

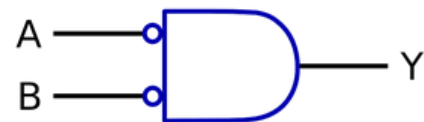
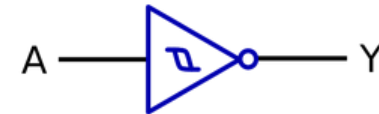
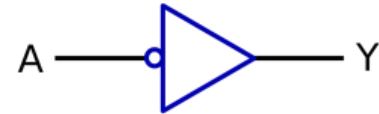
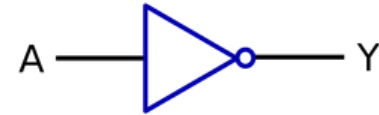
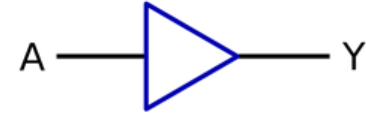
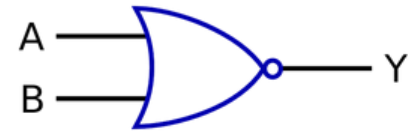
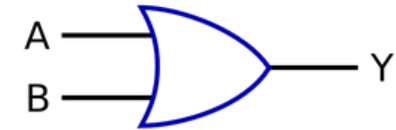
# Formal Logic and Grouping Games



# Overview of the Webinar

- The scope of formal logic on the LSAT
- Introduction to Conditional Logic
- Compound Conditionals
- Contrapositives
- Fallacies of Conditional Logic
- A Conditional Logic drill
- Where you will encounter Conditional Logic
- Introduction to Grouping Game
- Grouping Game Drill
- We'll stop every half hour for questions
- We appreciate you being here!
- This information can be found in even more depth in our free course

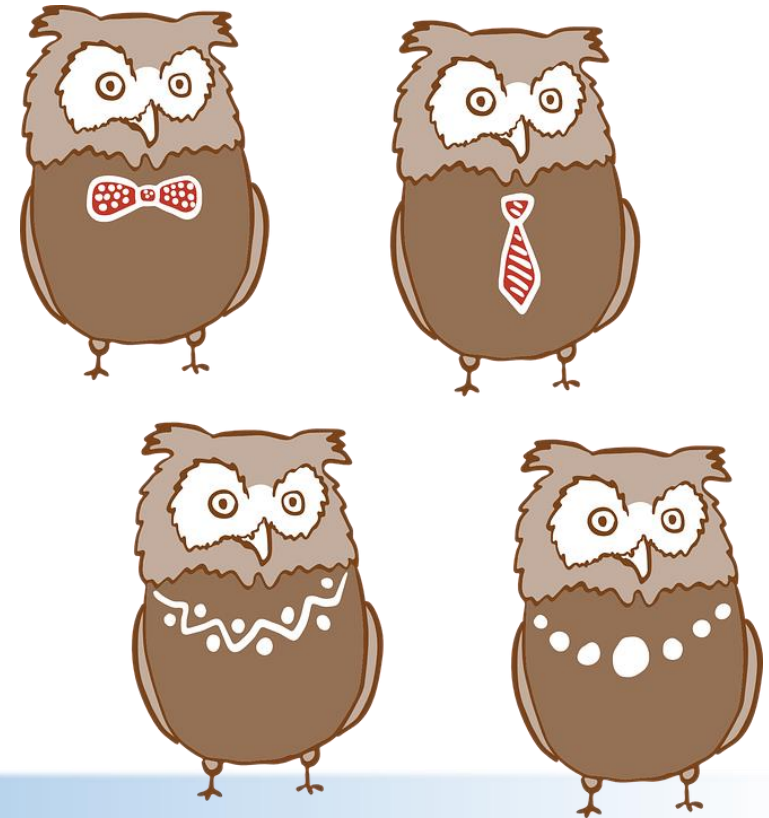
# What is Formal Logic?



The LSAT is not nearly this complicated!

# What is Formal Logic?

- Formal logic is a way of symbolizing relationships expressed in language.
- As we saw on the last slide, it can get pretty complicated!
- The LSAT only a handful of formal logic ideas...



# Formal Logic Tested on the LSAT

- There are a handful of notions that are rarely tested
- Most
- Some, Many, Several
- Not All

We cover these in our “Vocabulary of Formal Logic” video in Lesson 6 of the LSAT course, but they only rarely come up on the test.

But there is one type of relationship that the LSAT *always* tests, and it will test it in a couple of different ways....



