TinyBASIC: Interactive programming system

Commodore 64 BASIC and emulators

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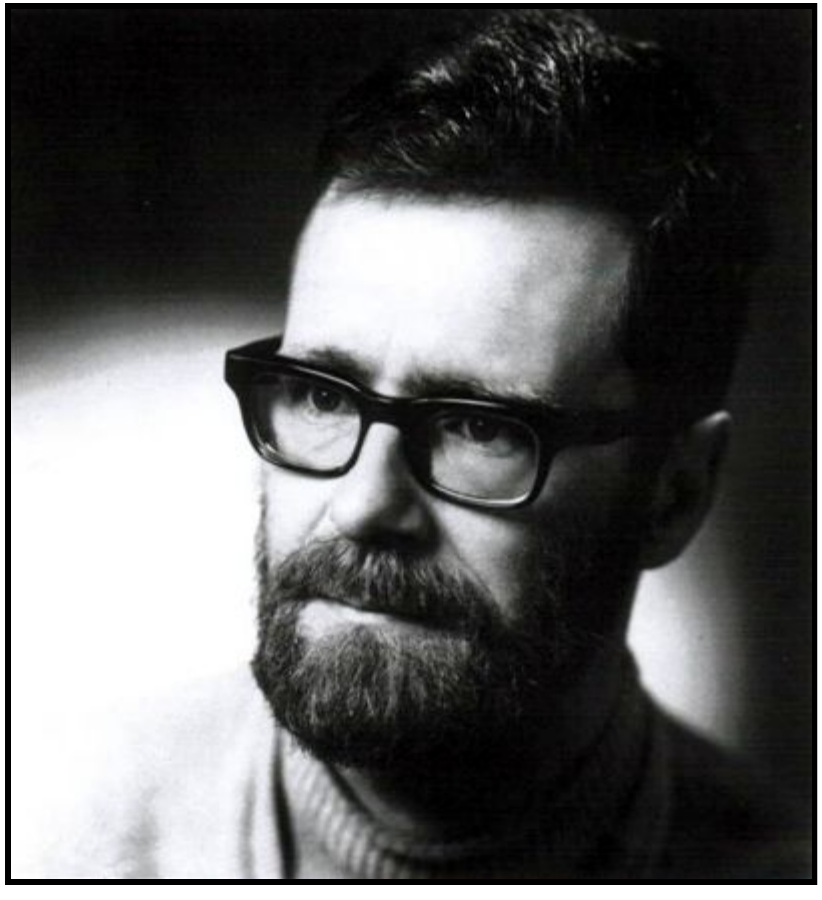

BASIC as a language?

Edsger Dijkstra on BASIC...

It is practically impossible to teach good programming to students that have had a prior exposure to BASIC: as potential programmers they are mentally mutilated beyond hope of regeneration.

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Why look at BASIC?

BASIC as a programming system

- Right at the birth of microcomputers
- Part of an early computing culture
- Interesting mode of interaction!

BASIC as a programming problem

- Interpreter with richer state
- Statements vs. expressions
- More interesting F# programming!

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Demo
Writing BASIC in C64 emulator

Realistic machine-level system emulator

All the clever hacks with **POKE** work!

See: C64 emulator

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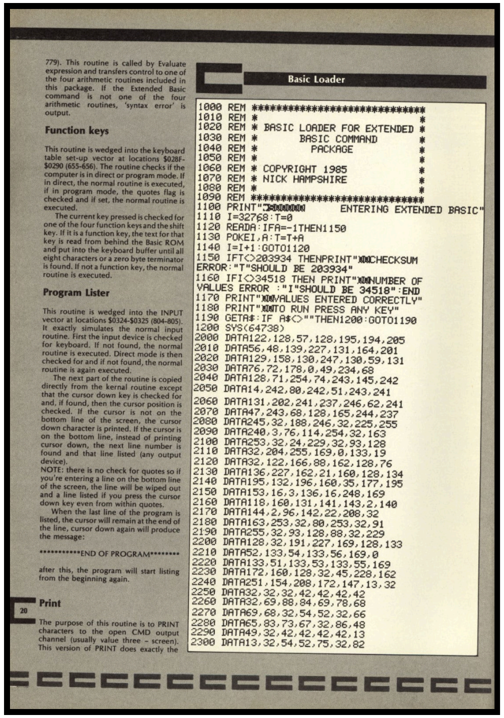
What is interesting about it?

