Bag A or Bag B?

Brenda Gunderson

Bag A or Bag B?

BAG A

Face Value	Frequency
- 1,000	1
10	7
20	6
30	2
40	2
50	1
60	1

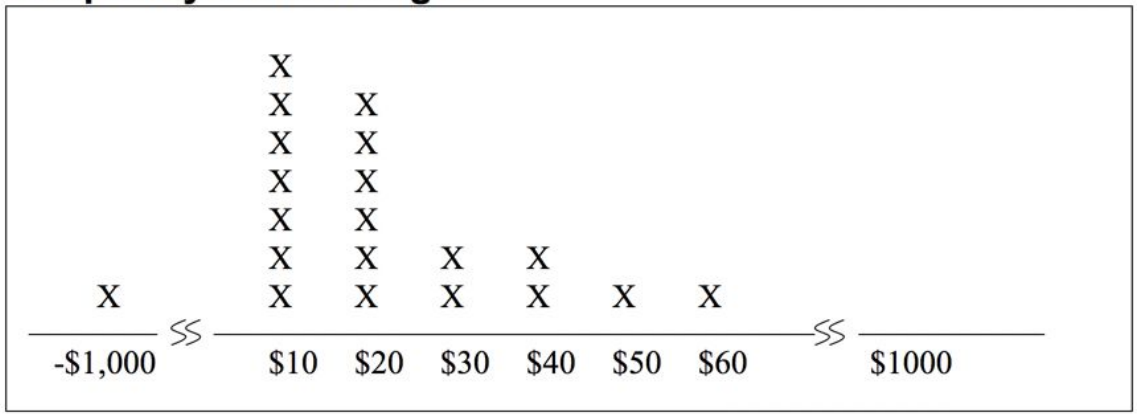
Total Value: -$560

BAG B

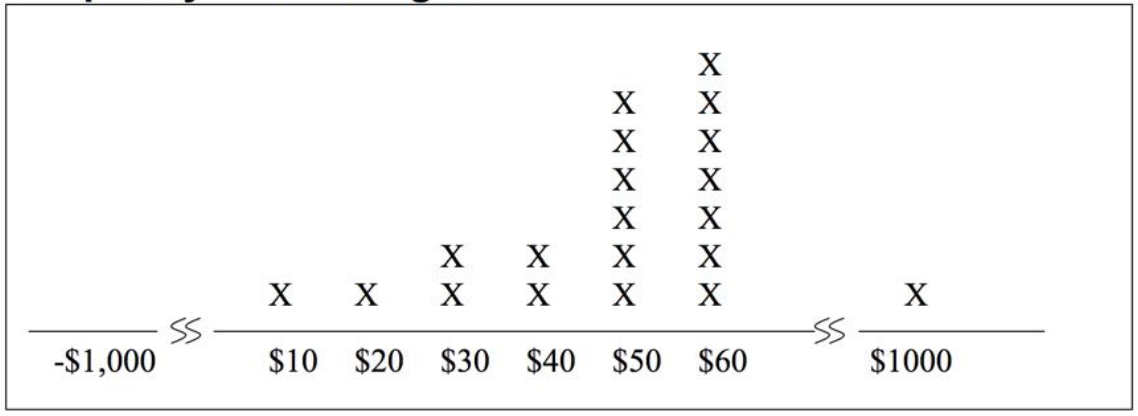
Face Value	Frequency
10	1
20	1
30	2
40	2
50	6
60	7
1,000	1

Total Value: -$1890

Frequency Plot for Bag A:



Frequency Plot for Bag B:

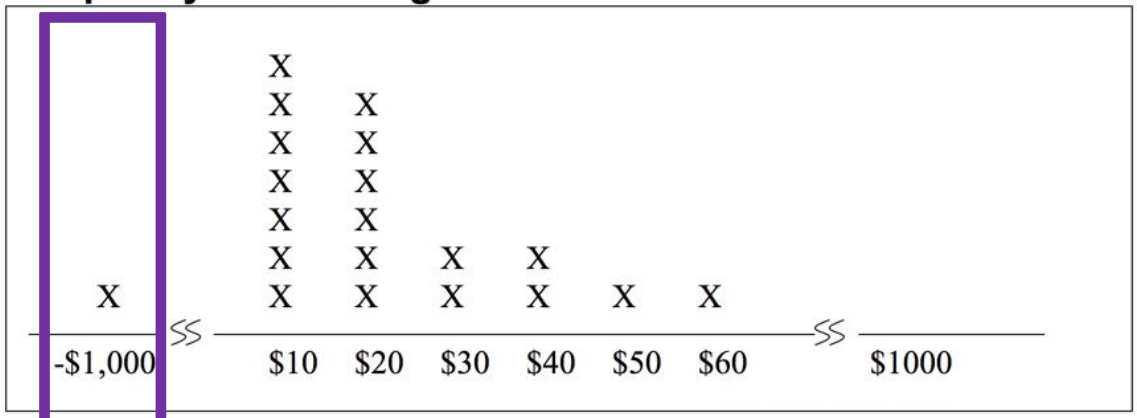


Select one voucher at random from shown bag and decide between two competing theories

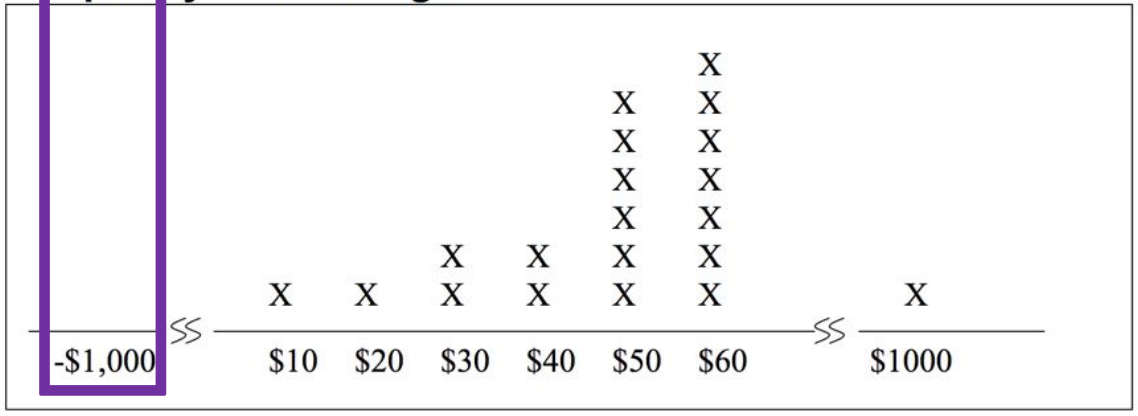
Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

Frequency Plot for Bag A:



Frequency Plot for Bag B:



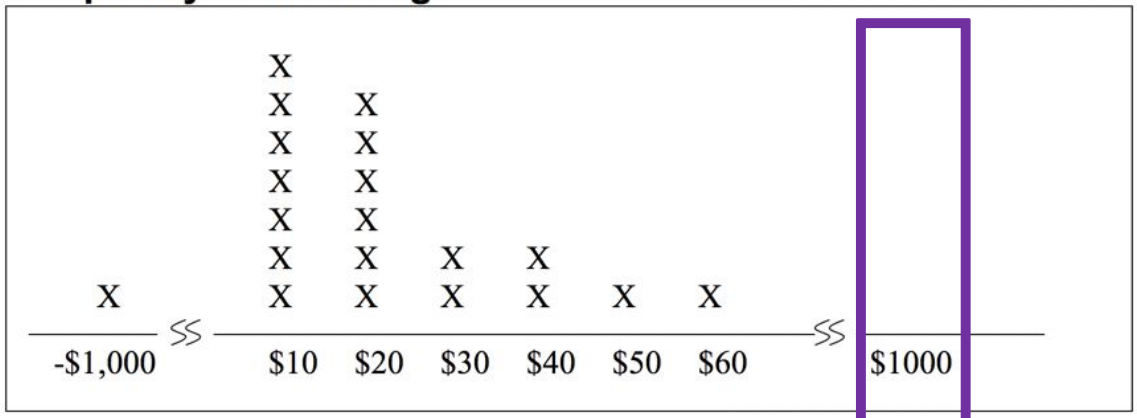
Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

