# Introduction

PLC: Chapter 1



# Basic Terminology

## Meta and Object Language

💡 **Definition of Meta and Object Language**
An object language is a language you study (e.g., C#, C) using a meta language.

A meta language is the language in which we conduct our discussions, in this course F#

## Interpreter

💡 **Interpreter**
An interpreter for a program written in some language is one that evaluates the abstract syntax.

## Environment

💡 **Environment**
When we work with variables we need an environment which maps variable names to values. Typically done with a tuple list:

```
let env = [("a", 3); ("c", 78); ("baf", 666); ("b", 111)];;
```

## Syntax and Semantics

💡 **Syntax**
Syntax deals with form: is this program text well-formed?

We distinguish between two kinds of syntax:

- Concrete Syntax
  - The representation of a program as a text, with whitespace, curly braces etc.
- Abstract Syntax
  - The representation of a program as a tree, e.g., F# datatype `CstI` etc.

💡 **Semantics**
Semantics deals with meaning: What does this well-formed program mean?

We distinguish between two kinds of semantics:

- Dynamic Semantics
  - The meaning or effect of a program at run-time; what happens when it is executed. May be expressed by `eval` functions.

For the rest of the course we take the following approach:

- **Abstract Syntax:** F# datatypes

- **Concrete Syntax:** Lexer and Parser specifications
- **Semantics:** F# functions, both static semantics (checks) and dynamic semantics (execution). Can be described by direct interpretation using functions, or by compilation to another language.

# Simple Expr Language

Found in Chapter 1: `Inro2.fs`

A simple expression language with support for:

- Integer constants
- Variables
- Primitive operators +, -, *

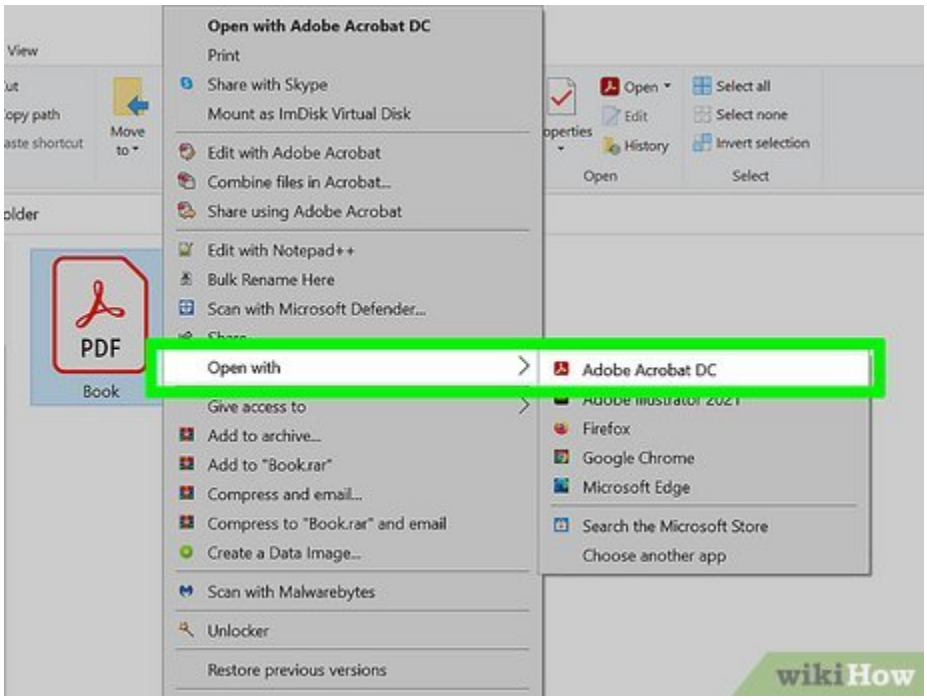
Variable mappings are stored in an environment list.

```
module Intro2

type expr =
  | CstI of int
  | Var of string
  | Prim of string * expr * expr;;

let rec lookup env x =
    match env with
    | []        -> failwith (x + " not found")
    | (y, v)::r -> if x=y then v else lookup r x

let rec eval e (env : (string * int) list) : int =
    match e with
    | CstI i            -> i
    | Var x             -> lookup env x
    | Prim("+", e1, e2) -> eval e1 env + eval e2 env
    | Prim("*", e1, e2) -> eval e1 env * eval e2 env
    | Prim("-", e1, e2) -> eval e1 env - eval e2 env
    | Prim _            -> failwith "unknown primitive"
```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