

# BASIC: A retrospective and appreciation for Linux in 2021

April 2021

John Nash

# History

## BASIC (Beginners' All-purpose Symbolic Instruction Code)

- John G. Kemeny and Thomas E. Kurtz, Dartmouth College in 1964 (later follow-up with True BASIC, “sort of”)
- Timesharing systems in late 1960s
- Microcomputers – Gates & Allen 1975
  - Others followed, e.g., North Star BASIC
    - > BASICA/GWBASIC -->QBASIC, Turbo BASIC
    - > Visual BASIC (which is different!)
- ISO-6373-1984 Minimal BASIC (JN voted on it in ‘83)
  - Since “withdrawn”: Why? When?

# Boundaries for This Review

- Keep to the “Minimal BASIC” genre
- Explore what is available for Linux users
- Consider possible value and uses of these tools but **NOT**
  - In any way a claim that this is how one should program today
  - Argue that BASIC is/was “wonderful”  
*We used what was available and worked!*

# What does (Minimal) BASIC offer?

- A useful tool for exploring “small” algorithms
- Prior to Perl/Python, a scripting language (usually with local OS extensions – N\* BASIC could read/write memory etc. PEEK/POKE)
- Modest didactic illustrations of programming structures, at least for traditional functional programming
- Huge legacy collection of (possibly rubbish) programs

# My BASIC version

From June and December 1975:

*Discussion paper: a characterization of BASIC*

8 pages; considers what is allowed in a subset of BASICs to prepare numerical (and some string) software to allow partial cross-platform use.

Left out: I/O streams, CALL, calculator mode

***VERY RUDIMENTARY, BUT USABLE***

Rather similar to ISO 6373:1984 (JN Canadian delegate to ISO in 1983 voting meeting in Geneva).

# Running old BASIC programs

*“Like old times”*

- Microsoft Open Sourced ? GWBASIC (May 21,2020)  
<https://devblogs.microsoft.com/commandline/microsoft-open-sources-gw-basic/>
- <https://gw-basic.com/> -- lots of resources to download,  
IF the sites are still there!
- <https://sourceforge.net/projects/pcbasic/> -- emulator
  - python3-pcbasic is in the Linux Mint repo.
- <https://smallbasic.github.io/> -- Ubuntu version 2020 July
  - IDE a bit awkward (small fonts); fast



# Running old BASIC programs (2)

- BAS: <http://www.moria.de/~michael/bas/> -- tarball of bas2.5 is linked, but Arch website points to 2.6 on same site.
  - Needs `configure/make/'sudo make install'`
- <https://www.thefreecountry.com/compilers/basic.shtml> -- appears to be maintained up to mid-2020
- Chipmunk BASIC -- <http://www.nicholson.com/rhn/basic/>
  - Many platforms, including Pi.
- Bywater Basic: <https://sourceforge.net/projects/bwbasic/>
  - Package `bwbasic` in Linux Mint

# Arithmetic and BASIC

- BASIC predated IEEE arithmetic by 2 decades
  - All flavours! North Star had a decimal floating-point in both software and a hardware FP board
  - NEC PC8201a and Radio Shack TRS80 Model 100 were both Kyocera derivatives but one (?RS) had decimal and other binary arithmetic.
  - Kahan -> Karpinski and others: PARANOIA to determine internal arithmetic
    - Program calceps.bas used here. Smallest number such that  $1+\text{eps} > 1$  is the “machine epsilon”



# Precision?

Program calceps.bas computes radix and number of digits. e.g., radix 2, 24 digits -->

$$\text{eps} = 2^{(-23)} = 1.192093\text{e-}07$$

Some BASICs allow “DEFDBL A-Z”, in which case

$$\text{dbleps} = 2^{(-55)} = 2.77556\text{D-}17$$

- R has `.Machine$double.eps = 2.220446e-16`
- Many difficult details re: implicit bits, denormalized numbers, etc.

