What's in the Bag?

Lecture 4
Sections 1.4.1-1.4.2

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Outline

Review Quiz

Example (Review Quiz)

1. The results of a study were found not to be statistically significant. We may conclude that
   (a) The null hypothesis was accepted.
   (b) The null hypothesis was not accepted.
   (c) The alternative hypothesis was accepted.
   (d) We cannot tell which was accepted.

Review Quiz

Example (Review Quiz)

2. The results of a study were found not to be statistically significant. We may conclude that
   (a) A Type I error could have been made.
   (b) A Type II error could have been made.
   (c) Either type of error could have been made.
   (d) Neither type of error could have been made.

Review Quiz Answers

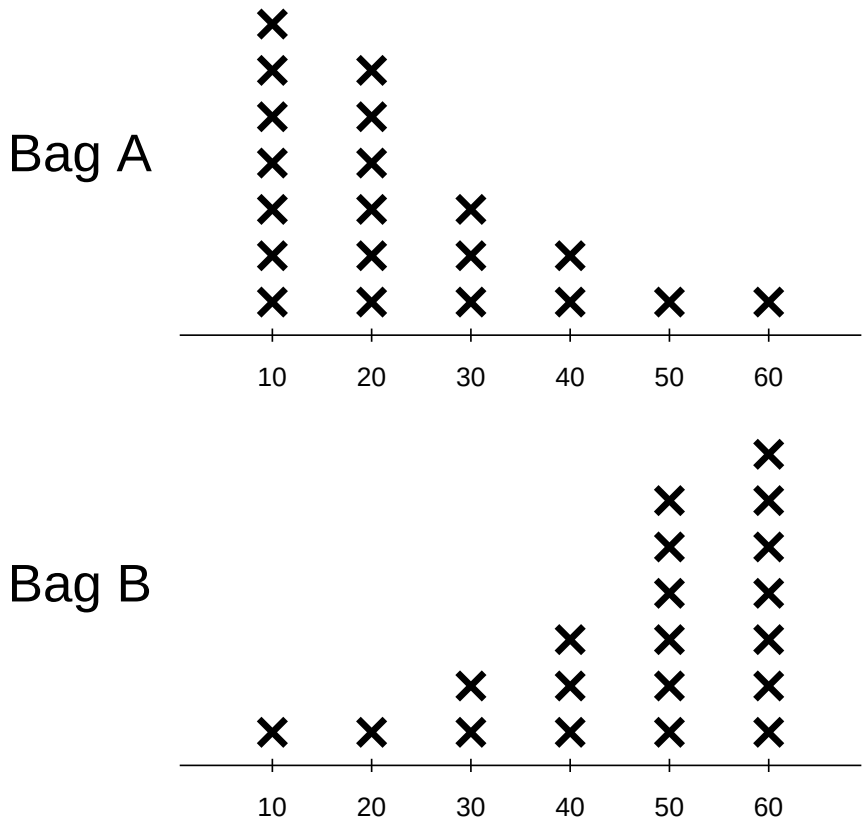
Example (Review Quiz Answers)

1. (a) The null hypothesis was accepted.
2. (b) A Type II error could have been made.

Outline

Two Bags

- Two bags contain vouchers worth various dollar amounts.



Two Bags

- The vouchers in Bag A are worth $470.
- The vouchers in Bag B are worth $930.
- You get to cash in the vouchers in whichever bag you want.
- Which bag should you choose?

Two Bags

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- The vouchers in Bag B are worth $930.
- You get to cash in the vouchers in whichever bag you want.
- Which bag should you choose?
- Oh, one more thing...

Two Bags

- The vouchers in Bag A are worth $470.
- The vouchers in Bag B are worth $930.
- You get to cash in the vouchers in whichever bag you want.
- Which bag should you choose?
- Oh, one more thing...
- You are handed one of the bags, but you do not know which bag is it.

Two Bags

- The vouchers in Bag A are worth $470.
- The vouchers in Bag B are worth $930.
- You get to cash in the vouchers in whichever bag you want.
- Which bag should you choose?
- Oh, one more thing...
- You are handed one of the bags, but you do not know which bag is it.
- You may look at one voucher in that bag.

Two Bags

- The vouchers in Bag A are worth $470.
- The vouchers in Bag B are worth $930.
- You get to cash in the vouchers in whichever bag you want.
- Which bag should you choose?
- Oh, one more thing...
- You are handed one of the bags, but you do not know which bag is it.
- You may look at one voucher in that bag.
- Based on that alone, you must choose which bag to cash in.

The Hypotheses

- The hypotheses are:
  - H_0: You are holding Bag A.
  - H_1: You are holding Bag B.
- You will choose one voucher at random from the bag and read its value.
- From that information, you will decide which bag you believe you are holding.
- Then you will choose the one that you believe is Bag B, take the money and run.

Decisions and Their Consequences

Our Decision	The State of Nature: It is Bag A	The State of Nature: It is Bag B
It is Bag A (switch bags)	Win $930	Win $470
It is Bag B (keep the bag)	Win $470	Win $930

Outline

Decision Rules

- There are several possible decision rules, some better than others.
- We will look at three of them.

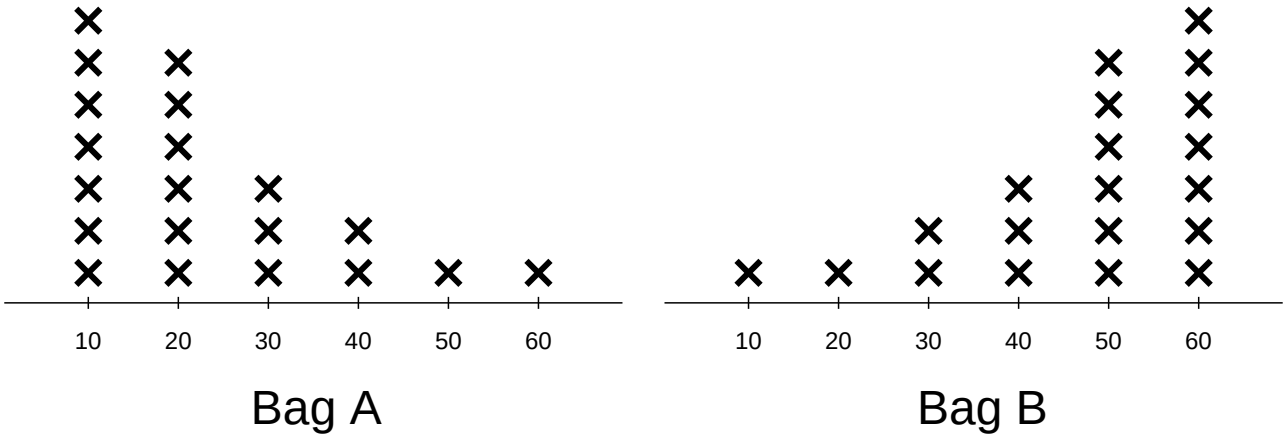
Outline

A Decision Rule

Decision Rule #1

Reject H_0 if the voucher is worth \$60.

