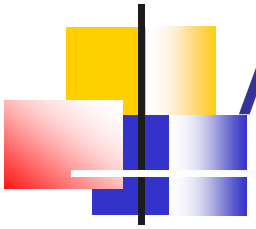
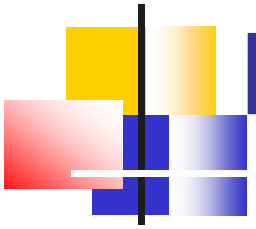


Abstract Syntax Trees

- The parser's output is an abstract syntax tree (AST) representing the grammatical structure of the parsed input
- ASTs represent only semantically meaningful aspects of input program, unlike concrete syntax trees which record the complete textual form of the input
  - There's no need to record keywords or punctuation like (), ;, else
  - The rest of compiler only cares about the abstract structure



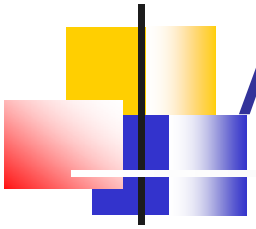
MiniJava AST Node Classes

Each node in an AST is an instance of an AST class

- `e.g. If`, `Assign`, `Plus`, `VarDecl`, etc.

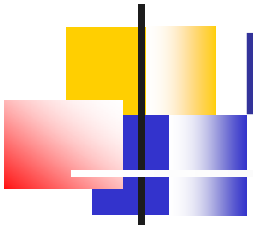
Each AST class declares its own instance variables holding its AST subtrees

- `If` has `Exp`, and 2 `Statement`
- `Assign` has `Identifier` and `Exp`
- `Plus` has 2 `Exp`
- `VarDecl` has `Type` and `Identifier`



AST Class Hierarchy

- AST classes are organized into an inheritance hierarchy based on commonalities of meaning and structure
- Each "abstract non-terminal" that has multiple alternative concrete forms will have an abstract class that's the superclass of the various alternative forms
  - `Statement` is abstract superclass of `If`, `Assign`, etc.
  - `Exp` is abstract superclass of `Plus`, `IdentifierExp`, etc.
  - `Type` is abstract superclass of `IntegerType`, `IdentifierType`, etc.

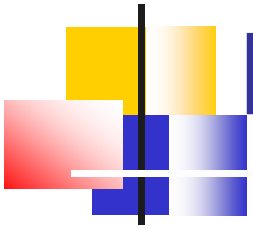


Productions

- All of the form:

```
LHS ::=  RHS1 {: Java code 1 :}
       | RHS2 {: Java code 2 :}
       | ...
       | RHSn {: Java code n :};
```

- Can label symbols in RHS with `:var` suffix to refer to its result value in Java code
  - `varleft` is set to line in input where `var` symbol was



Productions (cont.)

- Example

```
Exp ::= Exp:arg1 PLUS Exp:arg2
    {: RESULT = new AddExp(arg1, arg2,
                           arg1left);:}
| INT_LITERAL:value{: RESULT = new
  IntegerLiteral(     value,valueleft);:}
| Exp:rcvr PERIOD Identifier:message
  OPEN_PAREN ExpList:args CLOSE_PAREN
{: RESULT = new Call(
       rcvr,message,args,rcvrleft);:}
| ... ;
```