

CSc 453

Compilers and Systems Software

14 : Intermediate Code II

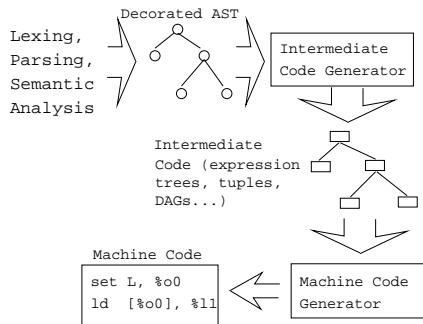
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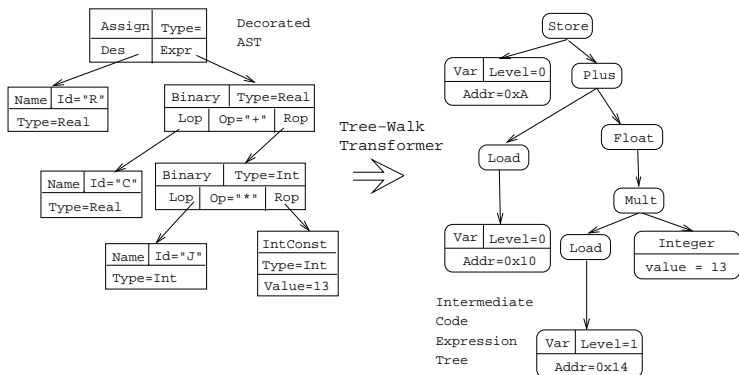
Intermediate Code Generation

Intermediate Code Generation



- After semantic analysis we traverse the AST and emit the correct intermediate code.

Generating Expression Trees



- An expression tree is generated from an AST. The `float` can easily be inserted since all types are known in the AST.

Generating Quadruples

- To generate quadruples from an AST we make an extra traversal of the tree after semantic analysis.
- Each AST node in an expression sub-tree is given an attribute \uparrow Place:**SymbolT** which represents the name of the identifier or temporary in which the value of the subtree will be computed.

Generating Quadruples...

```
PROCEDURE Program (n: Node);  
    Decl(n.DeclSeq);  
    Stat(n.StatSeq);  
END;
```

```
PROCEDURE Decl (n: Node);  
    IF n.Kind = ProcDecl THEN  
        Decl(n.Locals);  
        Decl(n.Next);  
        Stat(n.StatSeq);  
    ENDIF  
END;
```

Generating Quadruples. . .

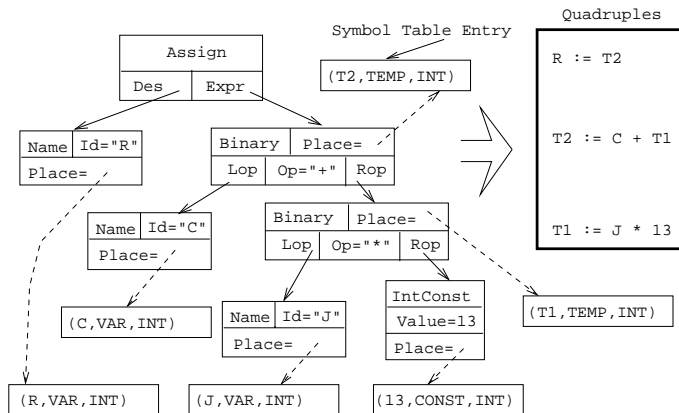
- NewTemp generates a new temporary var.

```
PROCEDURE Stat (n: Node);  
  IF n.Kind = Assign THEN  
    Expr(n.Des);  
    Expr(n.Expr);  
    Emit(n.Des.Place := n.Expr.Place);  
    Stat(n.Next);  
  ENDIF  
END;
```

Generating Quadruples...

```
PROCEDURE Expr (n: Node);
  IF n.Kind = Add THEN
    Expr(n.LOP);
    Expr(n.ROP);
    n.Place := NewTemp();
    Emit(n.Place ':=' n.LOP.Place '+' n.ROP.Place);
  ELSIF n.Kind = VarRef THEN
    n.Place := n.Symbol;
  ENDIF
END;
```


Generating Quadruples...



Attribute Grammar Notation

Attribute Grammar

- The tree-walker is better described using an attribute grammar notation.

```
Assign ::= Des:Expr Expr:Expr  
{ Emit(n.Des.Place ':=' n.Expr.Place); }
```

```
Add ::= LOP:Expr ROP:Expr  
{ n.Place := NewTemp();  
  Emit(n.Place ':=' n.LOP.Place '+' n.ROP.Place);  
}
```

```
Name ::= Ident  
{ n.Place := n.Symbol; }
```

Summary

Readings and References

- Read Louden:
Generating Intermediate Code 407–410