- What is α?
- What is β?



Rejection and Acceptance Regions

Definition (Rejection Region)

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

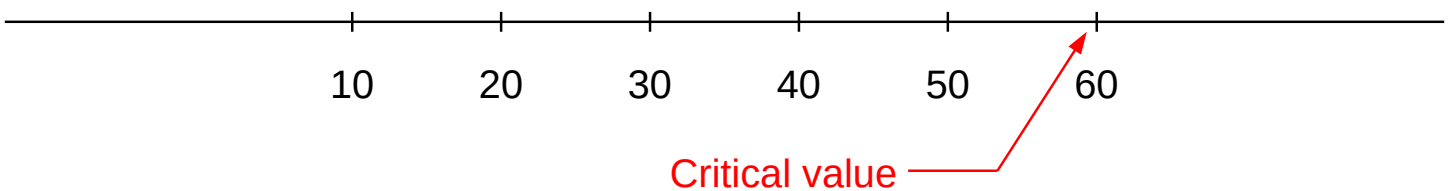
Definition (Acceptance Region)

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

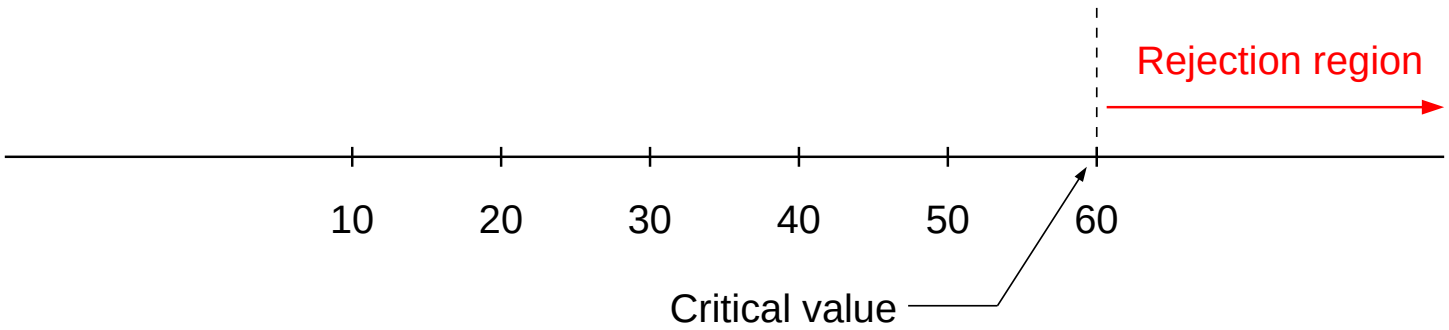
Definition (Critical Value(s))