# Variety in Radix:No.of digits

<i>Interpreter</i>	<i>calceps.bas</i>	<i>calcepsd.bas</i>
PCBASIC	2 : 24	2 : 56
Bas	2 : 53	2 : 53
Bywater	2 : 53	2 : 53
GWBASIC	2 : 24	2 : 56
SmallBASIC	128 : 7	N/A ???!
Chipmunk	2 : 53	N/A

# Speed varies?

Loop  $i$  from 1 to  $n$ :  $\exp(\sin(\cos(i)))$

Framework	secs/million	base $n$
DosBox-reg-GWBASIC	53222	10,000
PCBASIC	219.5313	10,000
DosBox-max-GWBASIC	330	100,000
Bwbasic	233	10,000,000
Bas	15	10,000,000
SmallBASIC	2	10,000,000
Chipmunk	1.6	100,000,000

Note the extreme range of speeds.

# Differing sums

`sum(exp(sin(cos(i))))` for  $i=1$  to  $n$  using  $n=10000$

DosBox-GWBASIC:	12029.85
PCBASIC:	12029.85
Bywater	12029.8254087
Bas	12029.83
SmallBASIC:	12029.82540864

# Some Sample programs

- I find many on web sites are trivial
- Many of my own are “utilities” e.g., CRLF to CR for text files. Better tools exist.
- Let’s try some that have some content.
  - DOLDAYS: effective interest rate earned.
  - XNSY3A: very long period uniform RNG
  - Largest small hexagon: constrained optimization

# DOLDAYS + DAILINT

- Have dates (YYYYMMDD) and amounts, as well as total interest earned.
- What was effective rate? Is daily interest worthwhile?
- **WARNING:** have not checked correctness recently. Codes converted from North Star BASIC (\ to : is all I had to do! BUT N\* had 8 digit decimal arithmetic).



# XNSY3A

- Nash, Sande, Young 30 decimal digit generator
- A linear congruential pseudo-random number generator

$$X(i+1) = ( M * X(i) + 1 ) \text{ mod } P$$

where  $M = 949,646,992,329,231,482,614,750,213,261$

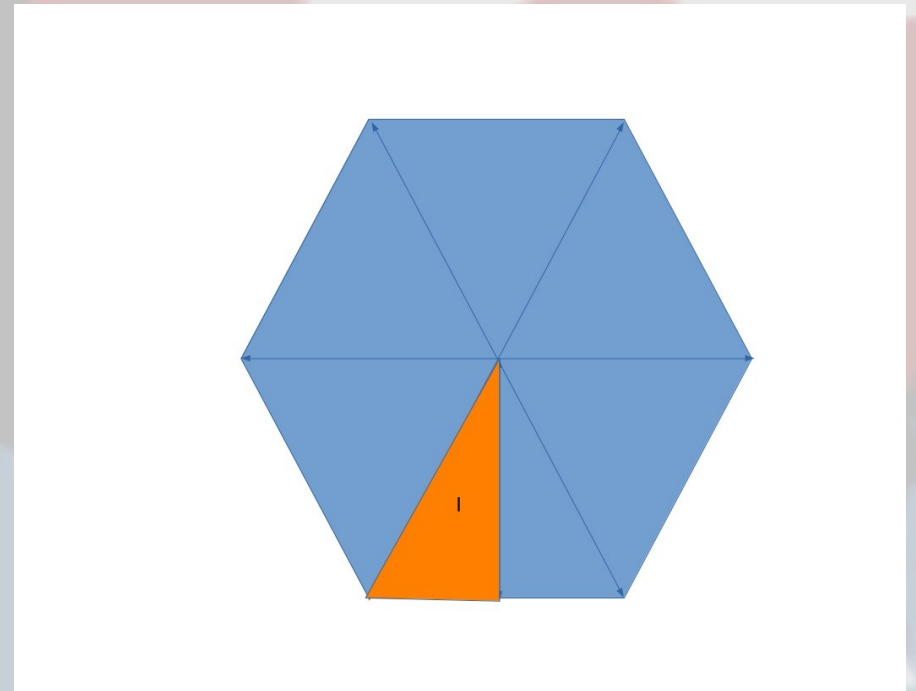
and  $P = 1,000,000,000,000,000,000,000,000,000,000$