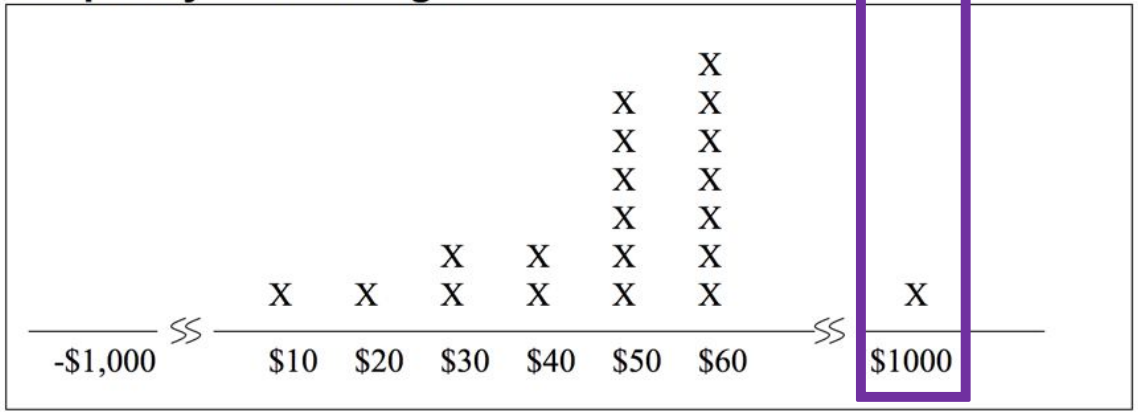
What if select -$1000?

=> Bag A

Frequency Plot for Bag A:



Frequency Plot for Bag B:



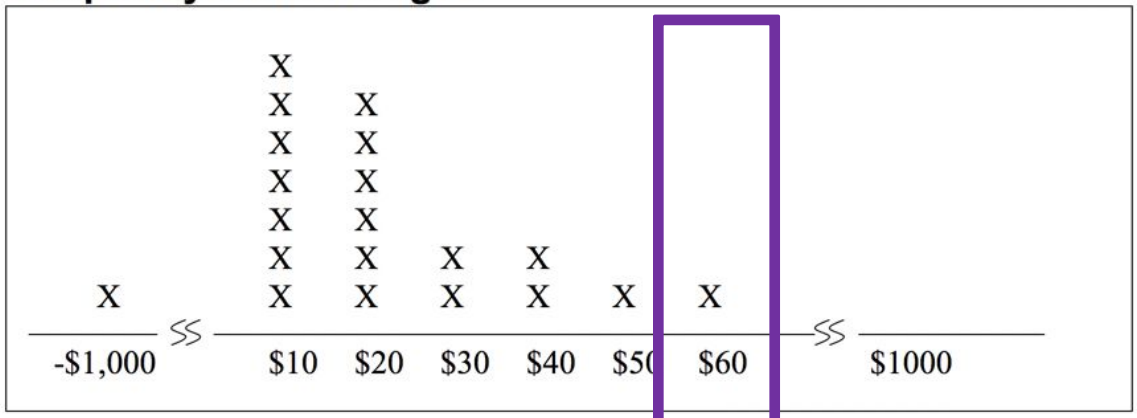
Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

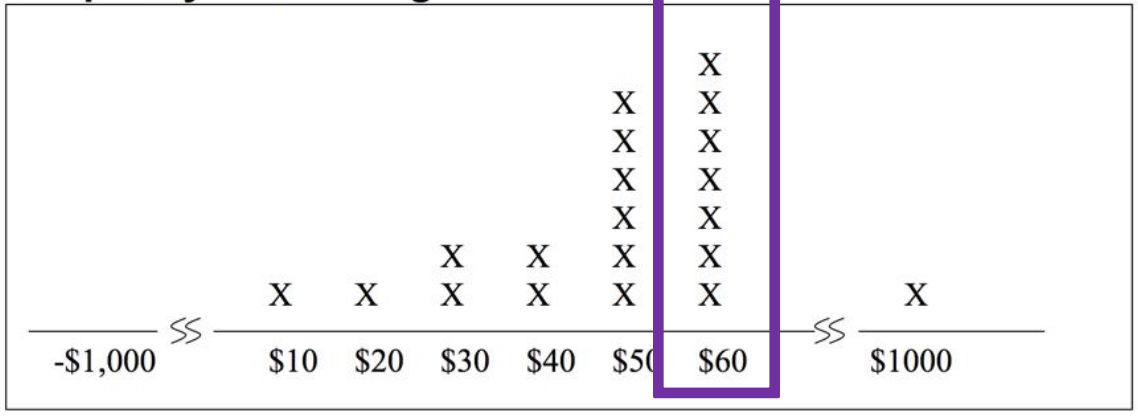
What if select $1000?

⇒ Bag B

Frequency Plot for Bag A:



Frequency Plot for Bag B:



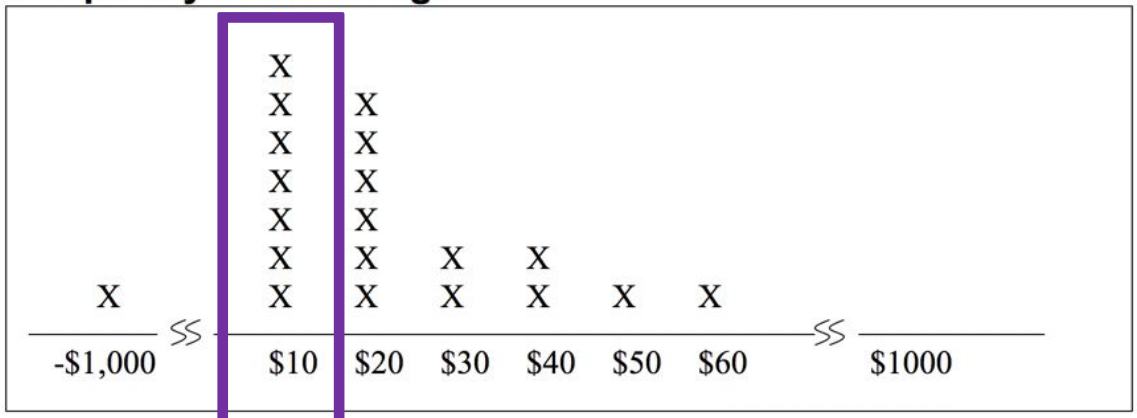
Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

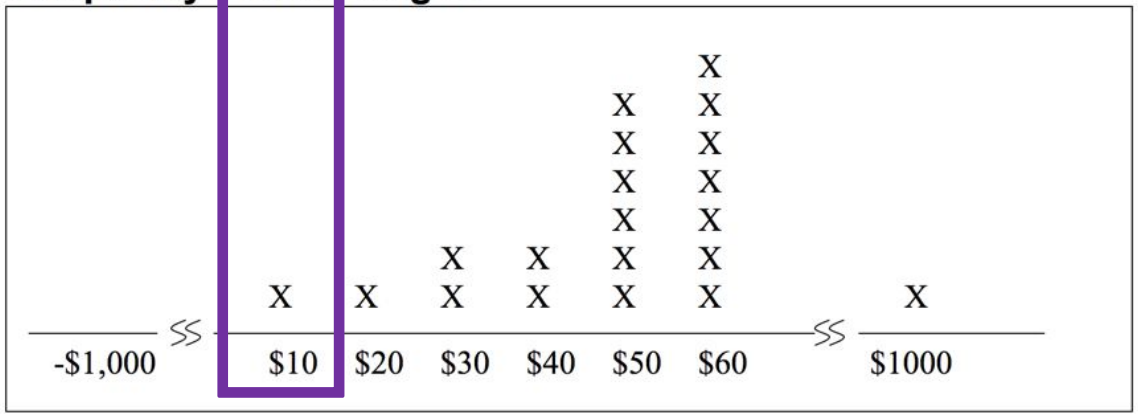
What if select $60?

