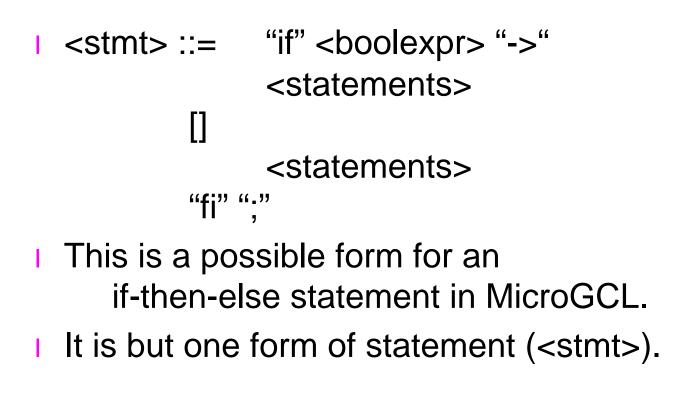
### Designing Semantic Structures

#### Thinking Like a Compiler Designer

# Step 1-- Language Design

- Start by defining the language cleanly and developing a sound grammar.
- Good language design leads to good compiler design.
- Languages should be largely LL(1) so that predictive parsing can be done by humans. Compilers need not be LL(1).

# **Example-- if-then-else**



# Step 2. Look at an Example

- A sample if-then-else statement might be:
- if a < b -> write a; [] write b; fi;
- Pick a simple, but representative example to work with. (In some cases one example isn't sufficient to cover the possible options.)

# Step 3. Write Output Code

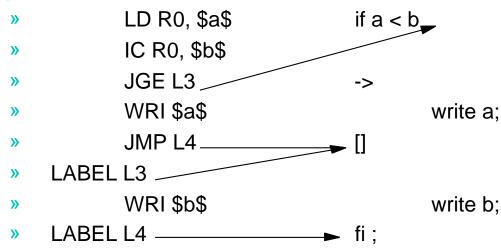
By hand, write down the code for your example in the target language.

| <b>»</b> | LD R0, \$a\$ | if a < b |
|----------|--------------|----------|
| <b>»</b> | IC R0, \$b\$ |          |
| <b>»</b> | JGE L3       | ->       |
| <b>»</b> | WRI \$a\$    | write a; |
| <b>»</b> | JMP L4       | []       |
| <b>»</b> | LABEL L3     |          |
| <b>»</b> | WRI \$b\$    | write b; |
| <b>»</b> | LABEL L4     | fi;      |

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# Step 4. Analyze

Find the earliest point at which you can generate each piece of code.



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## **Step 4. continued**

- You now know where to put semantic routines.

# **Step 5. The Parameters**

- Now determine what information each semantic routine needs to initiate generation of the required code.
- This gives you the input parameters of that routine.
- The location at which that information is first known gives the output parameters of the routine at that location.

## **Step 5. continued**

- #iftest needs the operator from the <boolexpr> and a label. It can create the label. Therefore the <boolexpr> must return the operator and pass it to #iftest
- #elsepart needs the label from #iftest and another label that it can generate
  #endif needs the label from #elsepart.

## **Step 5. continued**

- #iftest receives an operator record and returns a label record with a new label.
- #elsepart receives the label record from #startif and returns a modified label record with a new label.
- #endif receives the label record returned by #elsepart.

#### Notes

- If you have a complex situation, you may need to try more than one example.
- Your goal is to place semantic routines to cover all cases, but to do so as cleanly as possible.

You also want to pass as little information as reasonable.

### **Notes continued**

- The values returned by a semantic routine are held as local variables in the parsing routine that contains the call to the semantic routine. Alternatively they are stored on a stack.
- They are never stored in fixed global variables, since the language is likely recursive.