Learnability

- Your computer boots into BASIC
- Copy games code from magazines


Function keys

Program Lister

Print

Basic Loader

```
1000 REM ******************************
1010 REM *                            *
1020 REM * BASIC LOADER FOR EXTENDED *
1030 REM *       BASIC COMMAND        *
1040 REM *          PACKAGE           *
1050 REM *                            *
1060 REM * COPYRIGHT 1985             *
1070 REM * NICK HAMPSHIRE             *
1080 REM *                            *
1090 REM ******************************
1100 PRINT"          ENTERING EXTENDED BASIC"
1110 I=32768:T=0
1120 READA:IFA=-1THEN1150
1130 POKEI,A:T=T+A
1140 I=I+1:GOTO1120
1150 IFT<>203934 THENPRINT"CHECKSUM
ERROR:"T"SHOULD BE 203934"
1160 IFI<>34518 THEN PRINT"NUMBER OF
VALUES ERROR :"I"SHOULD BE 34518":END
1170 PRINT"VALUES ENTERED CORRECTLY"
1180 PRINT"TO RUN PRESS ANY KEY"
1190 GETA$:IF A$<>""THEN1200:GOTO1190
1200 SYS(64738)
2000 DATA122,128,57,128,195,194,205
2010 DATA56,48,139,227,131,164,201
2020 DATA129,158,130,247,130,59,131
2030 DATA76,72,178,0,49,234,68
2040 DATA128,71,254,74,243,145,242
2050 DATA14,242,80,242,51,243,241
2060 DATA131,202,241,237,246,62,241
2070 DATA47,243,68,128,165,244,237
2080 DATA245,32,188,246,32,225,255
2090 DATA240,3,76,114,254,32,163
2100 DATA253,32,24,229,32,93,128
2110 DATA32,204,255,169,0,133,19
2120 DATA32,122,166,88,162,128,76
2130 DATA136,227,162,21,160,128,134
2140 DATA195,132,196,160,35,177,195
2150 DATA153,16,3,136,16,248,169
2160 DATA118,160,131,141,143,2,140
2170 DATA144,2,96,142,22,208,32
2180 DATA163,253,32,80,253,32,91
2190 DATA255,32,93,128,88,32,229
2200 DATA128,32,191,227,169,128,133
2210 DATA52,133,54,133,56,169,0
2220 DATA133,51,133,53,133,55,169
2230 DATA172,160,128,32,45,228,162
2240 DATA251,154,208,172,147,13,32
2250 DATA32,32,32,42,42,42,42
2260 DATA32,69,88,84,69,78,68
2270 DATA69,68,32,54,52,32,66
2280 DATA65,83,73,67,32,86,48
2290 DATA49,32,42,42,42,42,13
2300 DATA13,32,54,52,75,32,82
```

From novice to hacker

- Easy to write basic programs
- Much more with **POKE** and **SYS**!

Interaction mode

- Code editor and REPL at the same time

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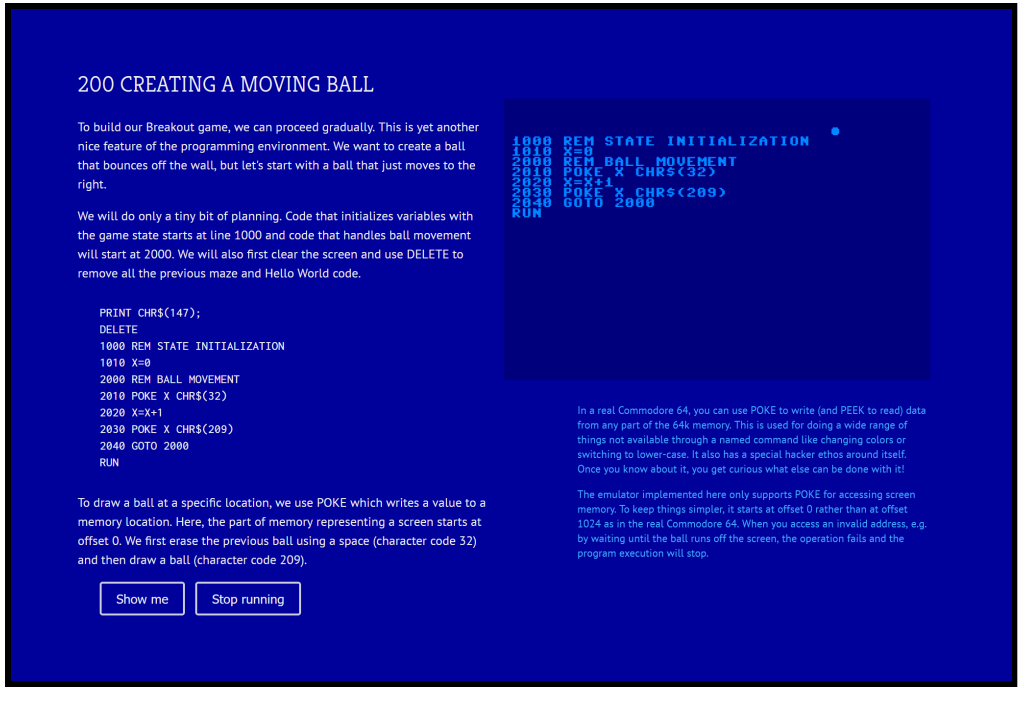

Demo

My C64 essay

Explore the interaction

How it helps write, test and debug code?

