Physics Lecture

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Contents

1 Passing

There will be 2 exams / tests. There will be weekly lists of tasks to do for Exercises.

2 Curriculum

- 1/3 of the course is basic logic formulas, useful for simplifying if-else comparisons
- 1/3 will cover information what will be helpful to courses on databases, machine learning & artificial intelligence
- 1/3 will cover details on semantics that will be useful on the masters level

3 What is logic?

- Logic is defined as formal apparatus for reasoning.
- There are two elements:
  - Formal language - a set of sentences built with symbols
  - Semantics - a method of adding meaning to them

4 Sentences in logic

- Basic symbols, variables: a,b,c
- Logical connectives, operators:
  - OR (alternative, disjunction) $\vee$
  - AND (conjunction) $\wedge$
  - NOT (negation) $\neg$
  - IF ... THEN (implication) $\implies$
  - TRUE IF AND ONLY IF $\iff$
  - Tautology $\top$

5 Logic Laws

- $(a \wedge b) \vee c \equiv (a \vee c) \wedge (b \vee c)$
- $(a \vee b) \wedge c \equiv (a \wedge c) \vee (b \wedge c)$
- $\neg(a \vee b) \equiv \neg a \wedge \neg b$
- $\neg(a \wedge b) \equiv \neg a \vee \neg b$

6 The basics of Set Theory

- There is no formal definition. It's a collection of objects.
- The modern approach to sets was developed mainly in the 19th century by Cantor and others
- Since then it has been extended and other theories had been proposed

6.1 Notation

- $X = \{1, 2, 3\}; Y = \{Mon, Tue, Wed, Thu, Fri, Sat, Sun\}$
- $\emptyset$ - empty set
- $\mathbb{N}$ - set of Natural Numbers
- $\mathbb{Z}$ - set of all Integers
- $\mathbb{R}$ - set of all Real Numbers
- $x \in X$ x is an element of set X
- $X \subseteq Y$ all elements of X ale elements of Y
- $X \subset Y$ X is a proper subset of Y, that is all elements in X are also elements of Y and $X \neq Y 13$

6.2 Power Sets

- We use the notation 2^s to denote the power-set of S, that is the set of all subsets of S
- Any subset R of 2^s is a set family of s
- If S has n elements, then 2^s has 2^n elements.

- We use notation card(a) or $|A|$ or #A
- For any finite A the following is true: $card(2^A) = 2^{card(A)}$

7 Algebra and logic