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

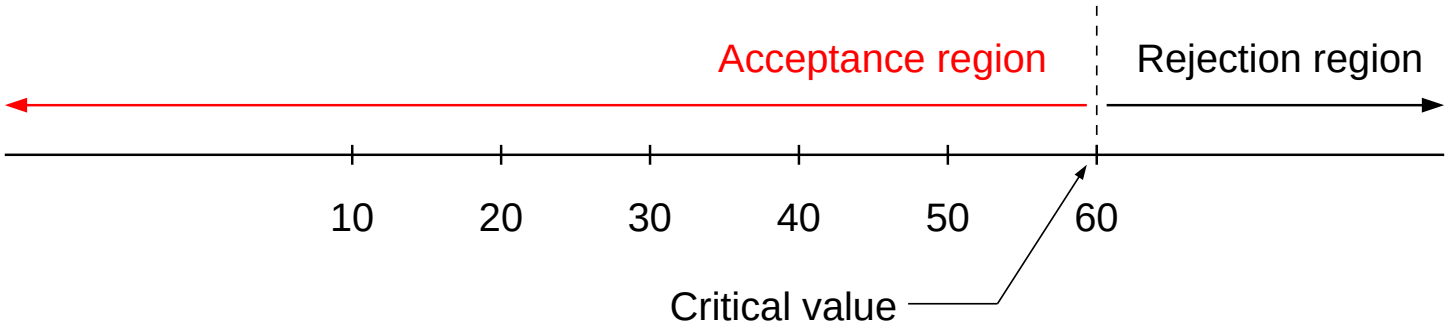
Decision Rule #1



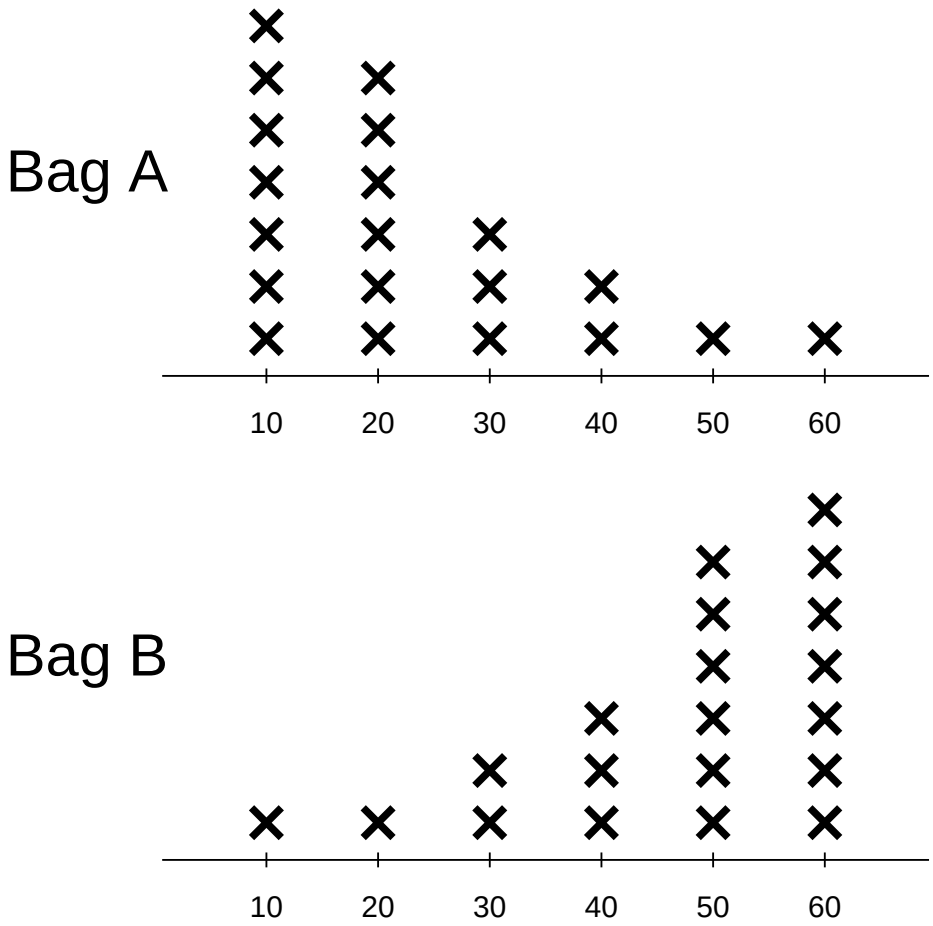
Decision Rule #1



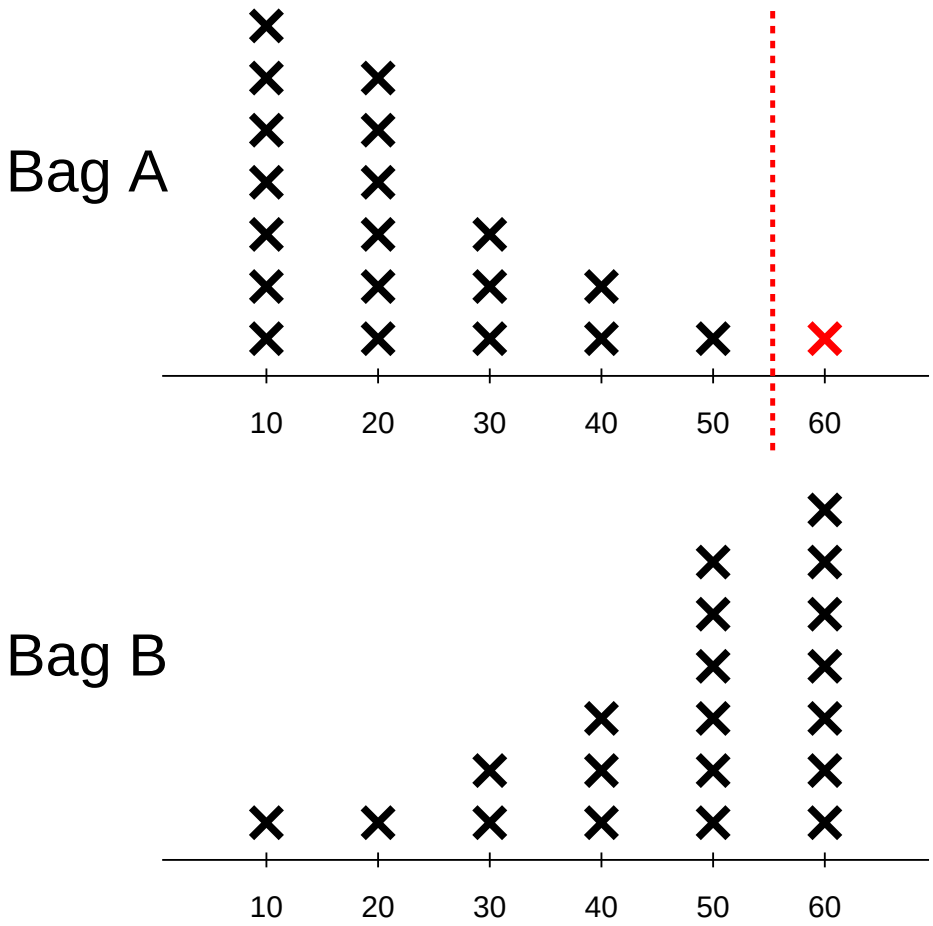
