Financial Lit Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 WS Assessment

 Target 25:

Logic and truth table

**I can:**

* Identify propositions
* Compose and interpret the negation of a statement
* Use logical connectors (and/or) and conditional statement (if, then)
* Use truth tables to find truth values of basic and complex statements

**Unit 12 Math Topics:**

* Boolean Algebra
* Venn Diagram

**Logic** is the study of reasoning. Our goal in this target is to examine arguments to determine their validity and soundness. We will look at propositions and logical connectors that are the building blocks of arguments. We will also use truth tables to help us examine complex statements.

A **proposition** is a complete sentence that is either true or false. Opinions can be propositions, but questions or phrases cannot. Which of the following are propositions?

 a. I am reading a math book. b. Math is fun! c. Do you like turtles? d. My cat

**Arguments** are made of one or more propositions (called **premises**), along with a **conclusion**. Propositions may be **negated**, or combined with **connectors** like “and”, and “or”. Let’s take a closer look at how these negations and logical connectors are used to create more complex statements.

Write the negation of the following propositions.

a. I am reading a math book. Negation: I am **not** reading a math book.

b. Math is fun! Negation:

c. The sky is not green. Negation:

d. Cars have wheels Negation:

Read the statement to determine the outcome

|  |
| --- |
| “Vote for this measure to repeal the ban on plastic bags.” |
| Yes means \_\_\_\_\_\_\_\_\_\_ | No means |

|  |
| --- |
| “The bill that overturned the ban on mandatory minimum sentencing was vetoed.” |
| Agree means  | Disagree means |

**Boolean Logic**

We can often classify items as belonging to sets. If you went the library to search for a book and they asked you to express your search using unions, intersections, and complements of sets, that would feel a little strange. Instead, we typically using words like “and”, “or”, and “not” to connect our keywords together to form a search. These words, which form the basis of Boolean logic, are directly related to our set operations. (Boolean logic was developed by the 19th-century English mathematician George Boole.)

When we use the word “and” between two propositions, it connects them to create a new statement that is also a proposition. For example

If you said, “when you go to the store, please get eggs **and** cereal,” Expecting both items

For an **AND** statement to be true, the connected propositions must both be true.

If even one proposition is false (for instance, you get eggs but not cereal), the entire statement is false.

If you said, “when you go to the store, please get eggs **or** cereal,” expecting one or the other.

For an **OR** statement to be true, at least one of the propositions must be true (or both could be true).



The English phrase “Go to the store and buy me eggs and bagels or cereal”

What does it mean?

“Go to the store and buy me eggs and (bagels or cereal)”

Option 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Option 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

“Go to the store and buy me (eggs and bagels) or cereal”

Option 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Option 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



“If it is raining, then we’ll go to the mall. Otherwise we’ll go for a hike.”

Rewrite the following statement in if p then q, else s format. “An accountant needs to withhold 15% of income for taxes if the income is below $30,000, and 20% of income if the income is $30,000 or more”



Translate each statement into symbolic notation.

Let *P* represent “I like Pepsi” and let *C* represent “I like Coke”.

a. I like Pepsi or I like Coke. Hint (P ? C)

b. I like Pepsi and I like Coke.

c. I do not like Pepsi.

d. It is not the case that I like Pepsi or Coke.

e. I like Pepsi and I do not like Coke.

Translate “We have carrots or we will not make soup” into symbols. Let *C* represent “we have carrots” and let *S* represent “we will make soup”.



For example, let’s work with two propositions: R = You paid your rent this month; E = You paid your electric bill this month.

|  |  |  |  |
| --- | --- | --- | --- |
| R | E | R and E | Explain |
| T | T |  | You have paid your rent and electric bill |
| T | F |  | You have paid your rent but not your electric bill |
| F | T |  | You have not paid your rent but you have paid your electric bill |
| F | F |  | You haven’t paid either your rent or electric bill (yet) |



Create a truth table for the following



Given A and not (B or C) = statement A must be true and neither B or C can be true,

Let A = Anaheim wins, B = Baltimore wins, C = Cleveland wins.

In what scenario, Anaheim will make to the playoffs? Hint: $A ⋀\~$(B$⋁C) $= True

Explain



Create a true table for the following



Let m = we order meatballs, p = we order pasta, and r = Ruba is happy.

Translate the statement if m and not p, then r “(*m* ⋀ ~*p*) → *r* “ into English

“If \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and don’t \_\_\_\_\_\_\_\_\_\_\_\_\_\_ , then \_\_\_\_\_\_\_\_\_\_\_\_\_\_”.

Explain where and why this statement is false (what row)

Create a truth table for the statement If B or C, then (A and B)

**Assessment Target 25**

**I can…** apply logic structure and truth table evaluation

Which of the following are propositions? Explain

a. How far?

b. Portland is not in Oregon.

c. Portland Community College.

d. It is raining.

Write the negation of each proposition.

a. I ride my bike to campus.

b. Portland is not in Oregon.

Write a proposition that contains a double negative.

Write a proposition that contains a triple negativ

Create a truth table for the statement *A* ⋀ ~(*B* ⋁ *C*) : A and not (B or C)