# Chapter 3
# Theory

## 3.1 Basic Notions

**Exercise 3.1 (World Logic)** Answer to the following questions:

- What are the main characteristics of a representation language?
- What is the difference between extensional and intentional representations?
- What is the difference between an atomic formula and a complex formula?
- What is an interpretation function?
- What is entailment and what are its properties?
- What are the desired properties of logic languages?
- When it is the case that a theory is correct and complete?
- Can you describe the main reasoning problems?

**Exercise 3.2 (Ambiguity)** Indicate which of the following statements regarding the modeling process are TRUE (one or more):

- Given an observed phenomenon, there are always different modeling of the same phenomenon, due to differences in perceptions or conceptualizations by different people.
- Abstraction is a modeling process that allows us to identify aspects of the observed phenomenon that are relevant to the problem to be solved.
- A source of ambiguity comes from using two different terms in language to denote the same object in the world.

**Exercise 3.3** Indicate which of the following statements about world models (World Logics) are TRUE (one or more):

- A model is a set of atomic analog representations, i.e., representations that cannot be further decomposed.
- An assertional theory always correctly represents all and only the facts of the model it describes.
- A domain is the set of all possible facts that are used to represent the world.

- An assertional language contains at least one assertion for each fact contained in the domain it describes.
- ER models are linguistic representations of the world for which an assertional theory can be constructed by defining an interpretation function.

**Exercise 3.4 (Logic)** Indicate which of the following statements about logics are TRUE (one or more):

1. The interpretation function is defined only for atomic formulas, and not necessarily all of them.
2. A theory can describe more than one model and, dually, a model can be described by more than one theory.
3. Solving a model checking problem consists of checking whether a theory $\mathcal{T}$ is correct and complete with respect to a model `M`.
4. $\mathcal{T}_2$ is a logical consequence of $\mathcal{T}_1$ ("$\mathcal{T}_1$ logically entails $\mathcal{T}_2$") if every model of $\mathcal{T}_1$ is also a model of $\mathcal{T}_2$.
5. A representational language contains atomic assertions, complex assertions (where atomic assertions and complex assertions constitute atomic formulas), and complex formulas.