⇒ Bag B

Frequency Plot for Bag A:



Frequency Plot for Bag B:



Null:
Shown bag is **Bag A**

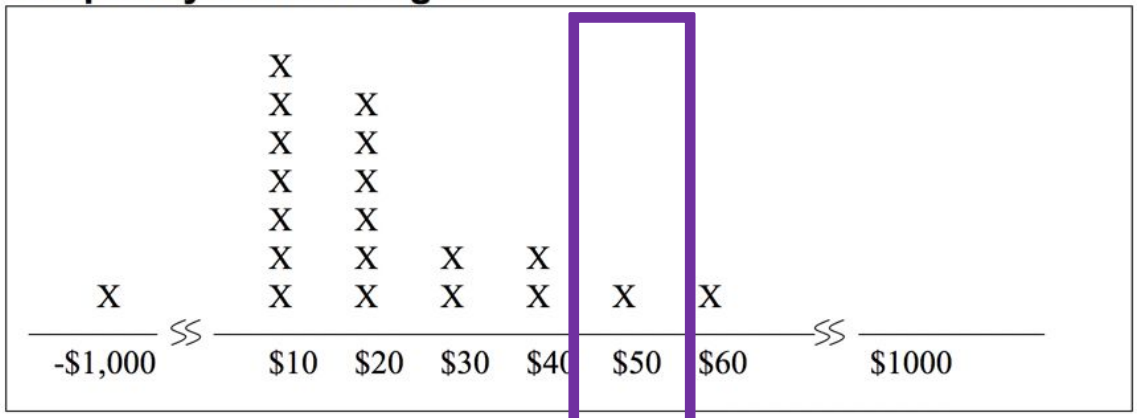
Alternative:
Shown bag is **Bag B**

What if select $10?

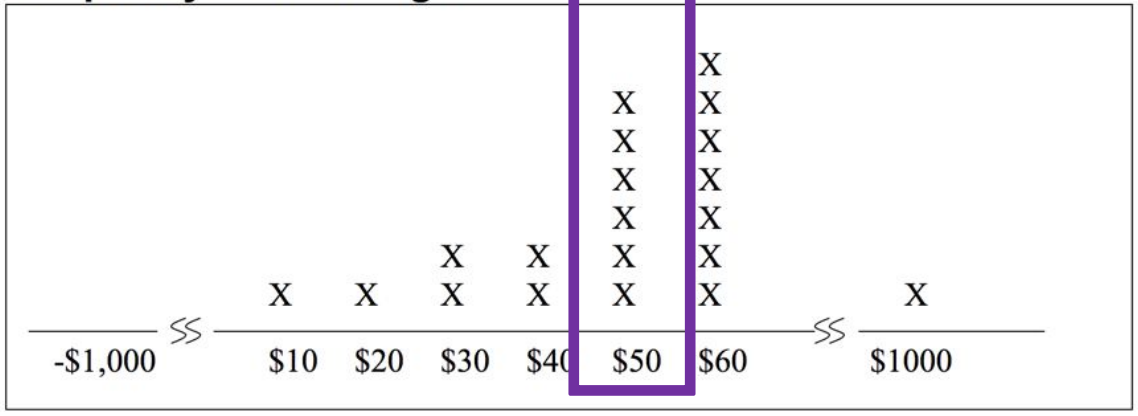
⇒ Bag A

Starting for form a **decision rule**

Frequency Plot for Bag A:



Frequency Plot for Bag B:



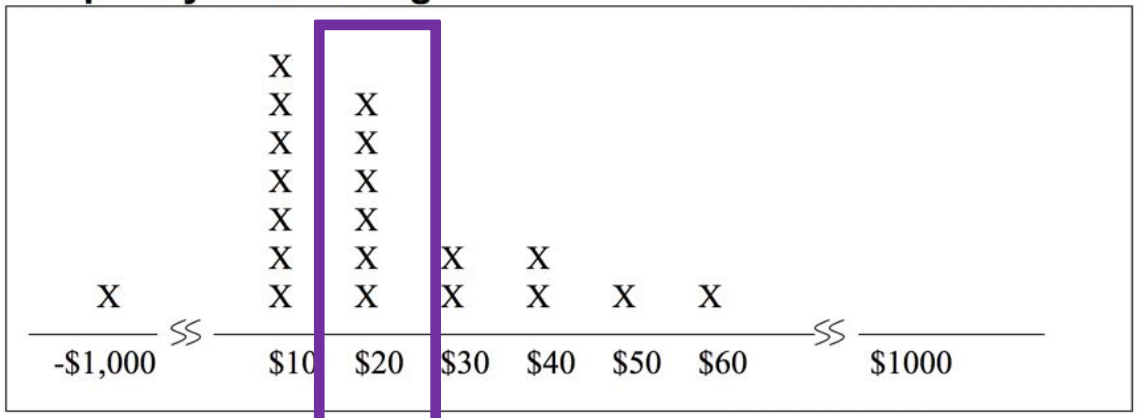
Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

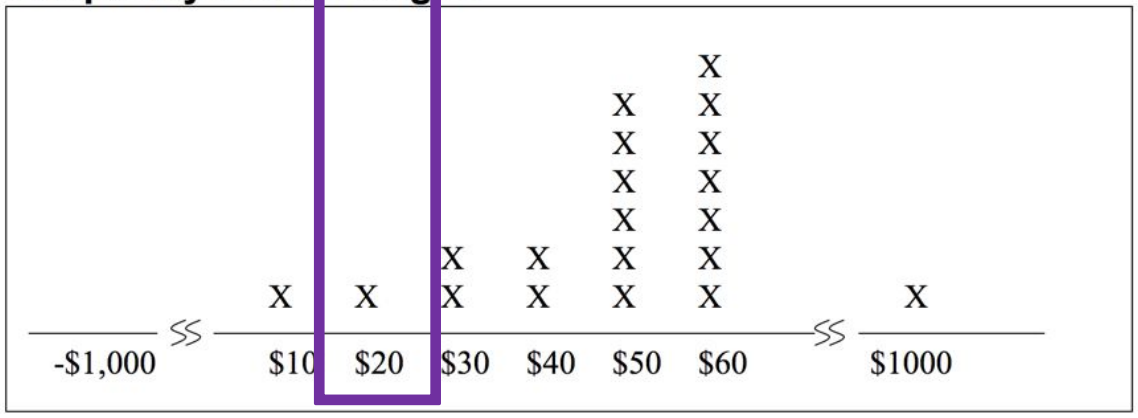
What if select $50?

⇒ Bag B

Frequency Plot for Bag A:



Frequency Plot for Bag B:



Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

What if select $20?

