

Welcome to cs655 - 801 (Spring-2020)

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- Office hour: TBD
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(<https://github.com/amir734jj/cs655-lecture-notes>)

Compiler Steps (according to textbook)

- Front-end:
 - Lexical analysis
 - Tokenizing
 - Syntax analysis
 - Parsing
 - Semantic analysis
 - Name resolution, binding, type-checking
 - Optimize AST
 - Intermediate code generation
- Back-end
 - Code generation
 - Machine independent code generation
 - Target code generation
 - Machine specific code generation

Essential Concepts

- AST
- BNF / E-BNF (Option, Repetition, Grouping, Concatination)
- Visitor pattern

Reading Recommendations

- Cool manual
- Textbook
- ◦ optional textbook "Dragon Book"

Cool

Subset of Scala

Cool or "Classroom Object Oriented Language" is a:

- static (not dynamic): types are determined at the compile-time as oppose to run-time
- strong (not weak): restrictions for type conversions
- manifest (not inferred): variable types are explicitly defined as oppose to implicit

Cool (Cont.)

More about "static" aspect.

Types are defined (or deduced) in AST (or Abstract Syntax Tree) before code is generated.

In dynamic languages like Python, JavaScript types are derived at the run-time hence, REPL
(or Read–Eval–Print-Loop).

Cool (Cont.)

More about manifest.

Unlike Scala which is a super-set of Cool, we have to be explicit about types. Scala comes with "duck" typing.

```
var i : Int = 234;
```


Cool syntax vs Java (part #1)

```
public class HelloWorld {  
    public static void main(String[] args) {  
        System.out.println("Hello, World");  
    }  
}
```

```
// We need to extend IO to be able to use `out`  
class Main() extends IO() {  
    // This is a expression "block"  
    // All block expressions that are "feature" (or root level) run after primary constructor is invoked  
    {  
        out("Hello, World");  
    }  
}
```

Cool syntax vs Java (part #2)

```
public class HelloWorld {  
    public static int factorial(int n) {  
        return n == 0 ? 1 : n * factorial(n - 1);  
    }  
  
    public static void main(String[] args) {  
        System.out.println("result: " + factorial(10));  
    }  
}
```

```
class Main() extends IO() {  
    // self keyword is similar to `this`, it's a way to access class scope  
    def factorial(n : Int) = if (n == 0) 1 else self.factorial(n - 1);  
  
    {  
        // Notice how there is no implicit conversion from Int to String unlike java  
        out("result: ".concat(factorial(10).toString()));  
    }  
}
```

Vector

Very similar to ArrayList in Java but not thread-safe and resizes by doubling the size as oppose to increase the size by half.

- Vector
 - size(): Int
 - add(Any): Unit
 - clear(): Unit
 - elements(): Enumeration
- Enumeration:
 - next(): Any
 - hasNext(): Boolean