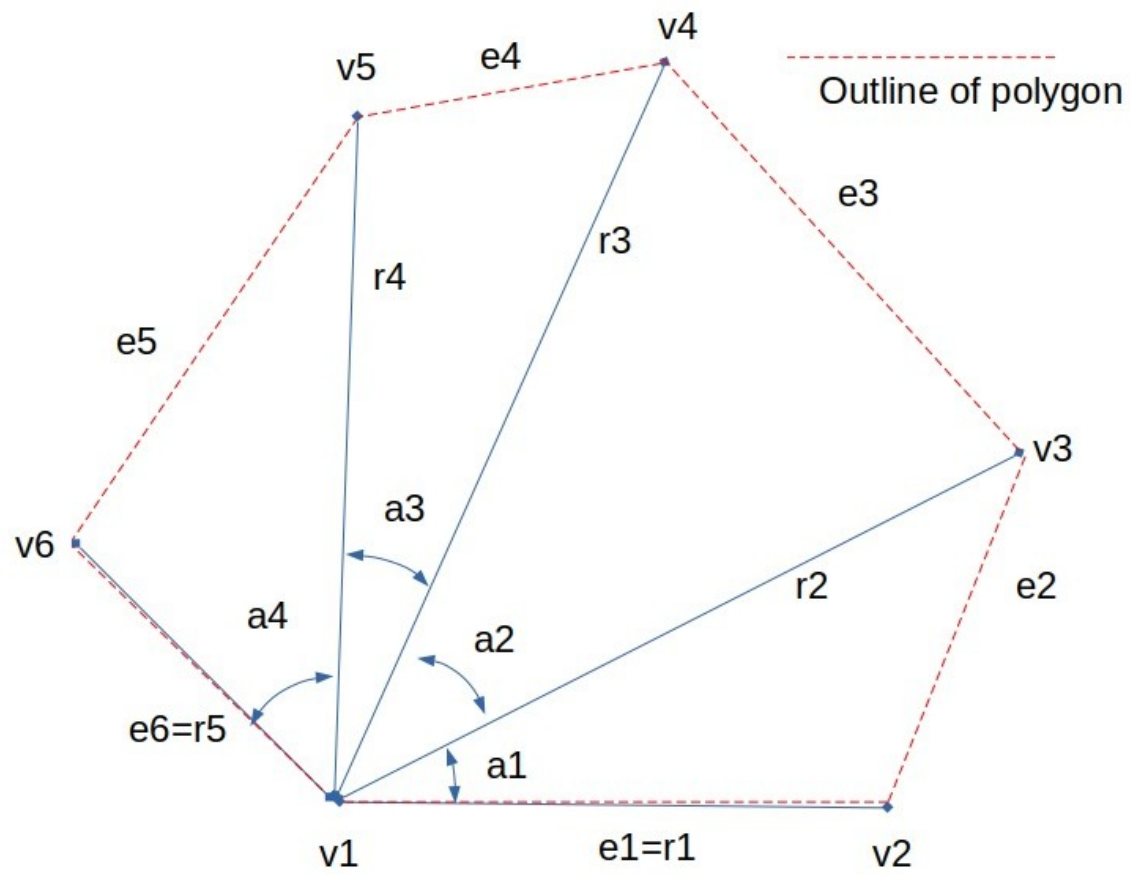
$$= 1E30 = 10^{30} = 10^{**30}$$

- Never published: referees didn't understand that good RNGs need long period (and some still don't).

# Largest Small Hexagon

- What is largest area n-sided polygon where no vertex is more than 1 unit from another. (n=6)
- Area 'reghex' is 0.6495191
- Set up as optimization
- Bounds on parameters
- Penalty for rest, using  
 $-2 * \text{Area} + \text{penalty} * \text{violation}$
- Programs minimize





# Notes-1

<https://smallbasic.github.io/> -- downloaded vn 12.19 amd64 deb for Ubuntu (July 16, 2020 date). There is a new release Jan 8, 2021, but not yet as deb). This provides a menu for smallBASIC that loads an IDE but it is very small on screen and difficult to see. However, does seem to show files. Clicked on bastimer.bas. Ctrl-R ran it VERY fast, but time resolution seems to be to second. How to get output into a file?

DOSBOX did not like bastimer.bas until line ending converted to DOS type. Remember to  
"MOUNT c: /home/john/current/BASIC-interpreters"

"yabasic": kept giving "Could not parse program" – seems very awkward

"python3-pcbasic" – called with pcbasic – seems to run well. In Linux Mint repos.

"my\_basic" : Could not get this to run – looks to be like Visual Basic

python3-pcbasic mimics GWBASIC except for screen (Hercules) graphics

Can run Microsoft with 'wine GWBASIC.EXE' in DOSBOX