⇒ Bag A

Frequency Plot for Bag A:

Frequency Plot for Bag B:

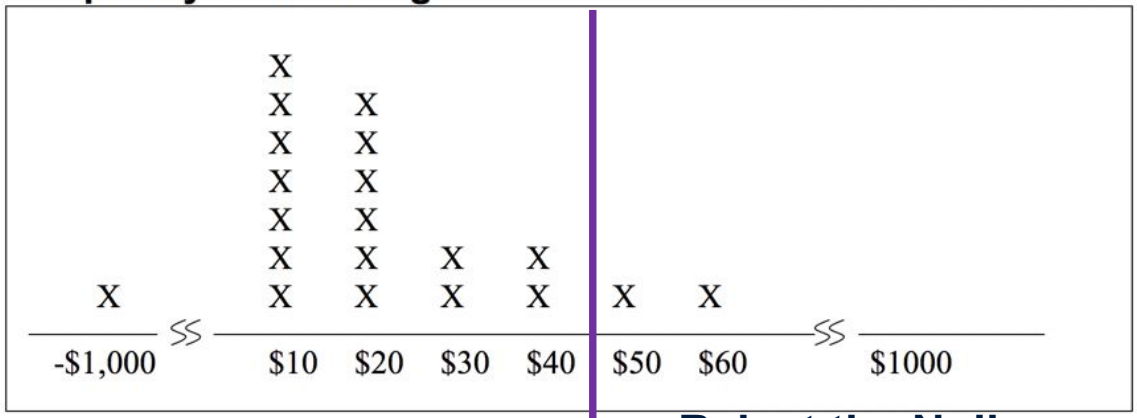
Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

What if select $40 or $30?

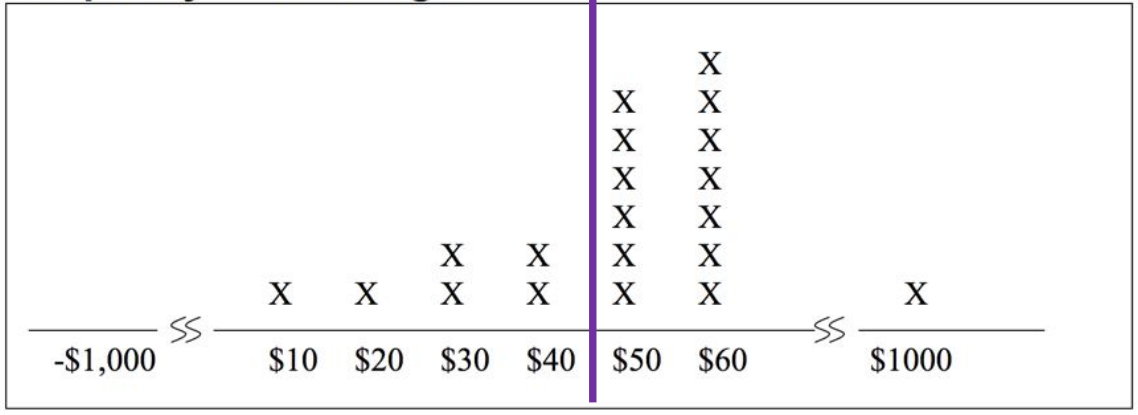
equally likely

Frequency Plot for Bag A:



Reject the Null

Frequency Plot for Bag B:

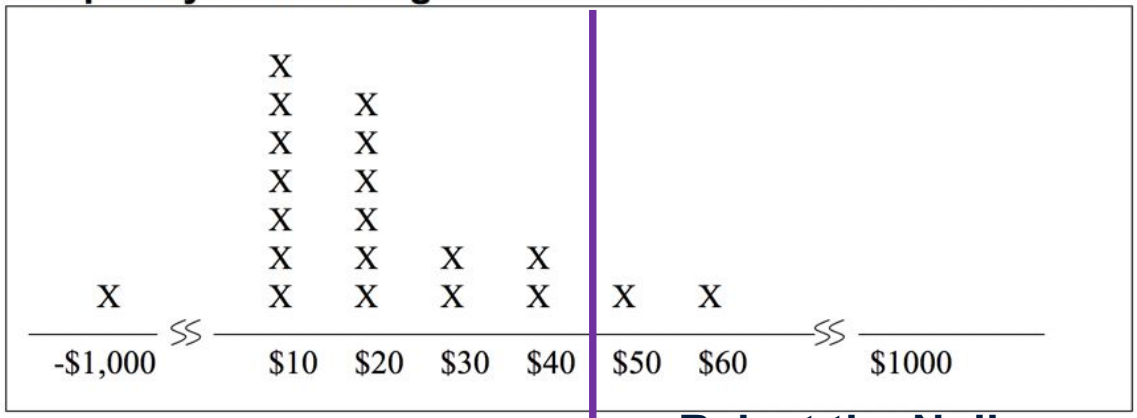


Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

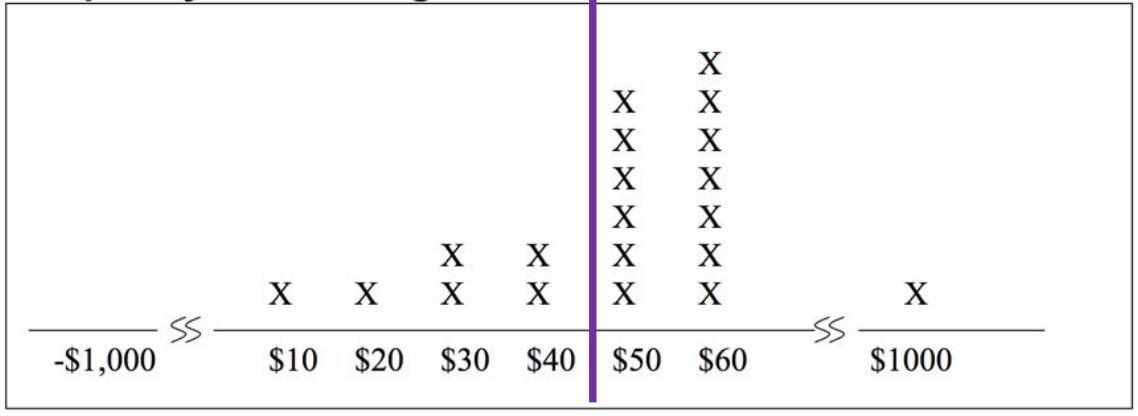
Decision Rule:
Reject the Null if voucher is $50 or higher

Frequency Plot for Bag A:



Reject the Null

Frequency Plot for Bag B:



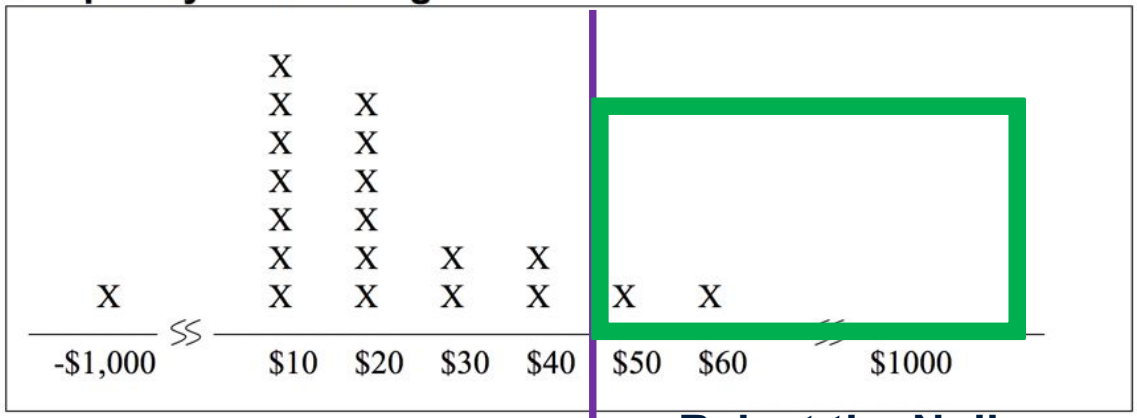
Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

