

## MATH 113: 2/7 WORKSHEET

*Ambiguity* is when something has multiple possible meanings. One kind is *structural ambiguity*, where the structure of the syntax admits multiple possible meanings.

“One morning I shot an elephant in my pajamas. How he got in my pajamas, I don’t know.” –Groucho Marx

If you saw the first sentence by itself, you probably would read “in my pajamas” are referring to yourself. The other possible interpretation, that the elephant was in your pajamas, wouldn’t occur. Which is why the joke works.

With symbolic logic, we aim to avoid ambiguity. The point of the grammar rules is to ensure each symbol of truth-functional logic has only one possible interpretation. One reason this unambiguity is helpful is that it lets us analyze ambiguity in natural language. Consider the following false statement.

Math class is not boring and confusing.

There’s two possible interpretations of this sentence:

- (1) Math class is not: both boring and confusing.
- (2) Math class is both: not boring and confusing.

We can formalize these different interpretations in the language of truth-functional logic. Use this key:

$B$  = “math class is boring”

$C$  = “math class is confusing”

The first sentence can be symbolized as “ $\neg(B \wedge C)$ ” while the second one would be “ $\neg B \wedge C$ ”.

An adder is small and venomous or harmful.

There’s two possible interpretations:

- (1) An adder is both small and (venomous or harmful).
- (2) An adder is (both small and venomous) or harmful.

Again we can symbolize the two sentences. Use the key:

$S$  = “an adder is small”

$V$  = “an adder is venomous”

$H$  = “an adder is harmful”

The first sentence can be symbolized as “ $S \wedge (V \vee H)$ ” and the second as “ $(S \wedge V) \vee H$ ”.

Sometimes ambiguity isn't structural but is *lexical*—it arises from words having multiple distinct meanings.

I went to the bank.

Bank could mean a financial institution, but it might also mean the lateral edge of a river. If you were to symbolize these sentences you would have to assign different variables to each, to remove the ambiguity.

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Some of the following sentences are ambiguous. If it is ambiguous, identify why and the possible interpretations are. Symbolize the interpretations (whether one or multiple) in the language of truth-functional logic, giving a key to specify the meaning of the variables.

- (1) The flower is not red or fragrant.
- (2) The zoo has lions or tigers and elehpants.
- (3) Flying planes can be dangerous.
- (4) Jack hit the bat with the ball.
- (5) Alice told Barbara that she was sure to win the prize.
- (6) There isn't no other way to do this!
- (7) All doors on the train will not open.