Not fully accurate

Program does not live in memory, **POKE** offsets are wrong

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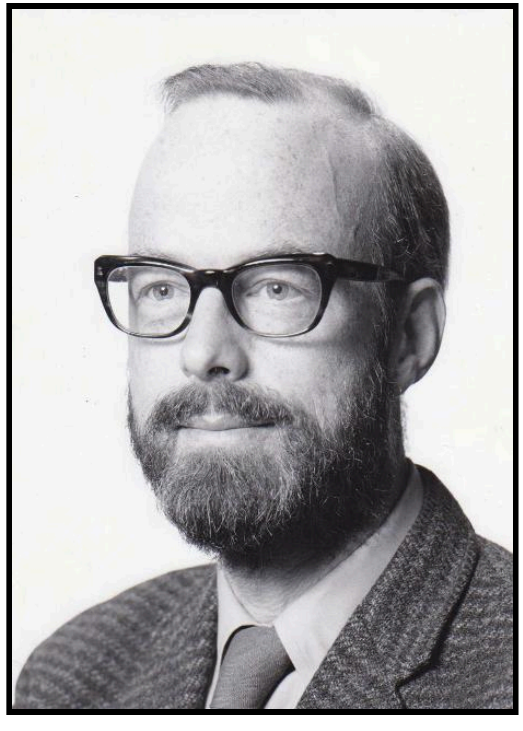
A bit of theory

Reasoning about programs

Reasoning about programs

Functional languages

- Compositional semantics
- Define meaning of $e_1 + e_2$ in terms of the meaning of e_1 and e_2



Imperative languages

- What is the meaning of `PRINT "HI"`?
- What is the meaning of `GOTO 10`?
- Whatever the interpreter does..
- Not very good for program proofs!

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```
 00 REM FACTORIAL IN BASIC
 10 Q=5
 20 N=1
 30 F=1
 40 IF N=Q THEN GOTO 100
 50 N=N+1
 60 F=F*N
 70 GOTO 40
100 PRINT F
```

Reasoning about BASIC programs

Hoare triples $\{P\}c\{Q\}$

Pre-condition P what is true before the command execution

Post-condition Q what is true after the command execution

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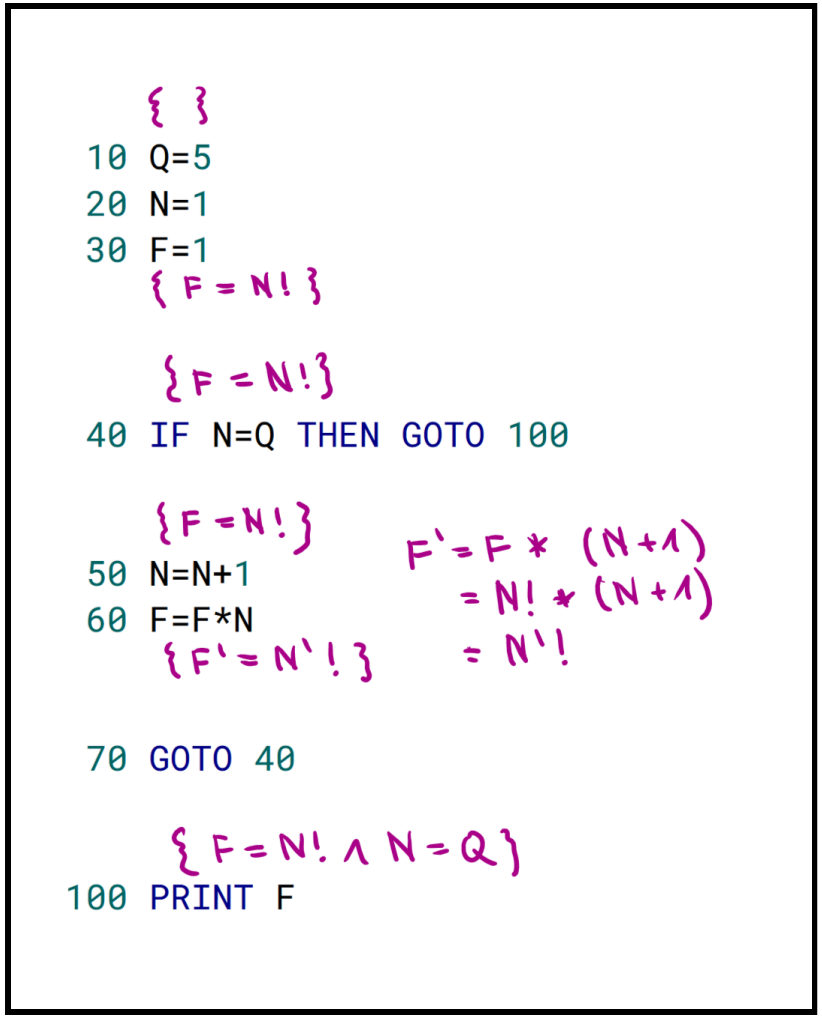

Reasoning about BASIC programs

Postconditions of a command before have to match preconditions of a command after

Coming up with the right properties is tricky!

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