Decision Rule:
Reject the Null if voucher is $50 or higher

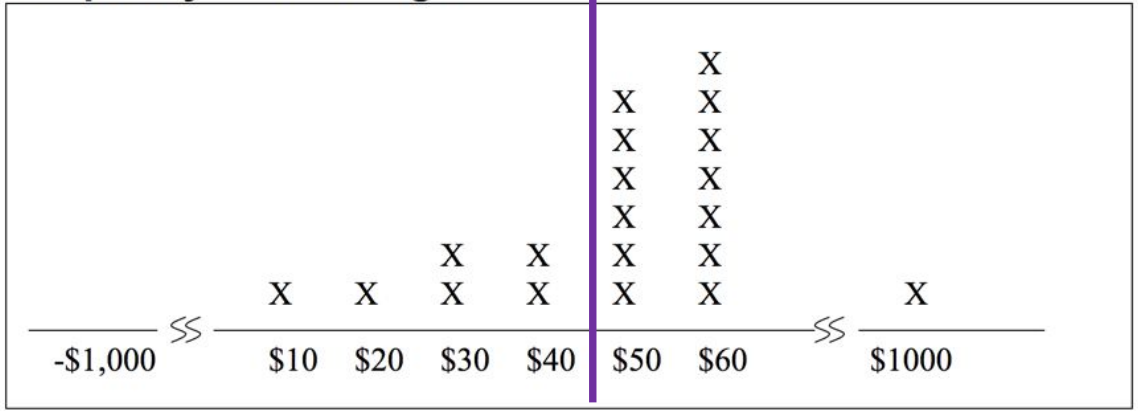
Error: Reject Null when Null True

Frequency Plot for Bag A:



Reject the Null

Frequency Plot for Bag B:



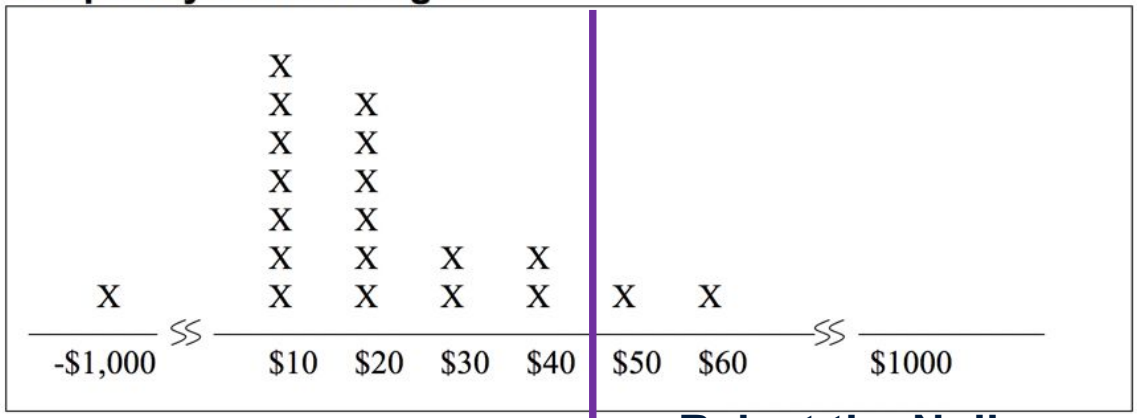
Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

Decision Rule:
Reject the Null if voucher is $50 or higher

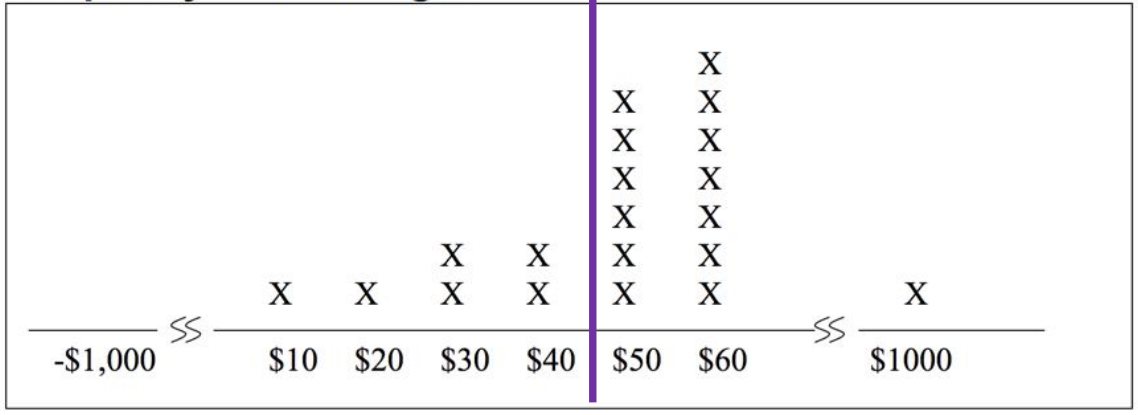
Error: Reject Null when Null True

Frequency Plot for Bag A:



Reject the Null

Frequency Plot for Bag B:

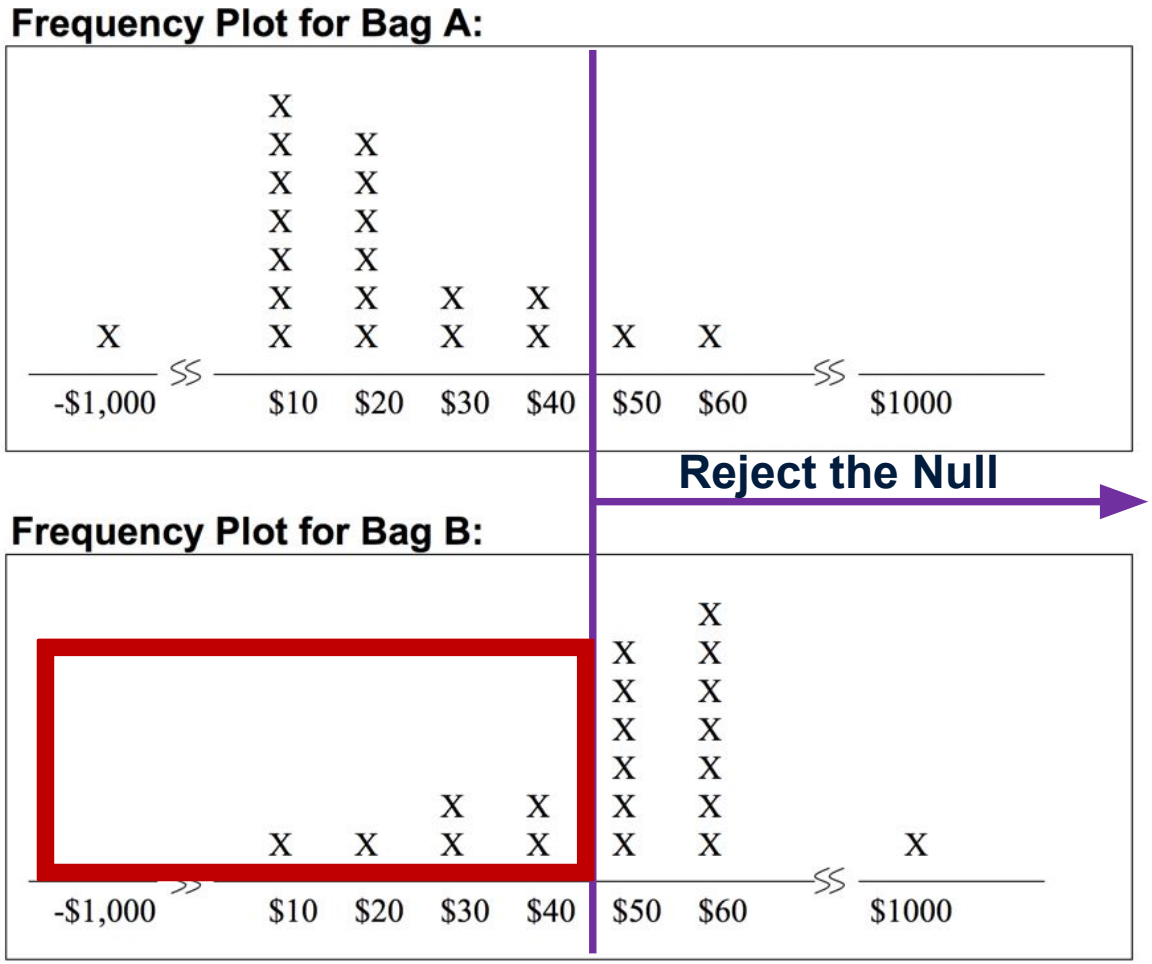


Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

Decision Rule:
Reject the Null if voucher is $50 or higher

Other Error: Do not Reject Null when Alternative True

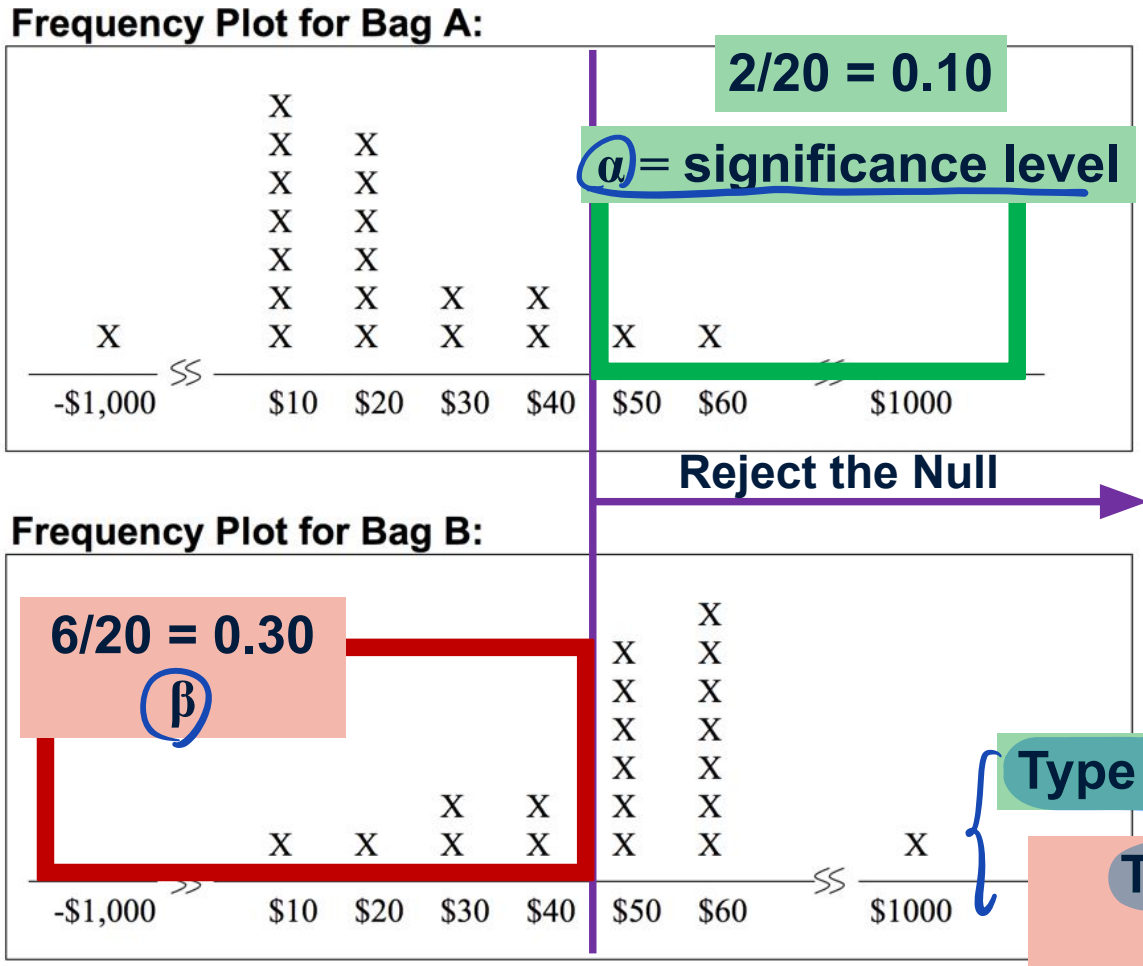


Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

Decision Rule:
Reject the Null if voucher is $50 or higher

Other Error: Do not Reject Null when Alternative True



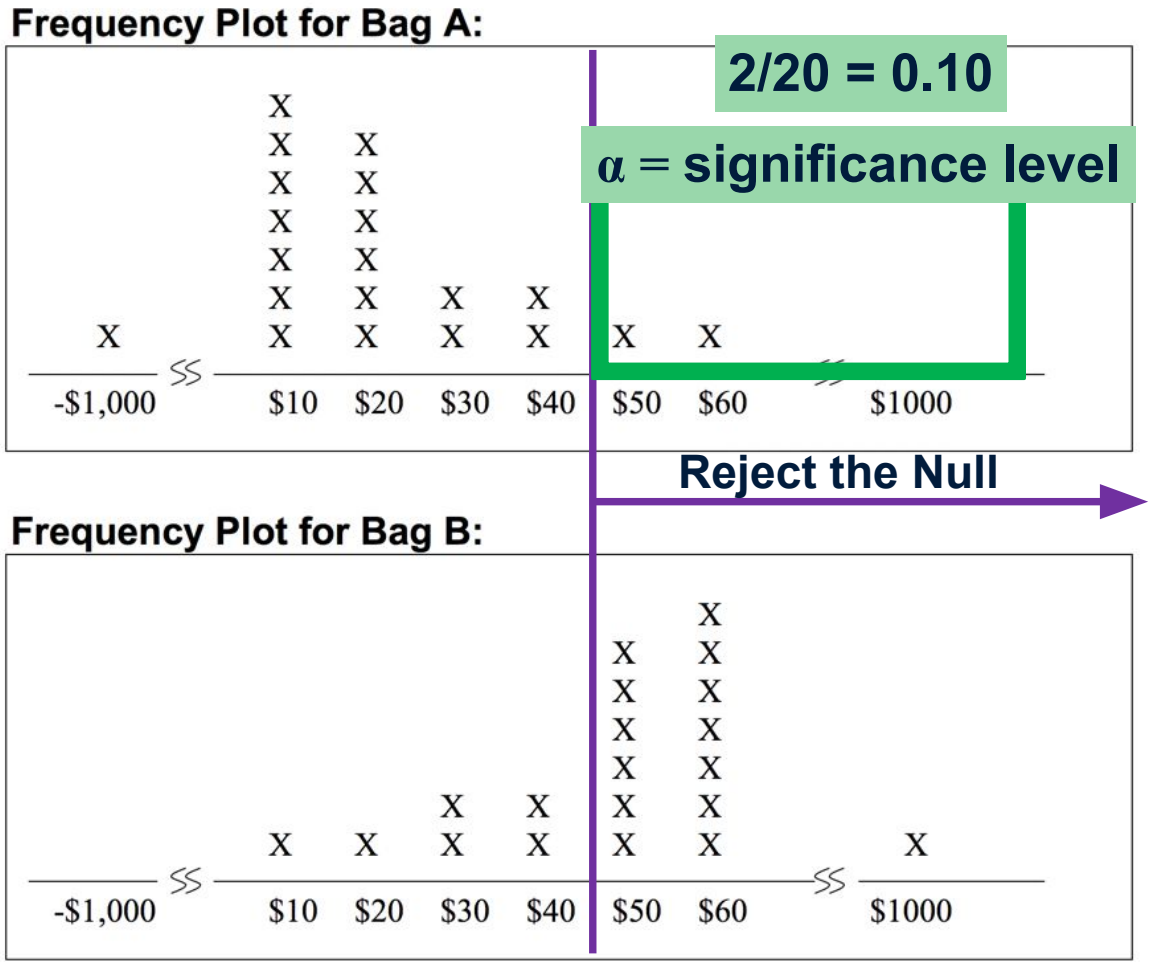
Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