# Introduction to Conditional Logic



- The only concept of formal logic routinely tested on the LSAT is called **conditional logic**.
- **Conditional logic** is tested in four different ways, and we'll cover the most common and fundamental expression of a conditional today.
- Conditional logic expresses “If, then,” relationships, such as:
  - “If I am in Boston, then I am in New England.”
  - “If I am not in California, then I am not in Los Angeles”
  - “If I am in Brooklyn, then I am not in Queens.”
- Each one of these is a conditional statement, and thus each one of these can be diagrammed using a conditional arrow.

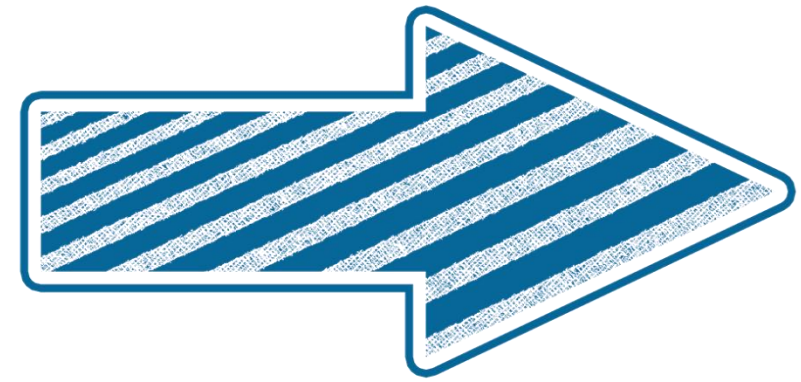
# The Conditional Arrow

- The conditional arrow is how we express conditional relationships in a neat and efficient way.
- Conditional arrows always have the same fundamental structure:

If → Then



# Using the Conditional Arrow



- Let's look back at our examples from a previous slide.
- “If I am in Boston, then I am in New England.”

If in Boston  $\rightarrow$  Then in New England

If Boston  $\rightarrow$  Then New England

- But if we remember that the term on the left is **always the if term**, and the term on the right is **always the then term**, we can eliminate those words from the conditional.

Boston  $\rightarrow$  New England

- And if we can remember that “B” means Boston and “NE” means New England, then we can write a very short diagram that exactly conveys the conditional:

B  $\rightarrow$  NE



# Negatives in Conditionals

- The second and third examples that we gave you on a previous slide both use “not.” There are a few ways to diagram not:

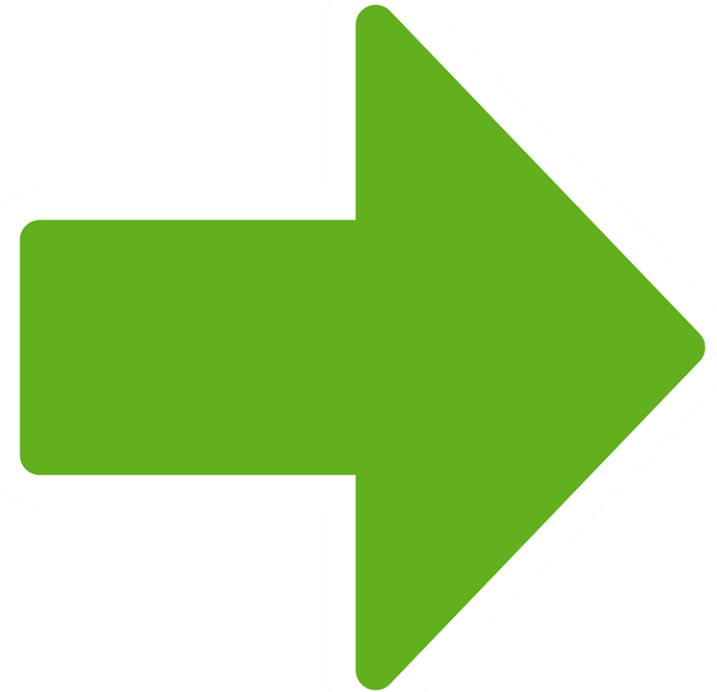
- You can use tildes. For example:

If Not US  $\rightarrow$  Not LA becomes

$\sim$ US  $\rightarrow$   $\sim$ LA

- You can also cross the terms out

US  $\rightarrow$  LA



# Some Facts About the Contrapositive.

- A fancy sounding work! Say it to your friends, and they'll know you're *serious* about the LSAT.
- The Contrapositive is a **logical inference** that can be **always** be drawn from **any** conditional statement.
- An inference is something that **must be true** based on the information given (you'll face inferences on all three sections of the test)
- This is remarkable only because many statements have no inferences that **are reliably true**, while the contrapositive is **always true** in any conditional statement.
- Every single modern LSAT, going back to LSAT #1, tests your ability to draw contrapositives in one form or another.

