

# AST

Abstract syntax tree (AST), or just syntax tree, is a tree representation of the abstract syntactic structure of source code written in a programming language.

# Terms

- Formal
- Actual
- Attribute
- Dispatch
  - Static
  - Dynamic

## Example of AST (#1)

- Given the following expression:

1 + 2

- The output AST would be:

```
+ BinaryExpression
- type: +
- left_value:
  LiteralExpr:
    value: 1
- right_value:
  LiteralExpr:
    value: 2
```

## Example of AST (#2)

- Given the following expression:

```
if (2 > 6) {  
    var d = 90  
    console.log(d)  
}
```

**Example of AST (#2) Cont.**

The output AST would be:

```
IfStatement
- condition
+ BinaryExpression
  - type: >
  - left_value: 2
  - right_value: 6
- body
  [
    - Assign
      - left: 'd';
      - right:
        LiteralExpr:
          - value: 90
    - MethodCall:
      - instanceName: console
      - methodName: log
      - args: [
        ]
  ]
]
```

# Lab exercise

Let's try to construct the AST for the following cool program

```
{  
  var i: Int = 0;  
  var b: Boolean = false;  
  while (i < 20) {  
    if (b) {  
      out("Pow!")  
    } else ();  
  
    b = !b;  
    i = i + 1  
  }  
}
```



# Solution

```
@265 = block:22
  @264 = let:22 'i 'Int
    @240 = int_lit:12 '0
    @263 = block:22
      @262 = let:22 'b 'Boolean
        @241 = bool_lit:13 false
        @261 = block:22
          @260 = loop:22
            @244 = lt:14
              @242 = variable:14 'i
              @243 = int_lit:14 '20
            @259 = block:21
              @251 = cond:17
                @245 = variable:15 'b
                @249 = block:17
                  @248 = dispatch:17 'out
                  @247 = variable:17 'this
                  @246 = string_lit:16 'Pow!
                @250 = unit:17
              @254 = assign:19 'b
              @253 = comp:19
                @252 = variable:19 'b
              @258 = assign:21 'i
              @257 = add:21
                @255 = variable:20 'i
                @256 = int_lit:21 '1
```

# Lab assignment

Follow "Cool Tour" to construct "Queens.cool" given it's AST. Basically reverse engineer the cool program from its AST.