Decision Rule:
Reject the Null if voucher is $50 or higher

Type 1 Error: Reject Null when Null True

Type 2 Error: Do not Reject Null when Alternative True

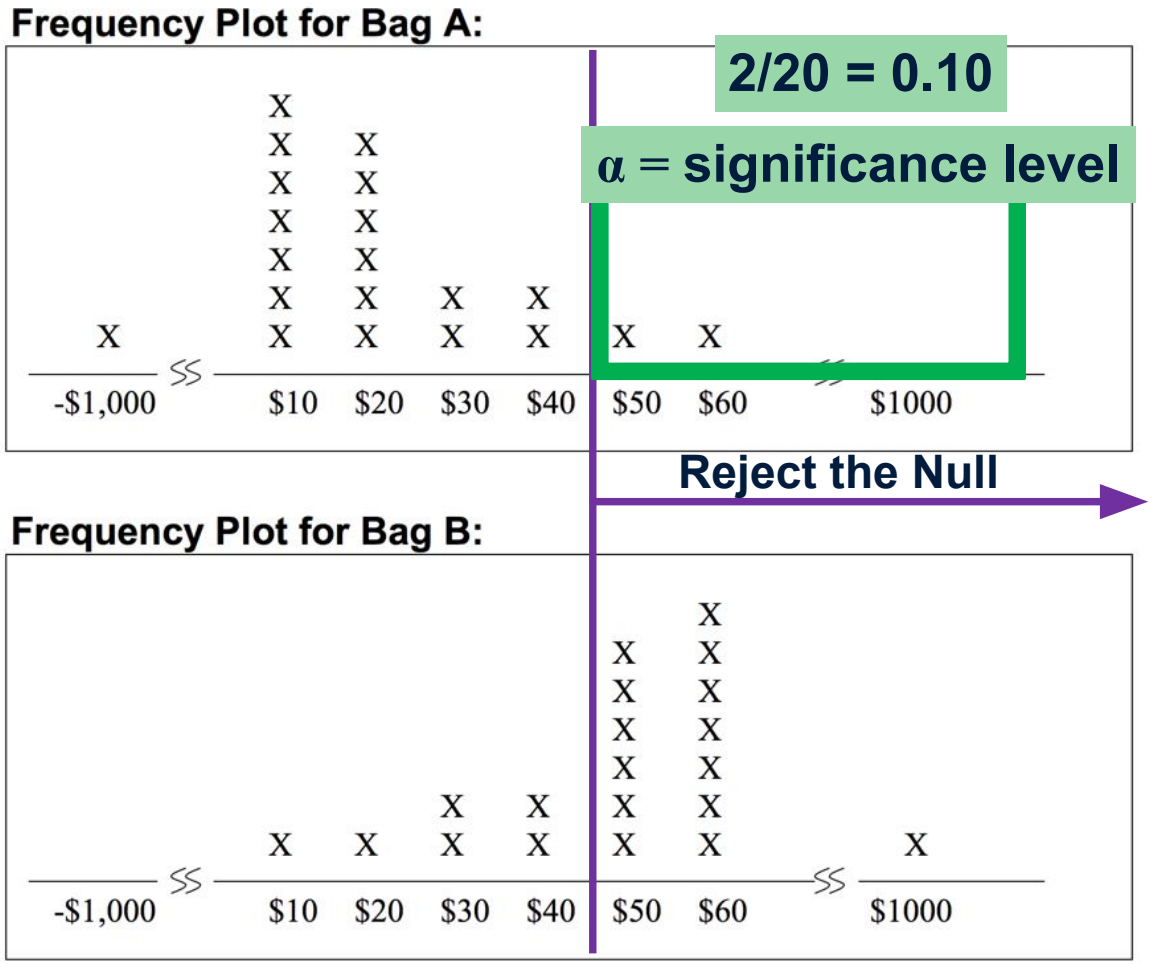


Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

Decision Rule:
Reject the Null if voucher is $50 or higher

Segment Title Here!



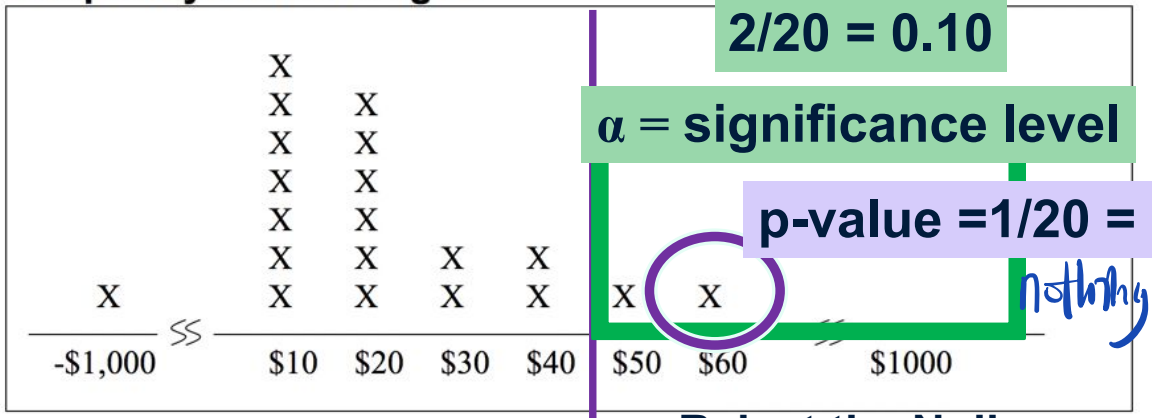
Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

Decision Rule:
Reject the Null if p-value is $\leq \alpha$

probability

Frequency Plot for Bag A:



2/20 = 0.10

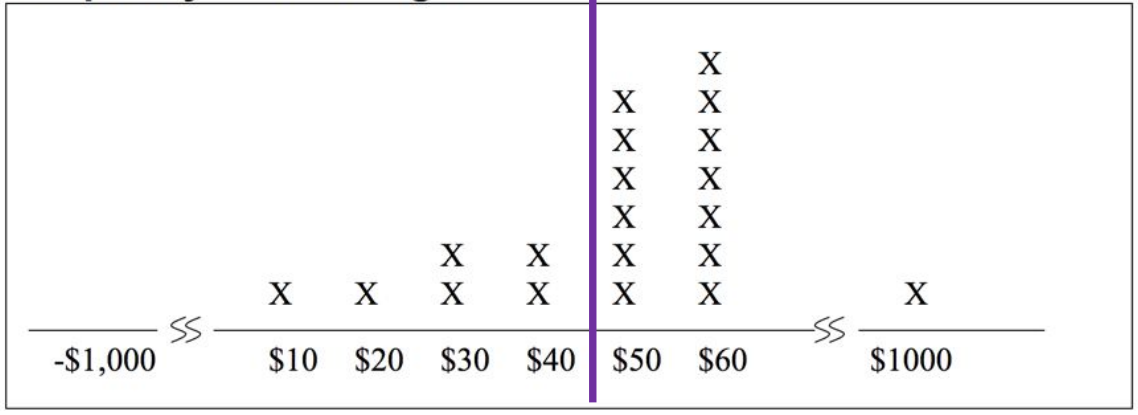
α = significance level

p-value =1/20 = 0.05

nothing more extreme

Reject the Null

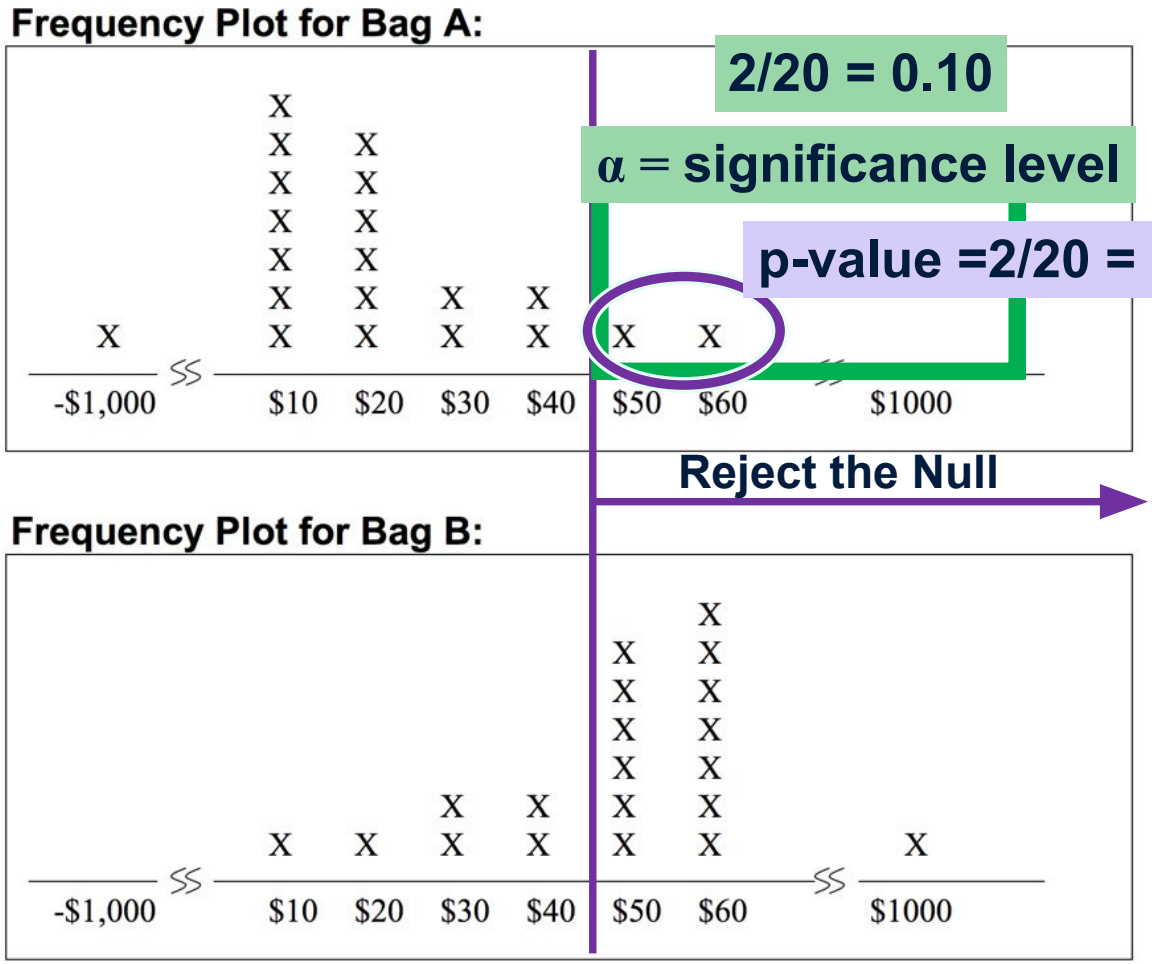
Frequency Plot for Bag B:



Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

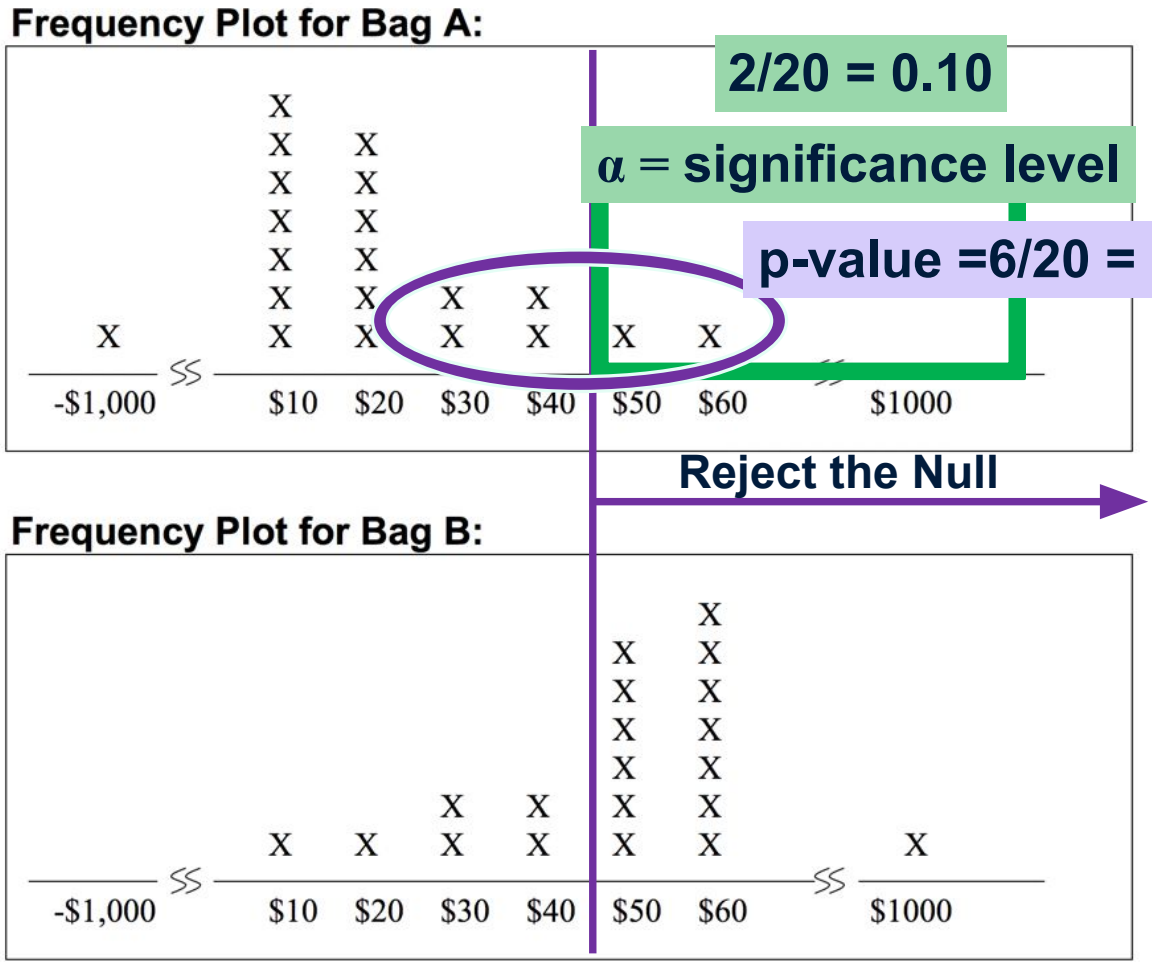
Decision Rule:
Reject the Null if p-value is $\leq \alpha$



Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

Decision Rule:
Reject the Null if p-value is $\leq \alpha$



Null:
Shown bag is **Bag A**

Alternative:
Shown bag is **Bag B**

Decision Rule:
Reject the Null if p-value is $\leq \alpha$

Hypothesis Testing

- Stating Hypotheses
- Selecting a Significance Level α
- Using data to make our decision (via p-value)

Probability of at least extreme when Null is true

More details about making inferences ahead!

frequentist vs. Bayesian

happen or not happen

① probability is in your mind rather than in the world

② based on new information, you can update your probability