# How to Find the Contrapositive

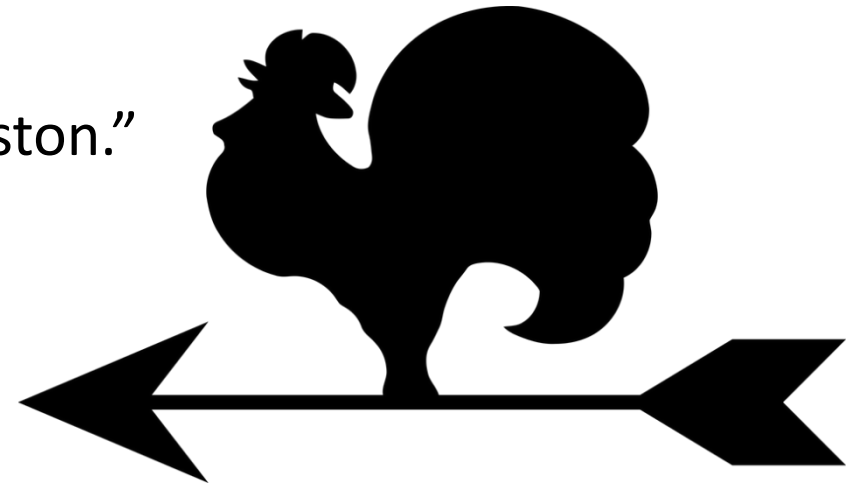
- There are three steps to finding a contrapositive, but the third is irrelevant for us so far. Let's take two of our examples:
- To find the contrapositive **flip the statements**
- Then, **negate the statements**.
- The contrapositive of "If you are in Boston, then you are in New England."

$B \rightarrow NE$

- Is "If you are not in New England, then you are not in Boston."

$\sim NE \rightarrow \sim B$

And it's even true!



# Contrapositives and Negations



$B \rightarrow NE$  becomes  $\sim NE \rightarrow \sim B$

But what about our other two examples: “If I am not in the US, then I’m not in LA” and “If I’m in Brooklyn, then I’m not in Queens”?

$\sim US \rightarrow \sim LA$       and       $B \rightarrow \sim Q$

Just when you multiply negatives in math, **two negatives make a positive.**

To find the contrapositive, we flip the statements and negate them, which makes some terms positive. They become:

$LA \rightarrow US$

$Q \rightarrow \sim B$

# Simple and Compound Conditionals



- So far, we've looked at **Simple Conditionals**. Simple conditionals only have two terms.
- Conditionals that have more than two terms are called **Compound Conditionals**, and those terms are bound with the words **And** and **Or**.

For example:

“If I am in the Twin Cities, then I am in Minneapolis or St. Paul”

“If I'm in a good mood and you're quiet, then I'll tell you a story.”

Each of these conditionals has three terms (Twin Cities, Minneapolis, St. Paul) and (Good Mood, Quiet, and Story).

# Diagramming Compound Conditionals

- Compound Conditionals are diagrammed just like simple conditionals:
- “If you live in the Twin Cities, then you live in Minneapolis or St Paul” is

M  
TC → or  
St. P

- “If I’m in a good mood and you’re quiet, then I’ll tell you a story”

GM  
and → S  
Q

# Quick Note On “Or” on the LSAT

- “Or” has two senses in English: **exclusive** and **inclusive**
- Exclusive Sense of Or: “You can make a left or a right up here, it doesn’t matter which.” This means “Left or Right, *but not both*.”
- Inclusive Sense of Or: “Thanks for coming. Would you like something to drink or eat?” This means “Drink or eat *or both*”
- Unless noted otherwise, **the LSAT always means inclusive or**. Every time you see “or” in a formal logic situation – in LR or LG – it

So “You live in Minneapolis or St Paul” in the previous example can mean “or both.” (Maybe you live in more than one place?)

