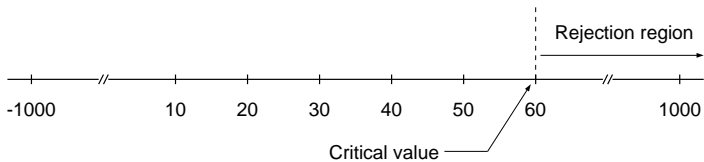
Possible Decision Rules

Decision Rule #1

Decision Rule #2

Decision Rule #3

Assignment



# Decision Rule #1

What's in the Bag?

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Homework Review

Bag A and Bag B

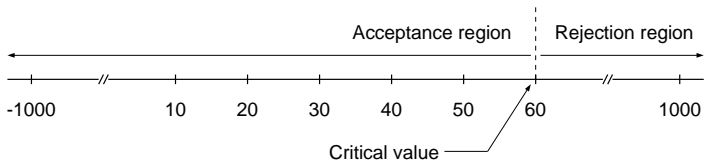
Possible Decision Rules

Decision Rule #1

Decision Rule #2

Decision Rule #3

Assignment



# Compute $\alpha$

What's in the Bag?

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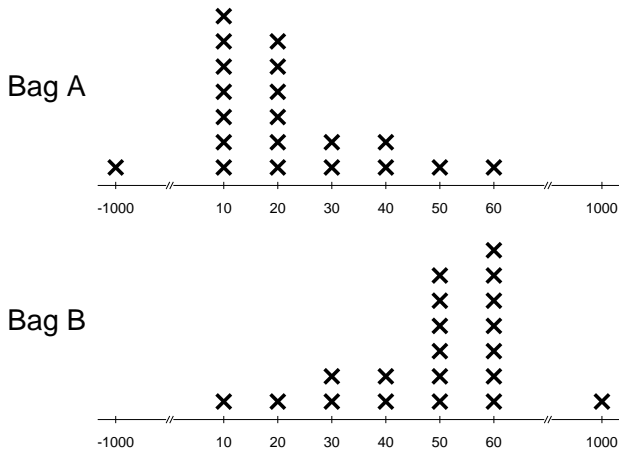
Homework Review

Bag A and Bag B

Possible Decision Rules

Decision Rule #1  
Decision Rule #2  
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Assignment



# Compute $\alpha$

What's in the Bag?

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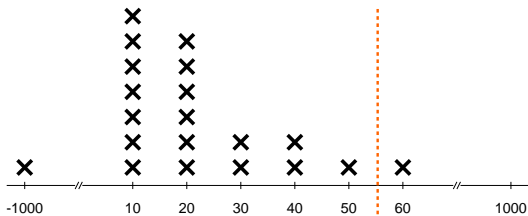
Bag A and Bag B

Possible Decision Rules

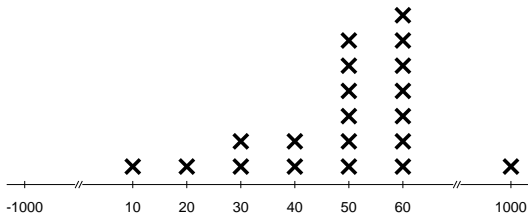
Decision Rule #1  
Decision Rule #2  
Decision Rule #3

Assignment

Bag A



Bag B



# Compute $\alpha$

What's in the Bag?

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Homework Review

Bag A and Bag B

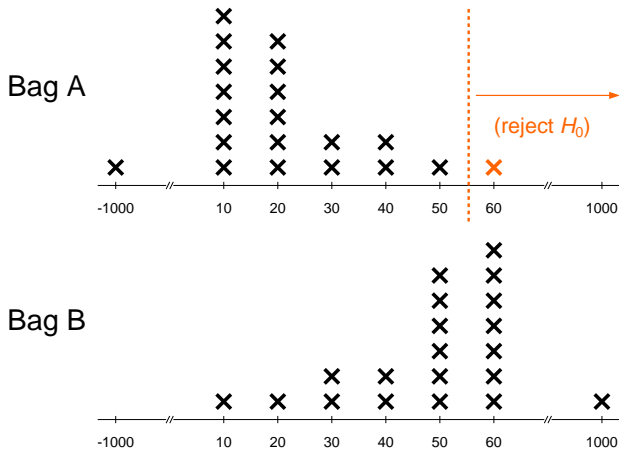
Possible Decision Rules

Decision Rule #1

Decision Rule #2

Decision Rule #3

Assignment



# Compute $\alpha$

What's in the Bag?

