Macro languages

Purpose: to improve readability of other code, abstraction, textual manipulation

Examples: Cpp, LaTeX, M4, macros in Lisp

Notable features: usually lexical (character or text) based, with some exceptions (Lisp, Rust)

Macro languages

Feet

- LaTeX:

```
\documentclass[12pt]{article}
\usepackage{latexgun,latexshoot}
\begin{document}
See how easy it is to shoot yourself in the foot? \\
\gun[leftfoot]{shoot} \\
\pain
\end{document}
```

Macro languages

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Particularly *conditional macros* whose expansion depends on other factors

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#ifdef SMALLINT
#define NUMBER short
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```

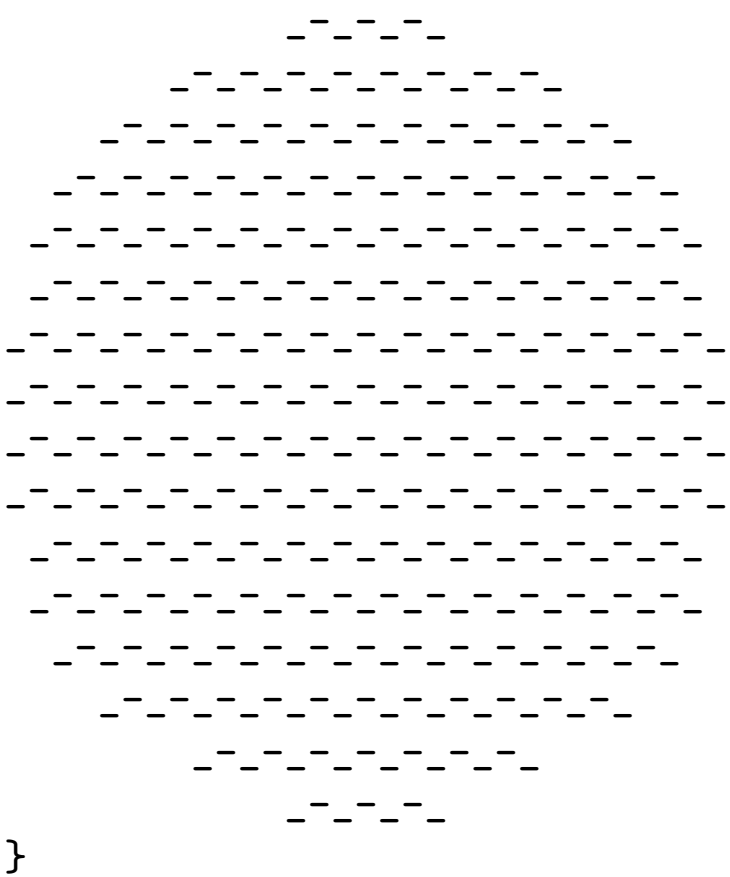
Then if we use `NUMBER` everywhere in our code

```
NUMBER x;
...
```

it takes only a single change to make our code use `short` rather than `int`: very useful for source code portability between architectures

C

```
#define _ F-->00||-F-OO--;
int F=00,OO=00;main(){F_OO();printf("%1.3f\n",4.*-F/OO/OO);}F_OO()
{
```



```
}
```

An enthusiastic use of C macros by Brian Westley

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The compiler then compiles `(car x)`

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```
(defmacro baz (l m)
  (if (> m 0)
      (list 'car l)
      (list 'cdr l)))
```

Will expand `baz` at compile time to a `car` or a `cdr`

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```
\begin{frame}
\frametitle{Macro languages}
\framesubtitle{\LaTeX}

Sometimes macros are used in their own right, e.g.,
\LaTeX, the typesetting language is macro based

\paruncover2{These slides are written in \LaTeX}
\end{frame}
```

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For example, a new chapter needs a new page, a big heading, lots of space before the next text

So you define a macro, say `\chapter`, that does all this

Usually, someone else has created an entire macro package so you don't have to

Scripting Languages

Purpose: control of other elements of a system, e.g., programs, “glue” to join elements together

Examples: DOS batch, sh, Python, Sed, Perl, Ruby, JavaScript . . .

Notable features: not particularly good at classical number crunching; generally lots of string processing and process manipulation

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Often, but not exclusively, interpreted rather than compiled

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- JavaScript: You've perfected a robust, rich user experience for shooting yourself in the foot. You then find that bullets are disabled on your gun

Scripting Languages

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For example, IBM's JCL was used to describe a list of programs to be loaded and run: recall batch processing

Scripting Languages

Feet

- JCL: You send your foot down to MIS with a 4000-page document explaining how you want it to be shot. Three years later, your foot comes back deep-fried

Scripting Languages

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The Unix command line language, originally sh (the Bourne Shell), lately bash (the Bourne Again shell)

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```
#!/bin/sh
setxkbmap -option "compose:menu" -option "ctrl:nocaps"
dispwin -L
[ "$XAUTHORITY" ] && cp -f "$XAUTHORITY" ~/.Xauthority
```

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Somewhat low-level, so not so good for more complex tasks, or less complex programmers

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String manipulation: sed is a *stream editor*

Reads files one line at a time (as a *stream*) and edits them, one line at a time, according to given rules

`sed -e 's/hello/goodbye/'`
Substitutes `goodbye` for occurrences of `hello` in its input

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More general is *awk*, but better is *Perl*

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Perl

Perl is/was used a lot in Web page creation and manipulation, amongst many other things

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The basic datatype is the string

The basic operation is pattern matching

It is also procedural, has first class functions, has objects and so on

The syntax is the usual C/Java/whatever, but with a few features

Scripting Languages

Perl

```
open IN, '<', 'infile';
open OUT, '>outfile';
$count = 0;
while (<IN>) {
  s/world/everybody/ if (/hello/);
  print OUT;
  $count++;
}
close IN;
close OUT;
print "$count lines\n";
```

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- and false at end of file
- it assigns to the variable `$_`

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- flexibility over `()` around function arguments

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And it is easy to write unreadable code in Perl

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Web applications like Google Maps are coded using JavaScript

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This allows easy modification and extension (using "add-ons")

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Java and JavaScript are **different** languages

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But you shouldn’t take this analogy too far

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- JScript: Microsoft
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- JavaScript: Sun/Mozilla/etc.
- JScript: Microsoft
- ActionScript: Adobe

Ecma: formerly *European Computer Manufacturers Association*, now just “Ecma International”, is a standards body

Scripting Languages

JavaScript

```
function getdoc()
{
   var input = document.getElementById("num");
   var num = input.value;

   if (parseInt(num) == num && num > 0 && num < 5000) {
     document.location = "http://www.rfc-editor.org/rfc/rfc"
                         + num + ".txt";
   }
   else {
     alert("Not a valid RFC number!");
     input.value = "";
   }
   return false;
}
```

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- variables declared by `var`, no type declarations
- a variable can hold items of any type
- syntax reminiscent of Java (and C and so on)

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We shall be talking more about JavaScript when we examine OO in detail