# Contraposing Compound Conditionals

- The first two steps of our contrapositive apply to compound conditionals: **flip** and **negate**.
- There's a third step introduced here: **Every "And" becomes "Or," and Every "Or" becomes "And."**

M		GM
TC → or		and → S
StP		Q
Becomes		Becomes
~M		~GM
and → ~TC		~S → or
~StP		~Q



# Drill!

- You'll find these ten questions on your handout. You can also just copy from the screen. **Diagram each conditional and its contrapositive**
- 1) If the cruise goes to Jamaica, then it won't go to Trinidad.
  - 2) If the interview is room #2, then it won't be in rooms #1 or #3.
  - 3) All of the students at this law school did well on the LSAT.
  - 4) None of my friends are here.
  - 5) I can't focus if you're going to play video games or watch a movie.
  - 6) All of your employees must wear goggles in order to follow procedure.
  - 7) Each of the students achieved a passing mark
  - 8) If you are a properly licensed JD and you practice law, you're a lawyer
  - 9) You'd be a fool not to take that deal!
  - 10) I can bake the cake only if I have eggs and butter

# Drill Solutions Page 1

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# Drill Solutions Page 2

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- 7) Each of the students achieved a passing mark
- 8) If you are a properly licensed JD and you practice law, you're a lawyer
- 9) You'd be a fool not to take that deal!
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# Where will you face conditionals on the LSAT?

- Two places: Logic Games and Logical Reasoning
- In Logical Reasoning, “Formal Logic” Prompts will often test conditional relationships. You may see something like:

“All of the students in the history major are in the history club. All of the members of the history club pay annual dues and attend monthly meetings.”

- You’ll also frequently see conditionals in Logic Games, specifically in....



# Grouping Games!



# The Key Skills of Logic Games

- The LG section of the LSAT tests your ability to order and think through relationships and structures. There are three key skills.
- Sequencing – putting things in order. This is a key skill. Check out Lesson 1 of our free LSAT course for more information.
- Matching – attributing qualities to certain variables. Check out Lesson 7 of our free LSAT course for more information.
- Grouping – sorting variables into groups. We'll be doing these together today, but you can also check out Lesson 4 of our free LSAT course.

# Grouping Games Ask You To...

- Sort elements into different categories. If the primary aim of a *linear* game is *sequencing*, then the primary aim of a grouping game is **sorting**.
- These games – more than any other – tend to heavily feature conditional logic in the rules.
- Let's take a look at how grouping games are going to show up on the LSAT...



# Basic In/Out Grouping

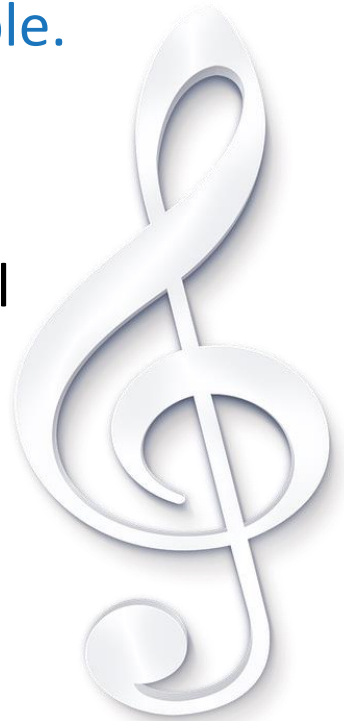
Nine musicians – M, N, O, P, R, S, T, U, and X – are auditioning for an ensemble. Five will be selected. The following conditions apply:

- This is a “Basic” Grouping Game. Two groups: Included and Excluded. We’ll diagram it like this:

In: \_\_\_\_\_

Out: \_\_\_\_\_

Note: **Always** diagram the excluded category! Keep track of those who are out.





# Two Separate Groups

Of six applicants – G, H, I, J, K, and M –, four will attend Birmingham Law School and two will attend Chester Law School. No student attends both, and every student must one or the other. The following conditions apply:

This is effectively the same as the last game!

B: \_\_\_ \_\_\_ \_\_\_ \_\_\_

C: \_\_\_ \_\_\_

Both this game and the last game are **binary games**

If you aren't in, you're out.

If you aren't at Birmingham, you're at Chester.



# Fixed Number v. Variable Number

Each of six applicants – G, H, I, J, K, and M – will attend either Birmingham Law School or attend Chester Law School. No student attends both, and every student must one or the other. Each law school is attended by at least one of the applicants. The following conditions apply:

B:  (  ) (  ) (  ) (  )

C:  (  ) (  ) (  ) (  )

Still a **binary** game, but the variability makes it a little bit trickier.

# Three or More Groups

The eight members of the Cadwell family – D, E, F, G, H, I, J, K, and L – will stay in three different hotel rooms during their vacation. Each hotel room is occupied by at least one family member, and no family member stays in more than room.