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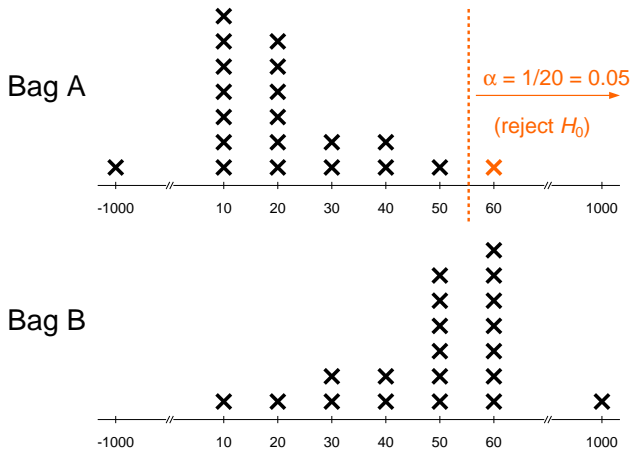
Homework Review

Bag A and Bag B

Possible Decision Rules

Decision Rule #1  
Decision Rule #2  
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Assignment



# Compute $\beta$

What's in the Bag?

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Bag A and Bag B

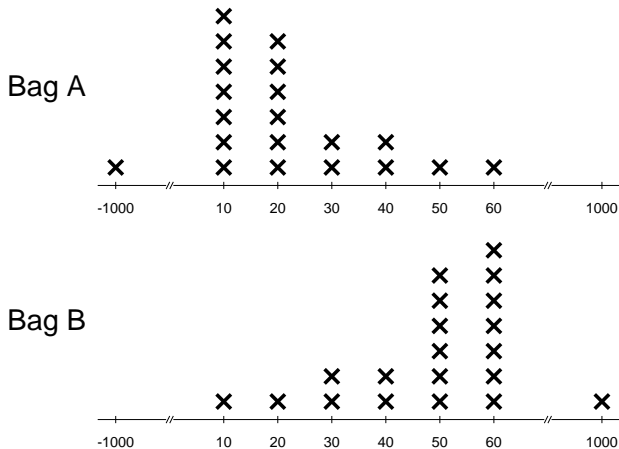
Possible Decision Rules

Decision Rule #1

Decision Rule #2

Decision Rule #3

Assignment



# Compute $\beta$

What's in the Bag?

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Homework Review

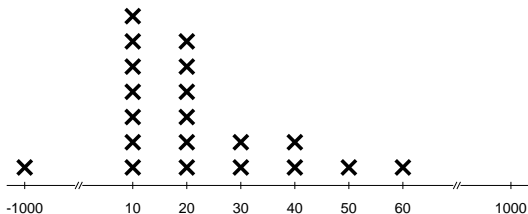
Bag A and Bag B

Possible Decision Rules

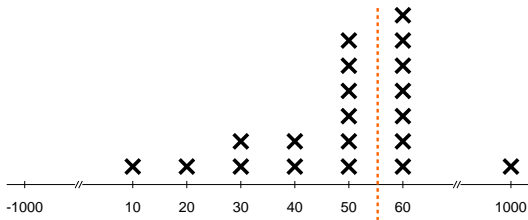
Decision Rule #1  
Decision Rule #2  
Decision Rule #3

Assignment

Bag A



Bag B



# Compute $\beta$

What's in the Bag?

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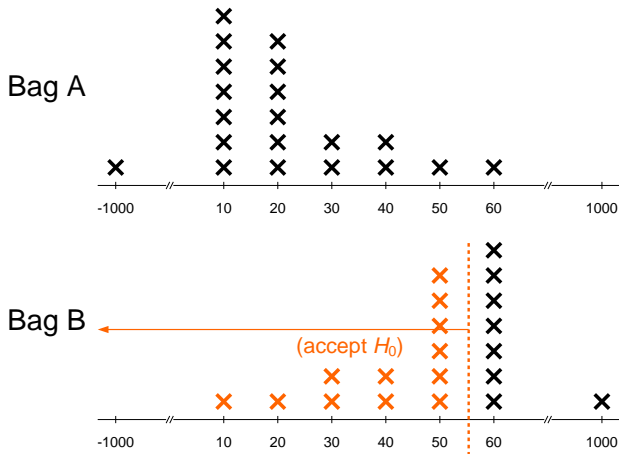
Homework Review

Bag A and Bag B

Possible Decision Rules

Decision Rule #1  
Decision Rule #2  
Decision Rule #3

Assignment



# Compute $\beta$

What's in the Bag?