Decision Rule #1



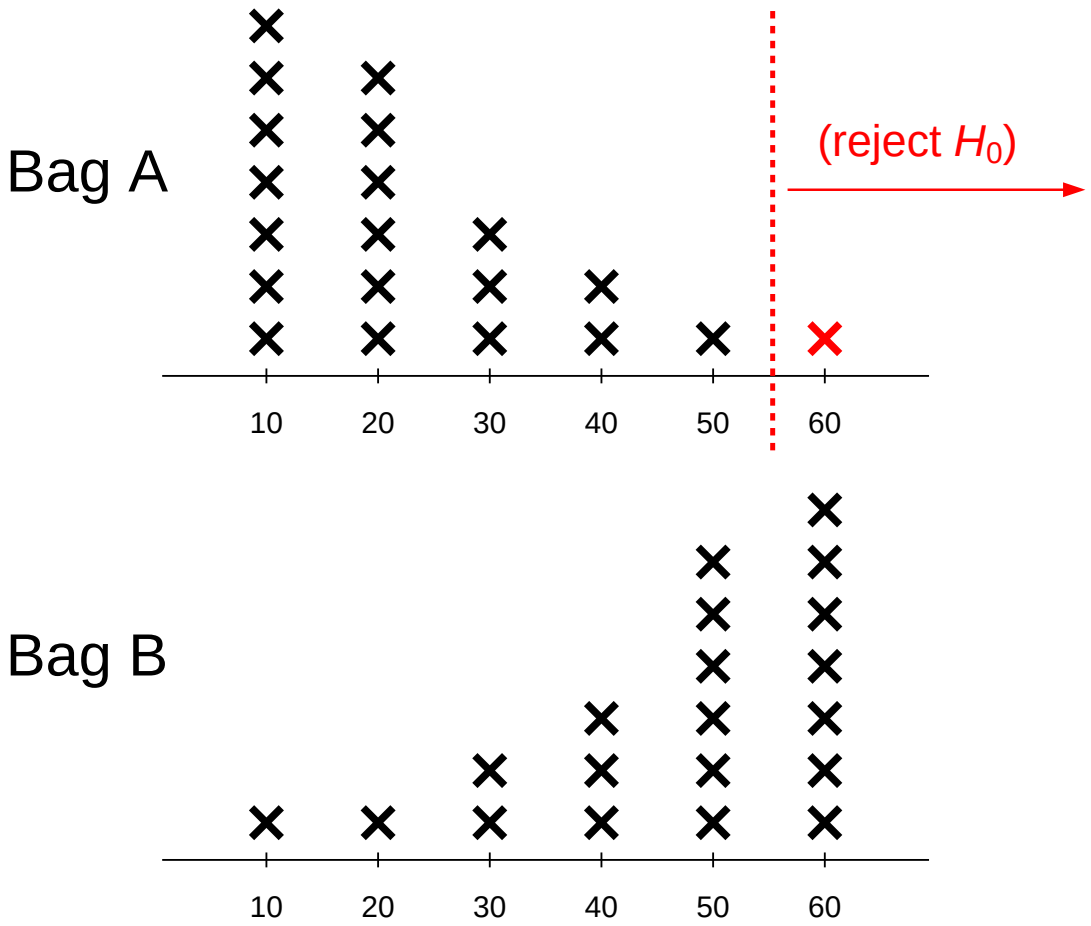
Compute α



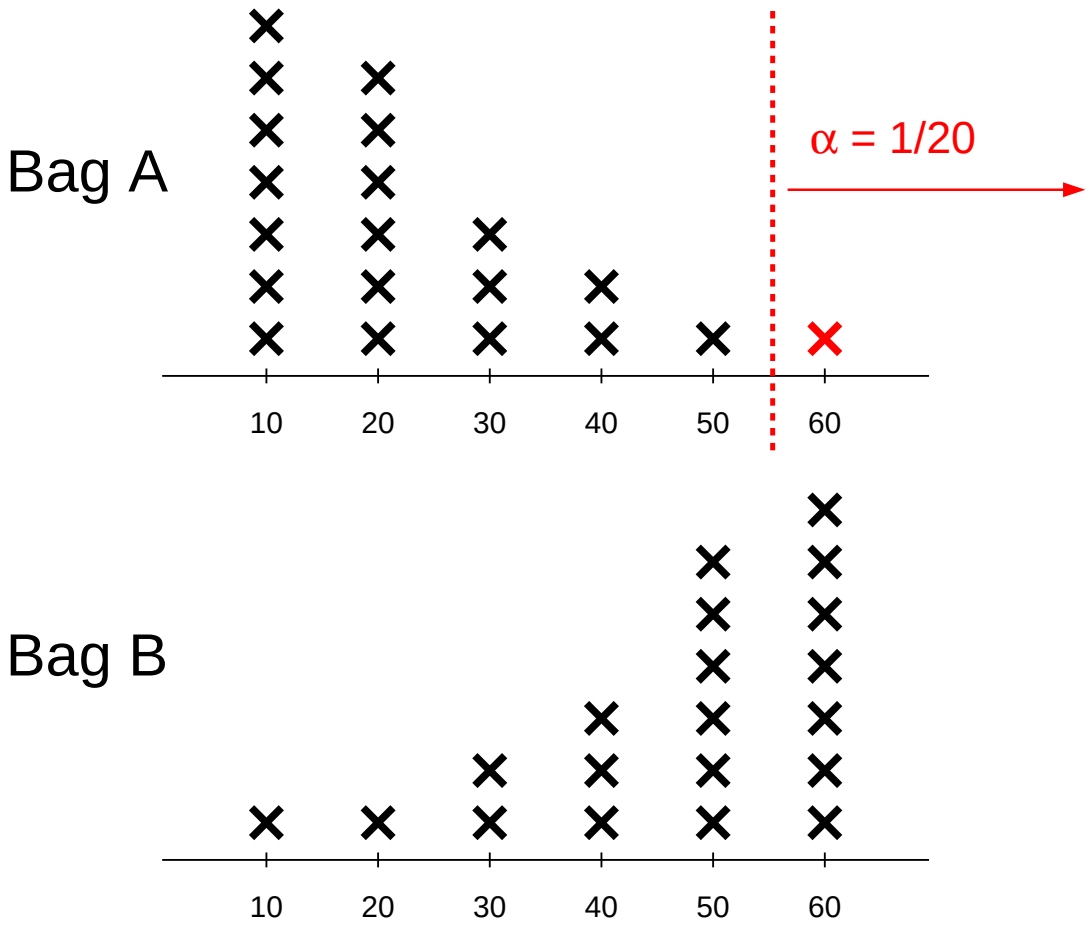
Compute α



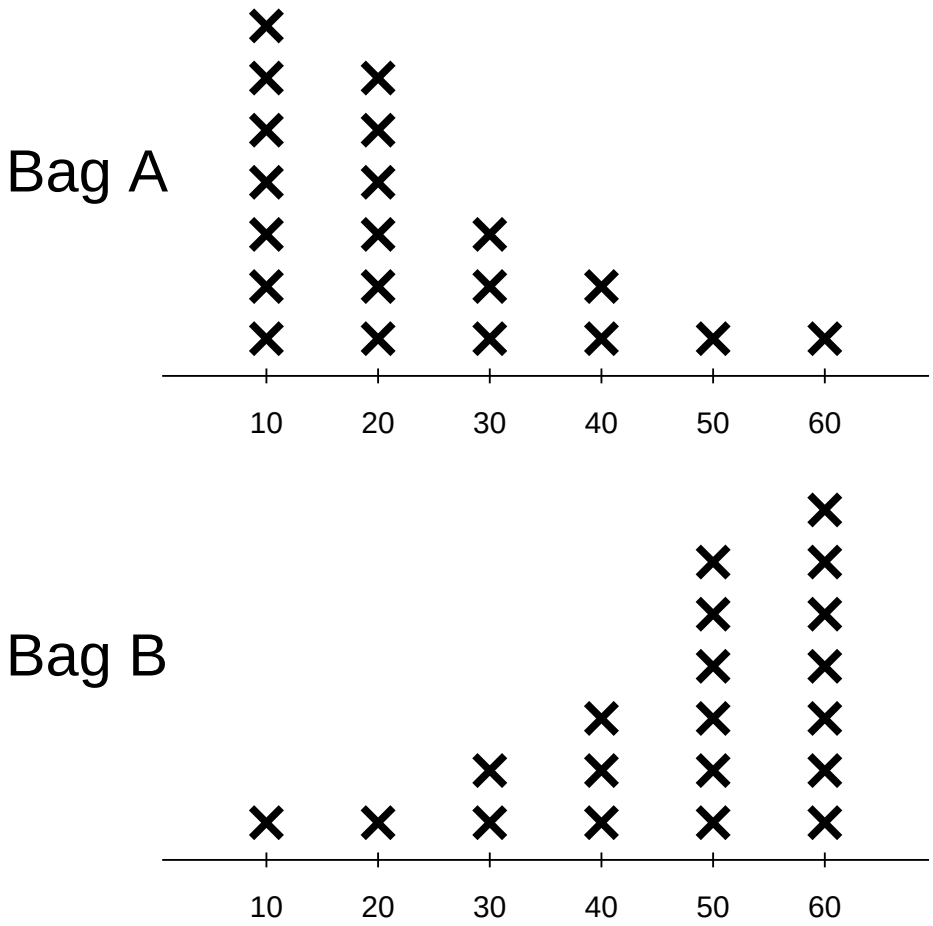
Compute α



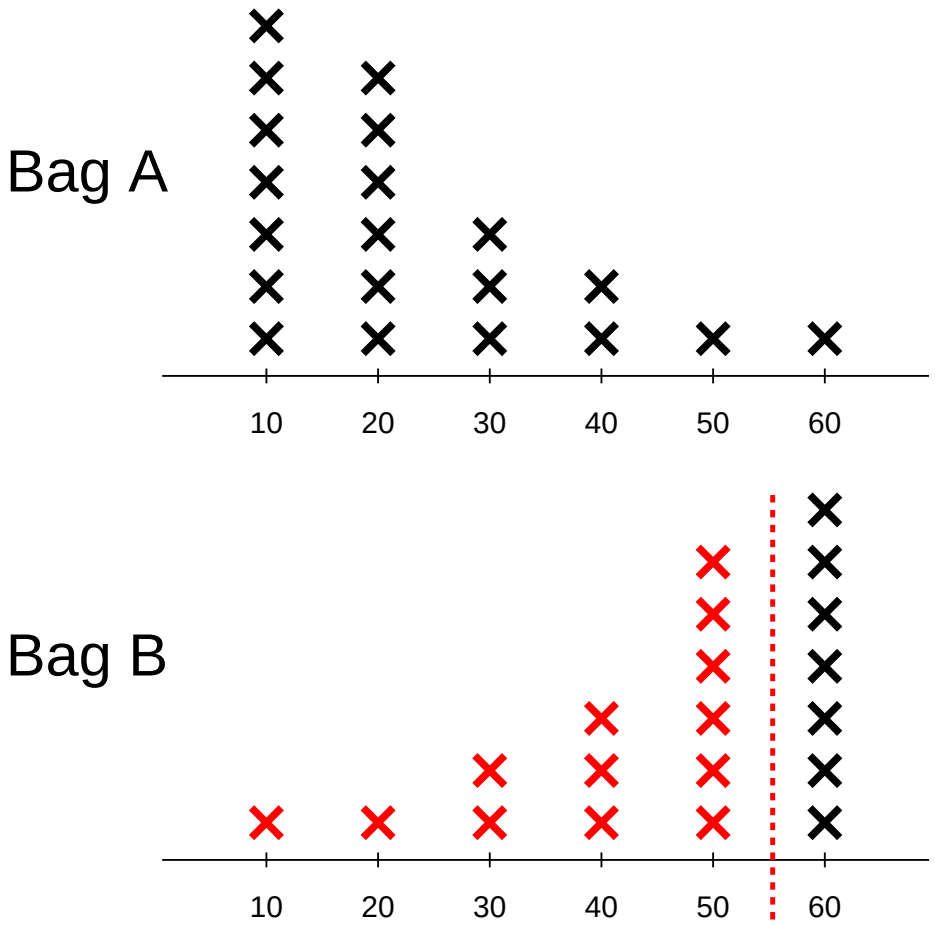
