CS342: Organization of Prog. Languages

Topic 19:
And Now For Something Completely Different

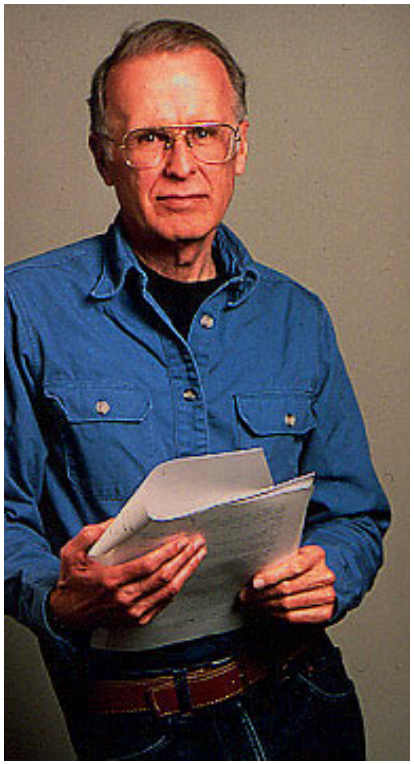
- John Backus, in memoriam.
- How well do you know C?
- Scheme 5 vs Common Lisp vs Scheme 6
- Fortran and Fortress

John Backus

- 1924 born. Initially studied chemistry. Drafted into US Army. Began medical training. Diagnosed with brain tumor, removed. Training as radio technician.
- Studied mathematics at Columbia. Masters at age 25.
- 1950 joined IBM. Worked on project to calculate position of moon.
- 1954 assembled team to develop Fortran. First HLL to be used widely.
- Part of committee to develop Algol 58 and Algol 60. Invented BNF for this (notation for context-free grammars).
- Later worked on functional programming:
  "Can programming be liberated from the von Neumann style? A functional style and its algebra of programs" (CACM August 1978).
- IBM Fellow 1963, Turing Award 1977, Draper Prize 1993.

- Turing award citation:
  For profound, influential, and lasting contributions to the design of practical high-level programming systems, notably through his work on FORTRAN, and for seminal publication of formal procedures for the specification of programming languages.

- 2007 died age 82.



How Well Do you Know C?

- The International Obfuscated C Code Contest
  `http://www0.us.ioccc.org/main.html`
- 19th IOCCC Competetion closed Feb 28.
- Goals:
  - To write the most obscure/obfuscated C program under the rules.
  - To show the importance of programming style, in an ironic way.
  - To stress C compilers with unusual code.
  - To illustrate some of the subtleties of the C language.
  - To provide a safe forum for poor C code. :-)
- Rules (excerpt):
  - Complete, original ANSI C program $\leq$ 4096 bytes, $\leq$ 2048 bytes excluding white space, etc.
  - Legal abuse of the rules is somewhat encouraged.

Example

```
int i;main(){for(;i["]<i;++i){--i;}"];read('-'-'-',i+++"hell\
o, world!\n",'/'/'/'));}read(j,i,p){write(j/p+p,i---j,i/i);}
```

- Prints "hello world!", anoymous 1984.

What?

```
int i;main(){for(;i["]<i;++i){--i;}"];read('-'-'-',i+++"hell\
o, world!\n",'/'/'/'));}read(j,i,p){write(j/p+p,i---j,i/i);}
```

What?

```
int i;

main() {
    for( ;
        i["]<i;++i){--i;}"];
        read('-'-'-',i+++"hello, world!\n",'/'/'/')
    ) ;
}

read(j,i,p) { write(j/p+p, i---j, i/i); }
```

What?

```
int i;

main() {
    for( ;
        i["]<i;++i){--i;}"];
        read(0,i+++"hello, world!\n",'/'/'/')
    ) ;
}

read(j,i,p) { write(j/p+p, i---j, i/i); }
```

What?

```
int i;

main() {
    for( ;
        i["]<i;++i){--i;}"];
        read(0,i+++"hello, world!\n",1)
    ) ;
}

read(j,i,p) { write(j/p+p, i---j, i/i); }
```

What?

```
int i;

main() {
    for( ;
        i["]<i;++i){--i;}"];
        w(0,i+++"hello, world!\n",1)
    ) ;
}

w(j,i,p) { write(0/1+1, i---0, i/i); }
```

What?

```
int i;

main() {
    for( ;
        i["]<i;++i){--i;}"];
        w(i+++"hello, world!\n")
    ) ;
}

w(i) { write(1, i--, 1); }
```