Here, we don't get room numbers or names. We also get three separate groups. We can be sure that the rules of this game are going to have a lot more to do with which family members are clustered together than where specifically they go.

1: \_\_\_

2: \_\_\_

3: \_\_\_

# Rules in In/Out Grouping

Nine musicians – M, N, O, P, R, S, T, U, and X – are auditioning for an ensemble. Five will be selected. The following conditions apply:

If M is selected, then N is not selected

If O is not selected, then P must be selected

P and R are either both selected, or neither is

In: \_\_\_\_\_

Out: \_\_\_\_\_



# Fixed Number v. Variable Number

Each of six applicants – G, H, I, J, K, and M – will attend either Birmingham Law School or attend Chester Law School. No student attends both, and every student must one or the other. Each law school is attended by at least one of the applicants. The following conditions apply:

If G attends Birmingham, then K must attend Chester

If I attends Chester, then J and M must, too

B: \_\_\_ (\_\_\_) (\_\_\_) (\_\_\_) (\_\_\_)

C: \_\_\_ (\_\_\_) (\_\_\_) (\_\_\_) (\_\_\_)



# Drill Question Number 1

Seven dogs – S, T, U, W, X, Y, Z – will be adopted by two different owners, R and Q. Each dog will be adopted by one of the two owners, and no dog will be adopted by both. The following conditions apply:

If S is adopted by R, then T is adopted by R.

U and W cannot be adopted by the same owner.

If X is adopted by Q, then T is adopted by Q.

# Drill Question Number 2

A law firm is interviewing seven candidates – F, G, H, I, J, L, and M – to fill three positions at the firm. The following conditions apply:

If F is not hired, then J and L are hired.

If H is hired, then F is hired.

M and L must both be hired, or neither is.

# Drill Question Number 3

Eight books – one each on agriculture, business, culture, dendrology, economics, fine art, geology, and humanism – will be sorted onto three different shelves. The following conditions apply:

At least two books and no more than three books are on each shelf.

The books on fine art and culture must be on the same shelf

If the book on agriculture and dendrology are not together, then the books on economics and business are.



# Drill Question Number 4

Six mountaineers – M, N, O, P, Q, and R – will form teams of two to scale three peaks – A, B, and C. The following conditions apply:

R cannot climb Peak C

O and R cannot climb the same mountain together

If O climbs B, then P climbs C.

If N climbs A, then so does Q.



# Free LSAT Office Hours

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in Logical Reasoning**  
*September 21st @ 7pm ET*

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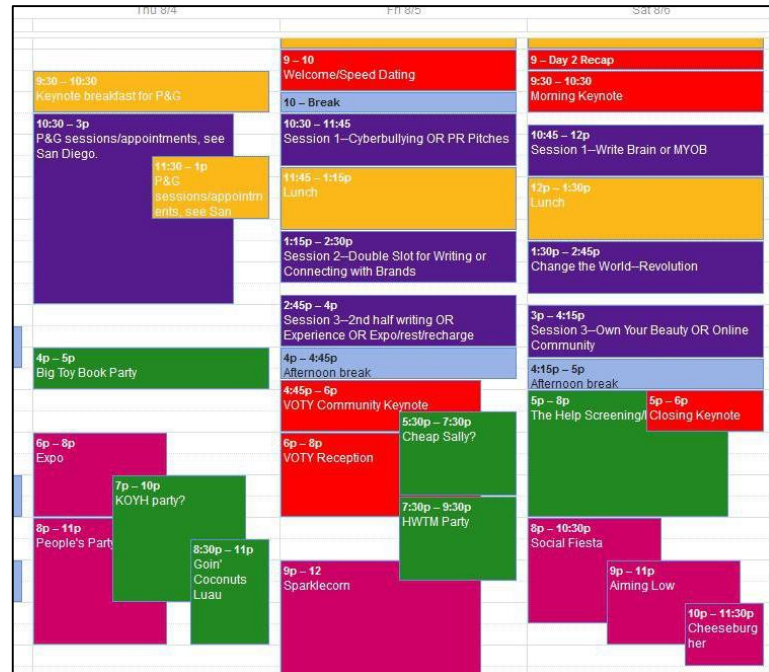
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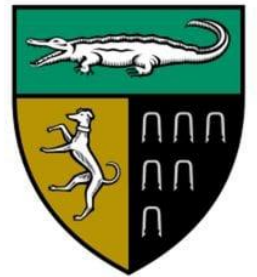
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