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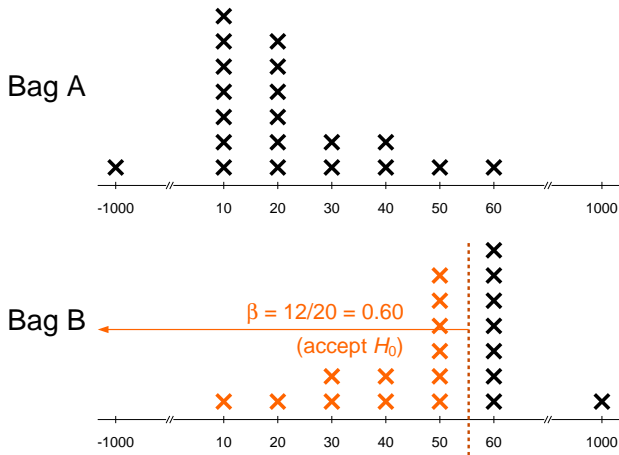
Homework Review

Bag A and Bag B

Possible Decision Rules

Decision Rule #1  
Decision Rule #2  
Decision Rule #3

Assignment



# Extreme Values

What's in the Bag?

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Homework Review

Bag A and Bag B

Possible Decision Rules

Decision Rule #1  
Decision Rule #2  
Decision Rule #3

Assignment

- Normally, either
  - The larger the observed value, the more likely we are to reject  $H_0$ , or
  - The smaller the observed value, the more likely we are to reject  $H_0$ .

## Definition (Direction of Extreme)

The **direction of extreme** is the direction, left or right or both, in which we are more likely to reject  $H_0$ .

# Extreme Values

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Assignment

## Definition (Most Extreme Value)

The **most extreme value** is the value furthest in the direction of extreme.

## Definition (Next-most Extreme Value, etc.)

The **next-most extreme value** is the value next-furthest in the direction of extreme, etc.

# Another Decision Rule

What's in the Bag?

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Decision Rule #1  
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Assignment

## Decision Rule #2

Reject  $H_0$  if the voucher is worth  $\geq \$50$ .

- What is  $\alpha$ ?
- What is  $\beta$ ?

# Compute $\alpha$ and $\beta$

What's in the Bag?

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Homework Review

Bag A and Bag B

Possible Decision Rules

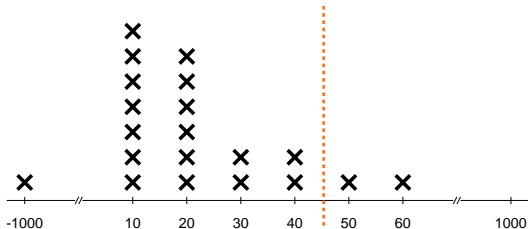
Decision Rule #1

Decision Rule #2

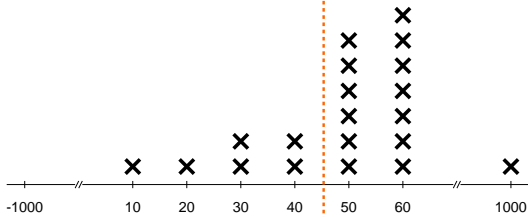
Decision Rule #3

Assignment

Bag A



Bag B



# Yet Another Decision Rule

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Decision Rule #1  
Decision Rule #2  
Decision Rule #3

Assignment

## Decision Rule #3

Reject  $H_0$  if the voucher is worth  $\geq \$40$ .

- What is  $\alpha$ ?
- What is  $\beta$ ?

# Compute $\alpha$ and $\beta$

What's in the Bag?

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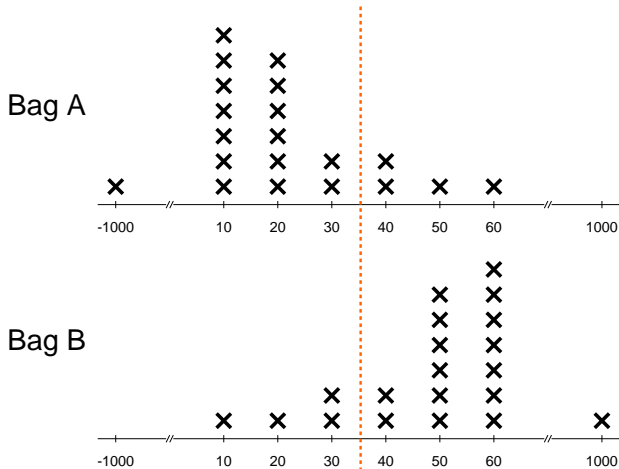
Homework Review

Bag A and Bag B

Possible Decision Rules

Decision Rule #1  
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# $\alpha$ VS. $\beta$

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Assignment

- If we modify the decision rule to decrease  $\alpha$ , we will increase  $\beta$ , and
- If we modify the decision rule to decrease  $\beta$ , we will increase  $\alpha$ .
- Is it possible to decrease both  $\alpha$  and  $\beta$  at the same time?

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Assignment

## Homework

- Read Section 1.4 - 1.4.2, pages 16 - 28.
- Let's Do It! 1.7, 1.8.
- Page 67, exercises 13 - 15, 17 - 23, 25.