Compute α



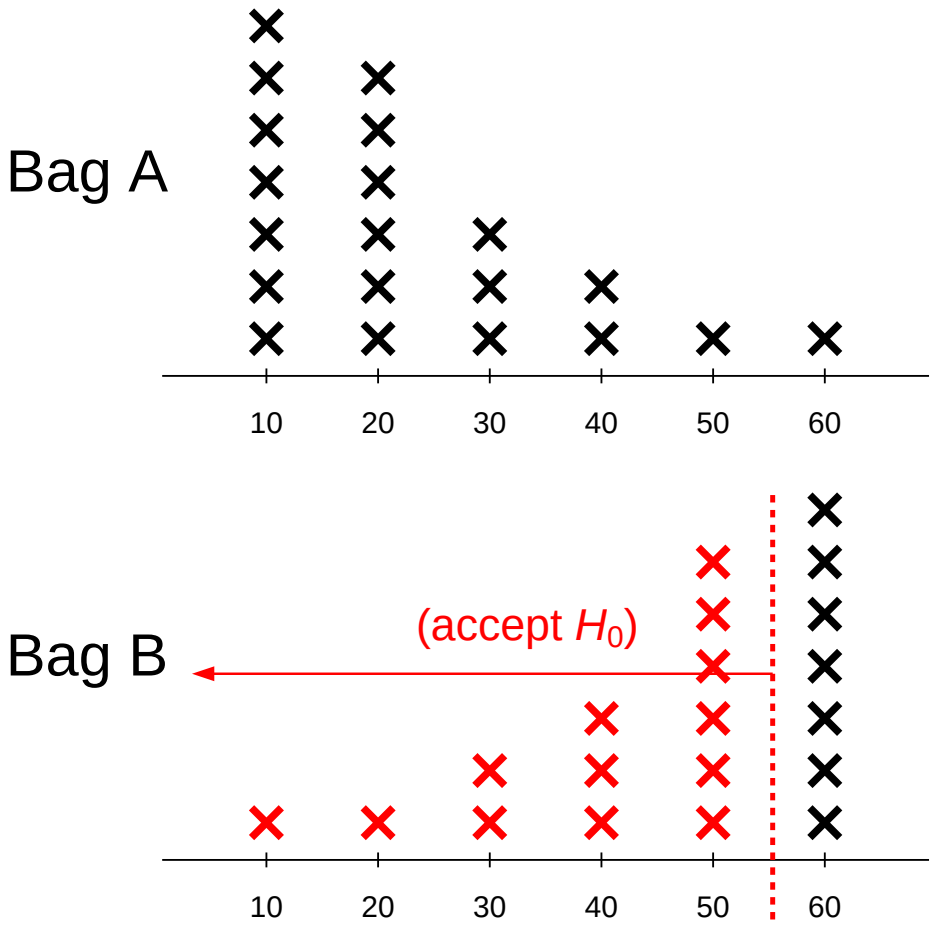
Compute β



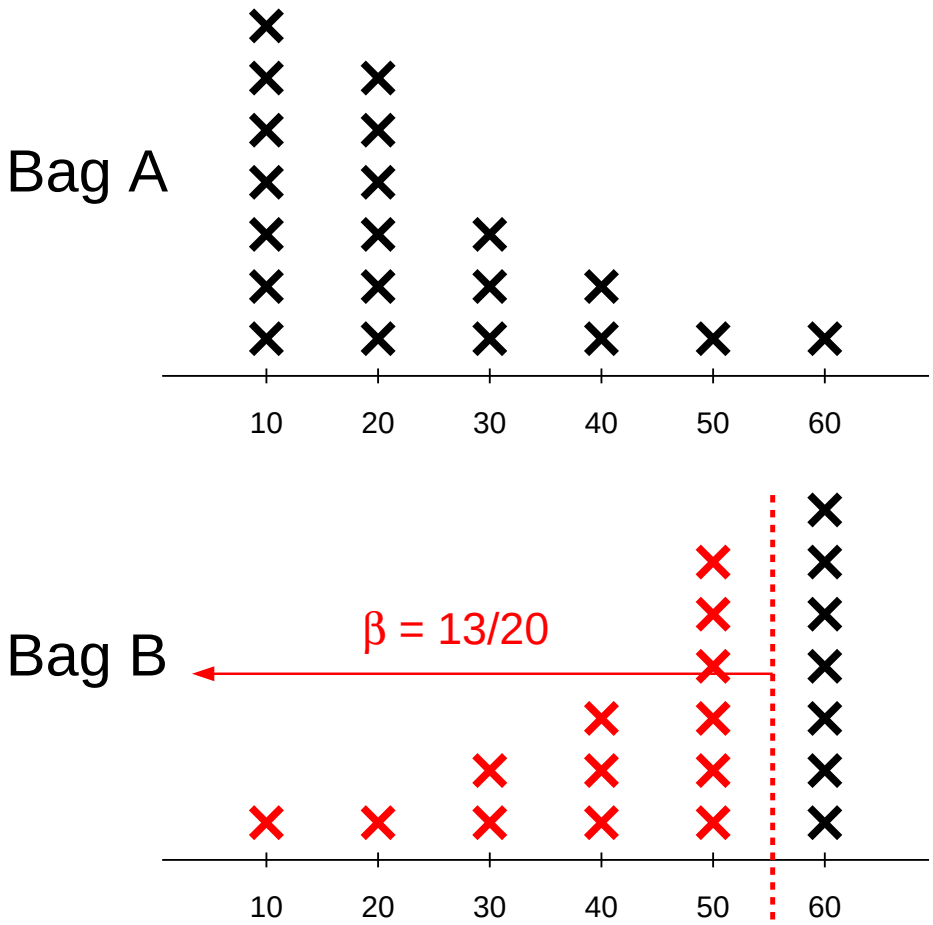
Compute β



Compute β



Compute β



Extreme Values

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.

