Formal Verification (FV): viewing a program as a logical argument and determining whether it behaves correctly using symbolic reasoning.

What is logical reasoning?

- Premises : facts
- Conclusions: what we deduce from the premises. The conclusion logically follows from the facts.
  ↳ Example: if the train arrives late and there are no taxis at the station, then John is late for his meeting. John is not late for his meeting. The train did arrive late. Were there taxis at the station?
    ↳ Yes!

What is formal logic?

- Syntax : acceptable sentence in the logic
- Semantics : what the symbols and sentences in the logic mean.
- proof theory: how the valid proofs in the logic are constructed.
- Logic provides :
  ↳ A language for expressing knowledge precisely (modelling / specification)
  ↳ A way to reason about the consequences of that knowledge rigorously (proof / verification)
- A logic is formal if there is only one possible interpretation of a formula in the language.

- formal logic is concerned with the structure of the argument.
- we use symbols in the syntax to represent phrases in the sentences. It's also called symbolic logic.
  - ↳ using symbols allows us to conquer complexity and eliminate non-logical aspects of argument.

- Propositional logic : a declarative sentence that is either true or false, but not both.

- Predicate logic: a means of describing relationships between objects, and a quantification over objects.
  - ↳ eg: "every course has an instructor."

- specification: ways of describing what a system is required to do.

- program correctness: a progam is correct iff the output is correct for every input.