What?

```
int i;
char *t = "]<i;++i){--i;}";
char *h = "hello, world!\n";

main() {
    for( ;
        i[t];
        w(i+++h)
    ) ;
}

w(i) { write(1, i--, 1); }
```

What?

```
int i;
char *t = "]<i;++i){--i;}";
char *h = "hello, world!\n";

main() {
    for( ; t[i] != 0; w(i+++h))
        ;
}

w(i) { write(1, i--, 1); }
```

What?

```
int i;
char *t = "xxxxxxxxxxxxxx";
char *h = "hello, world!\n";

main() {
    for( ; t[i] != 0; w(i+++h))
        ;
}

w(s) { write(1, s, 1); }
```

What?

```
int i;
char *t = "xxxxxxxxxxxxxx";
char *h = "hello, world!\n";

main() {
    for( ; t[i] != 0; w(h+i), i++)
        ;
}

w(s) { write(1, s, 1); }
```

What?

```
int i;
char *t = "xxxxxxxxxxxxxx";
char *h = "hello, world!\n";

main() {
    for( ; t[i] != 0; i++)
        w(h+i);
}

w(s) { write(1, s, 1); }
```

What?

```
int i;
char *h = "hello, world!\n";

main() {
    for(i = 0 ; i < 14; i++)
        w(h+i);
}

w(s) { write(1, s, 1); }
```

Other Examples

- Arachnid.c: an amazing program
  `http://www0.us.ioccc.org/2004/arachnid.c`
  `http://www0.us.ioccc.org/2004/arachnid.hint`

- Gavare.c: no keywords
  `http://www0.us.ioccc.org/2004/gavare.c`
  `http://www0.us.ioccc.org/2004/gavare.hint`

- Gavin.c: an operating system
  `http://www0.us.ioccc.org/2004/gavin.c`
  `http://www0.us.ioccc.org/2004/gavin.hint`

- Jason.c: an adventure game (think Zork)
  `http://www0.us.ioccc.org/2001/jason.c`
  `http://www0.us.ioccc.org/2001/jason.hint`

- Primenum.c: Not a prime number generator
  `http://www0.us.ioccc.org/2000/primenum.c`
  `http://www0.us.ioccc.org/2000/primenum.hint`

- Vic2.c: A prime number generator
  `http://www0.us.ioccc.org/2004/vik2.c`
  `http://www0.us.ioccc.org/2004/vik2.hint`

Scheme vs Common Lisp

- Scheme: Developed — 1970s by Gerald Jay Sussman and Guy Steele.
  Common Lisp: Developed — 1980s by committee.

- Scheme: Philosophy – minimalist
  Common Lisp: Philosophy — comprehensive.
- Scheme: Definition — 50 pages.
  Common Lisp: Definition — 1029 pages.
- Scheme: Namespaces — 1.
  Common Lisp: Namespaces — ≥ 3.
- Scheme: Binding — lexical.
  Common Lisp: Binding — lexical or dynamic.
- ...
- Scheme v6: Designed by committee.

Common Lisp

- Attempt to provide what was actually used in large lisp applications in various dialects.

- Package model (imports, exports, namespaces, inheritance).
- Keyword arguments to functions
- setf
- defstruct
- complex arrays
- Separate function and value spaces.
- Common Lisp Object System (CLOS)

Common Lisp Applications

- Orbitz travel booking.
- Xanalys investigation sw (police, security, fraud prevention).
- Jak and Daxter playstation games.
- Maxima (open source version of Macsyma)

Fortran

- Fortran 1960..present
- Efficient numerical programming.
- Most serious scientific computation on supercomputers.
- Looooooots of legacy. Good. Bad. Ugly.

Fortran Overhang

- fixed format source
- Hollerith format
- spaces irrelevant
- array layout and aliasing
- call by reference

Fortran Merits

- Compilers vectorize loop computations.
- Primitive operations for smart inter-processor communication of array data (e.g. cshift)
- Data placement aware. Important in super computing.

Fortran Successors

- Fortran, Fortran II, III, IV, 66, 77, 90, 95, 2003, 2008.

- Several efforts to produce a "successor" to Fortran.
- F — Subset of Fortran 95
- Fortran 2003. OO, polynoprhism, etc etc etc.
- Fortress at Sun,
  `http://research.sun.com/projects/plrg/fortress0618.pdf`