- 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.

Outline

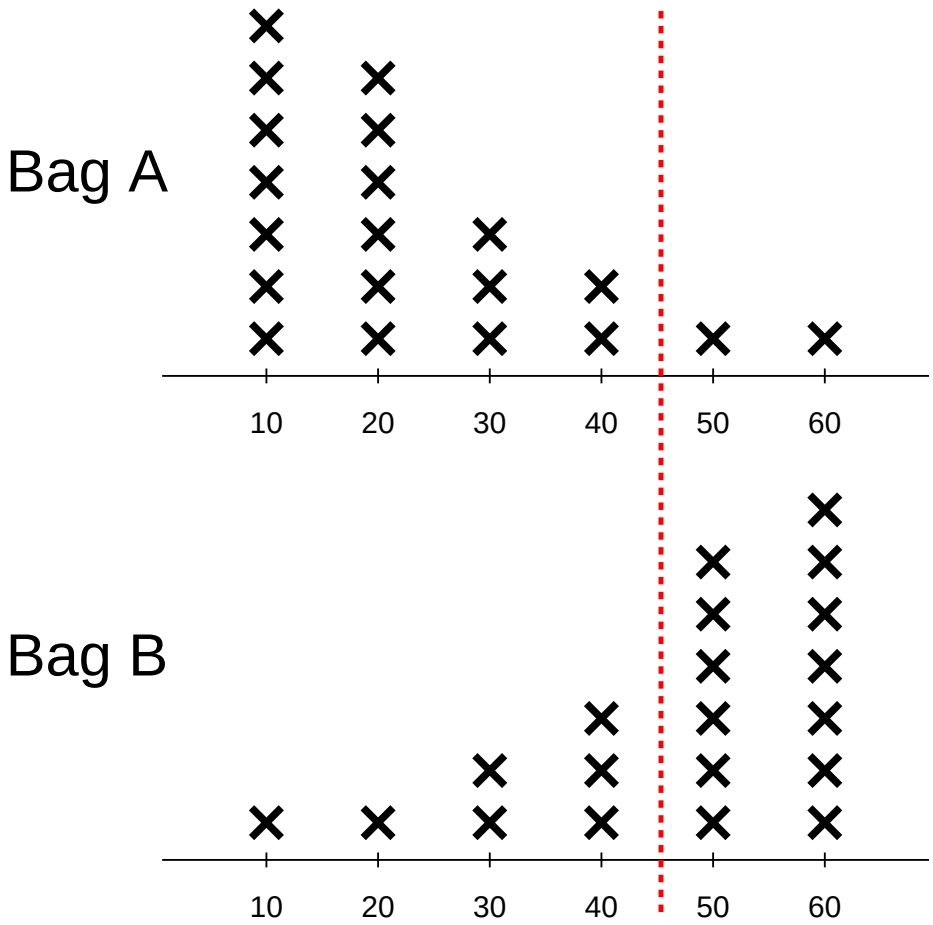
Another Decision Rule

Decision Rule #2

Reject H_0 if the voucher is worth at least \$50.

