2. Functional Programming & Scheme

Lecture 02 -- Programming Paradigms.pdf
Functions are first-class citizens: In languages supporting this feature, functions can be passed as arguments, returned as values, and assigned to variables.

Three major elements of language

These elements are fundamentals in the structure and operation of any programming language.

- Primitives: Basic elements that the language provides. Strings, booleans, integers etc.
  - Self-evaluating primitives: Their value is the object itself. Booleans, strings, numbers.
  - Built-in procedures: + , - , * , >, =, string=?, string-lenght
- Means of Combination: How different elements can be combined. Ex: (+ 2 3)
- Means of Abstraction: The ability to hide details and show only the essential features. (define score 23)

Question: What does esoteric mean?

Scheme Basics

- Self-evaluating: Some entities, like numbers, are self-evaluating, which means they evaluate to themselves.
- Name: If a name (or identifier) is encountered, the interpreter will return the value associated with that name in the current environment.
- Special form: These are syntactic constructs that have a unique evaluation mechanism. For example, `if`, `define`, and `lambda` are special forms in Scheme.
- Combination: A combination is a list where the first element is an operator, and the remaining elements are operands. The interpreter evaluates all sub-expressions of the combination and then applies the operator to the values of the operands.

Question: Do interpreters evaluate nested primitive statements in bottom-up or top-down fashion?

Rules For Evaluation

1. If self-evaluating, return value.
2. If a name, return value associated with name in environment.
3. If a special form, do something special.
4. If a combination, then
   a. Evaluate all of the subexpressions of the combination (in any order)

b. apply the operator to the values of the operands (arguments) and return the result

Rules For Application

1. If procedure is **primitive procedure**, just do it.
2. If procedure is a **compound procedure**, then:
   Evaluate the body of the procedure with each formal parameter replaced by the corresponding actual argument value.

Read-Eval-Print Loop (REPL)

An interactive programming environment where commands are read, evaluated, and the results are printed in a loop.