My Reflection on week 3 Class on Discrete mathematics

Quantifiers and Predicates

* Propositions can be used to state whether a statement is true or false.
* (∀) this is called a Universal quantifier and (∃) this is called an Existential quantifier.
* (∀): "For all x, P(x)," indicating the predicate is satisfied by every element in the domain.
* (∃): "There exists x such that P(x)," indicating the predicate is satisfied by at least one element in the domain.
* In this module we should translate the English statements into mathematical statements and prove the quantifiers whether true or false.
* In a statement like this “Every number in the set {2,4,8,16} is even” and “**∃x ∈ R ∶ x2 = 4”**. Blue is the quantifier; in this case it is a universal quantifier. Red is the domain value, the set of values provided. Violet is the predicate, which is like a condition given to prove whether it is true or false.
* To prove a (∀) to be false we need to provide an example but to prove it true we need to provide a general argument. To prove a (∃) to be false we need to provide a general argument but to prove it true we need to provide an example.
* This can be applied across various concepts; such as mathematics, computer science, philosophy, linguistics, and many more.

Nested Quantifiers

* Nested quantifiers are where quantified predicates are constructed and then quantified again to form complex propositions.
* Statements involving two or more quantifiers as having nested quantifiers.
* In this chapter, we will translate the nested quantifiers to an English statement.
* An example of nested quantifiers is: ∀x∃y ∶ y = x and ∃y∀x ∶ y = x. in this case, the first quantifier says “for every x there exists a y”, and the opposite statement says that “there exists a y for every x”.
* Another example is ∀x∃y ∶ P (x, y) and ∃y∀x ∶ P (x, y). in this case, the first quantifier says “everybody loves somebody” and “there is a person that everybody loves”.
* Usefulness of this concepts are it is applicable in various domains, enhancing logical reasoning and problem-solving skills: such as database querying, computer science and programming, mathematical modelling, AI, robotics, automation, education and assessment and many more.

Proving nested quantifiers

* the first part of the exercise goes over the quantifier and predicate concepts that were covered in previous modules. To build propositions, quantifiers like ∀ (for all) and ∃ (exists) are employed.
* Propositions with nested quantifiers are the next area of emphasis, showing how complex statements can be constructed. The examples create complex logical structures by combining existential and universal quantifiers.
* The solution offer illustration of how to use truth tables, logical reasoning, and careful case analysis to support or refute propositions. The significance of considering every option is underlined.
* The exercise explores how to manipulate propositions where quantifiers are negated as well as how to negate quantifiers.
* It is applied in various number of fields, such as; computer science and programming for the algorithm design and software verification, in database management, in AI, cryptography, and education and cognitive science.

References

Quantifiers and Predicates

1. Blurock, E., & Blurock, E. (2022, November 25). *Predicates | Baeldung on Computer Science*. Baeldung on Computer Science. <https://www.baeldung.com/cs/predicates#:~:text=A%20predicate%20asks%20a%20question,false%20(yes%20or%20no)>.
2. Wikipedia contributors. (2023, November 22). *First-order logic*. Wikipedia. <https://en.wikipedia.org/wiki/First-order_logic#:~:text=First%2Dorder%20logic%E2%80%94also%20known,%2C%20linguistics%2C%20and%20computer%20science>.

Nested Quantifiers

1. *Discrete Mathematics Nested Quantifiers*. (2020). I. Perepelitsa. <https://www.math.uh.edu/~irina/MATH3336/3336Notes/3336S15.pdf>
2. *First-order logic in Artificial Intelligence - Javatpoint*. (n.d.). www.javatpoint.com. <https://www.javatpoint.com/first-order-logic-in-artificial-intelligence>
3. Zajenkowski, M. (2013). Energetic arousal and language. *Human Factors*, *55*(5), 924–934. <https://doi.org/10.1177/0018720812474932>