- What is α?
- What is β?

Compute α and β



Outline

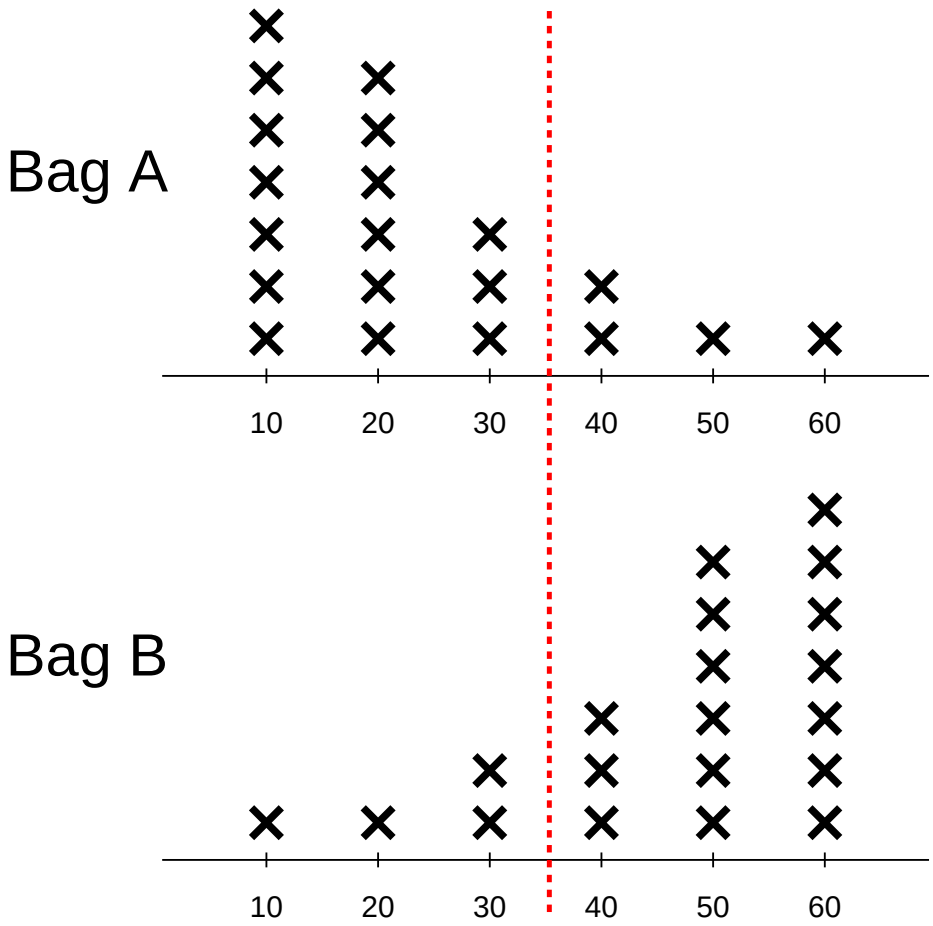
Yet Another Decision Rule

Decision Rule #3

Reject H_0 if the voucher is worth at least \$40.

- What is α?
- What is β?

