CSE443
Compilers

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Phases of a compiler

Intermediate Representation (IR): specification and generation

Figure 1.6, page 5 of text
Intermediate Representation (IR)

we’ll use IR defined in textbook: the "three address code"
Three address code instructions (see 6.2.1, pages 364-5)

1. \( x = y \text{ op } z \)
2. \( x = \text{ op } y \) (treat \textit{i2r} and \textit{r2i} as unary ops)
3. \( x = y \)
4. \text{goto L}
5. \text{if x goto L / ifFalse x goto L}
6. \text{if x relop y goto L}
7. \text{function calls:}
   - \text{param x}
   - \text{call p, n}
   - \( y = \text{call p} \)
   - \text{return y}
8. \( x = y[i] \) and \( x[i] = y \)
9. \( x = \&y, \ x = *y, \ *x = y \)

We'll start with these.

We'll spend significant time on function calls later.

We'll explore these as needed later on.
type information

What information does a type convey?

How is type information used during compilation?
type information

What information does a type convey?
- type indicates size
- type indicates storage location
  (a) primitives: either stack or heap
  (b) records: on heap (via pointer)
  (c) arrays: on heap (via pointer)
  (d) functions: code in static, locals on stack

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How is type information used during compilation?
- determines how to lay out records, arrays, invocation records in memory
- determines how to translate names in program to memory accesses
- determines which instructions to use to manipulate values in memory

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Sizes of types

- int: 32 bits (2’s complement)
- real: 64 bits (IEEE 754)
- Boolean: 8 bits (TBD: machine dependent)
- character: 8 bit (ASCII)
- address: 64 bits
Sizes/layouts of values of types

- **type string:** 1 \(\rightarrow\) character

- **4 bytes + length of string \(*\) size of character** (\(=\) 1 byte)

- **\# of dimensions is part of type**

<table>
<thead>
<tr>
<th>size of dimension 1 (integer)</th>
<th>(0)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0 0 5</td>
<td>V</td>
<td>A</td>
<td>X</td>
<td>E</td>
<td>S</td>
</tr>
</tbody>
</table>

https://en.wikipedia.org/wiki/VAX