Compute α and β

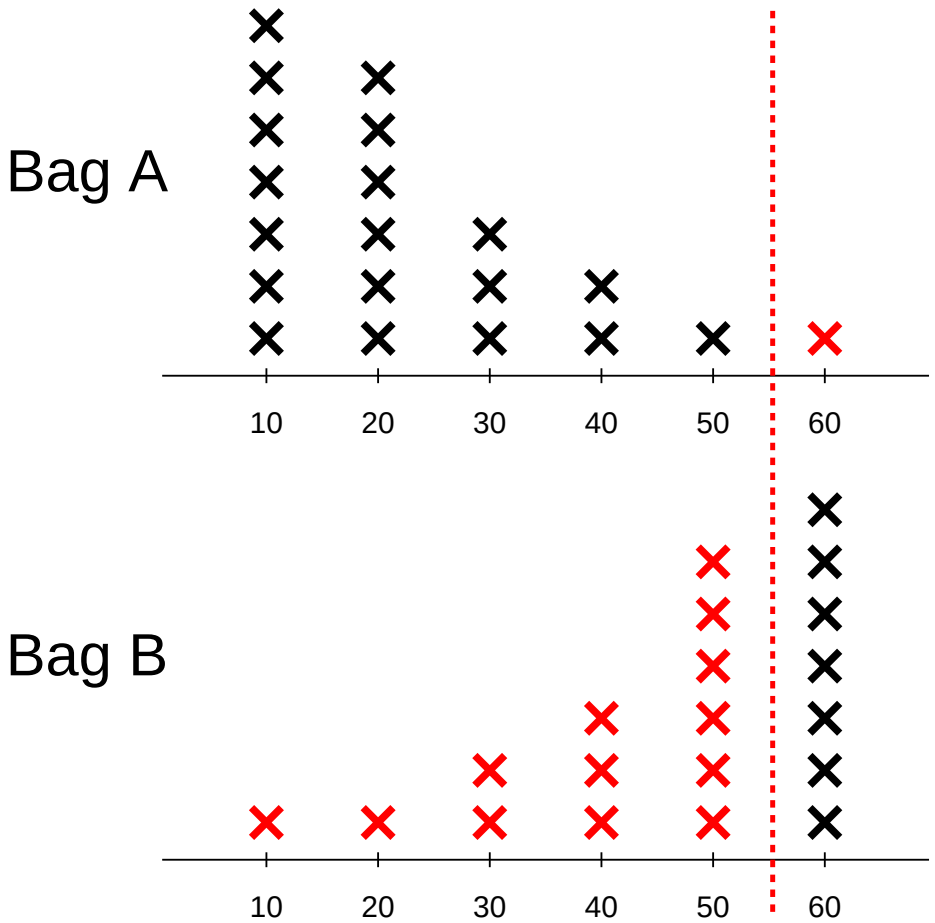


Outline

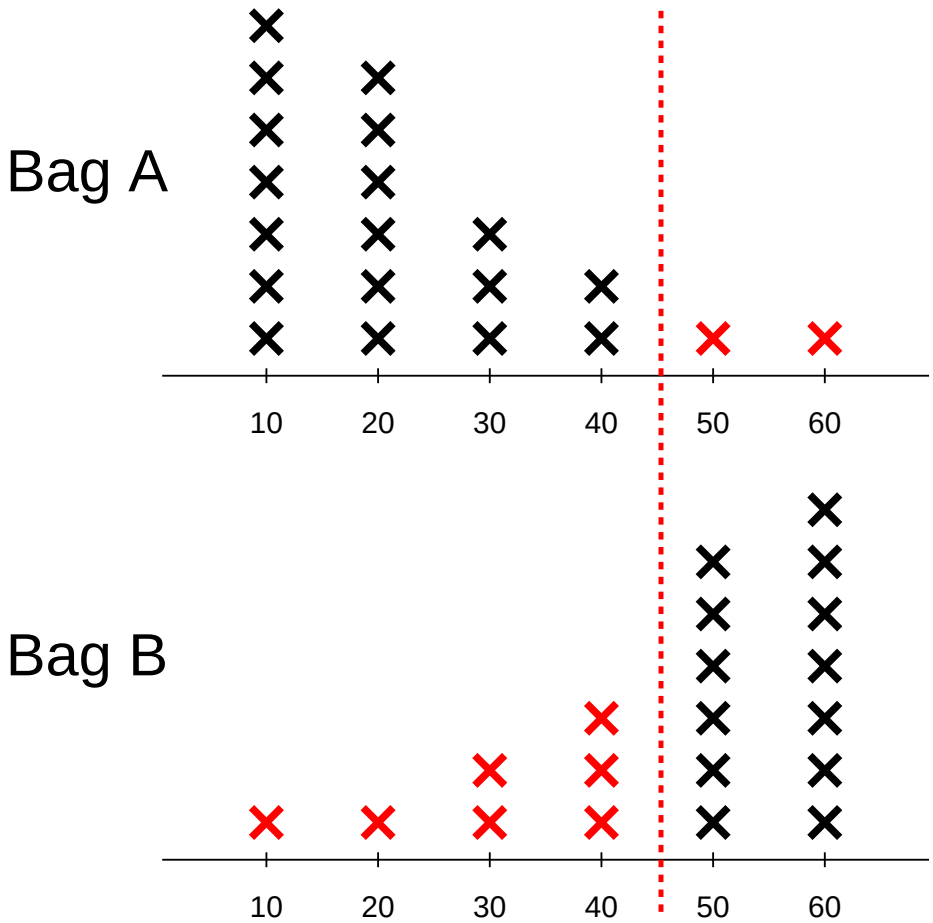
α vs. β

- If we modify the decision rule to decrease α, we will increase β, and
- If we modify the decision rule to decrease β, we will increase α.

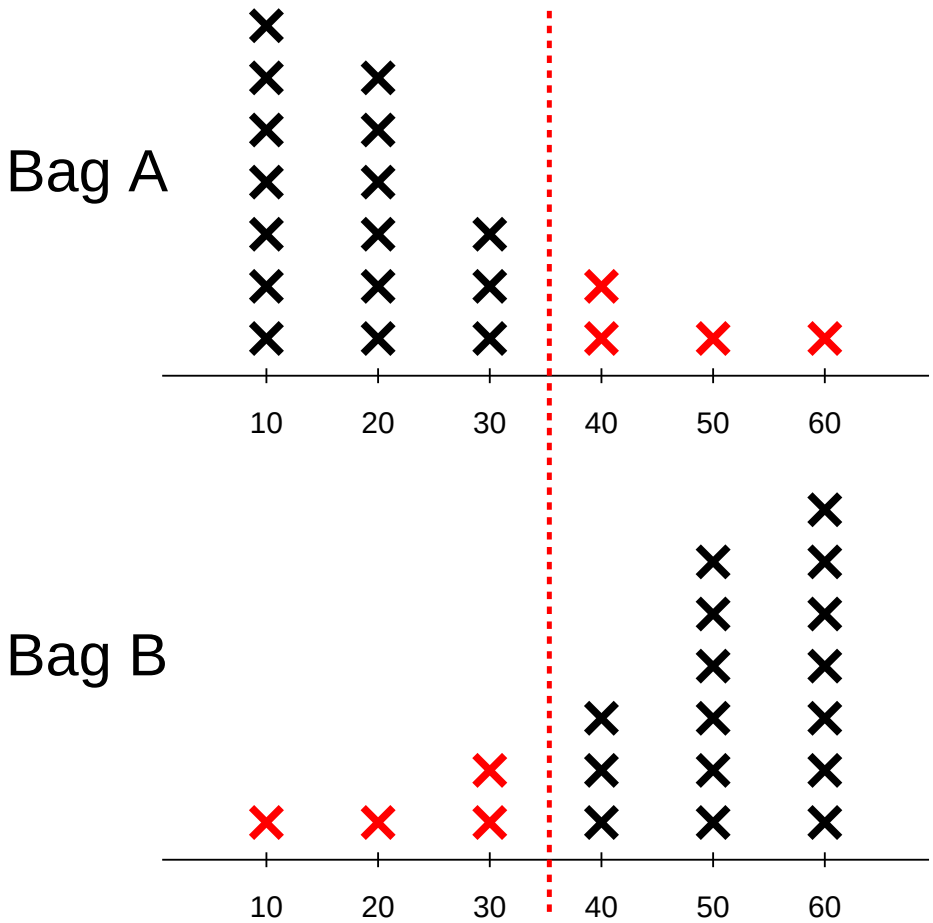
α vs. β



α vs. β



α vs. β



Outline

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.