Forth83 Benchmarks#

Below is a collection of some Benchmarks for Forth83 systems like VolksForth.

I found most of these benchmarks on <u>comp.lang.forth</u>, <u>Hans Bzemers</u> <u>4th</u> and Marcel Hendrix benchmark collection

Table of Contents

- Forth83 Benchmarks
- Results
- Benchme Helper
- Integer Calculations
- Fibonacci 1
- Fibonacci 2
- Forth Nesting Benchmark
- Forth Memory Move Benchmark
- count bits in byte
- Sieve Benchmark
- Greatest Common Divisor
- Takeuchi
- simple 6502 emulator

Results#

Name	System	Forth	Benchmark	Time (sec/ round)	
Carsten Strotmann	Atari Portfolio 8088 4.92Mhz	VolksForth MS- DOS (ITC)	Integer Calc	4.96	
Carsten Strotmann	Amstrad NC100 Z80 4.606Mhz	VolksForth CP/ M (ITC)	Integer Calc	6.23	
Martin Metz	Amstrad NC100 Z80 4.606Mhz	VolksForth CP/ M (ITC)	GCD 1	38.1	
Andreas Böhm	Commodore C64 6510	Audiogenic Forth-64	Integer Calc	526	
Andreas Böhm	Commodore C64 6510	Audiogenic Forth-64	Count Bits	140.22	
Andreas Böhm	Commodore C64 6510	Audiogenic Forth-64	Sieve Bench	18.1	
Andreas Böhm	Commodore C64 6510	Audiogenic Forth-64	GCD 1	215.52	
Andreas Böhm	Commodore C64 6510	Audiogenic Forth-64	GCD 2	84.84	
H. Jakob	c't 86 8086 5Mhz	Laxen/Perry F83	Integer Calc	9	
Neil Franklin	HP 100LX 80186 7.9Mhz	VolksForth 3.81.41 MS- DOS	Integer Calc	2.8	
Carsten Strotmann	Atari 130XE 6502 1.79Mhz	VolksForth 3.81	Integer Calc	596	
Carsten Strotmann	Atari 130XE 6502 1.79Mhz noDMA	VolksForth 3.81	Integer Calc	438	
J. Kunz	DEC 3000-600 Alpha 21064 175Mhz	pForth	Integer Calc	0.091	
J. Kunz	DEC 3000-600 Alpha 21064 175Mhz	pForth	Fibonacci 1	0.0038	
J. Kunz	DEC 3000-600 Alpha 21064 175Mhz	pForth	Fibonacci 2	0.00001425	
J. Kunz	DEC 3000-600 Alpha 21064 175Mhz	pForth	Nesting 32Mil	22	
J. Kunz	DEC 3000-600 Alpha 21064 175Mhz	pForth	6502emu	18	
Ingo Soetebier	Nextstation 68040 33Mhz	pfe	Nesting 1Mil	340	
KC85 Team	KC85/4 U880 4Mhz	VolksForth CP/ M	Nesting 1Mil	144	
Venty	Thinkpad T61, 2Ghz Core Duo	gforth-fast, Linux	Integer Calc	0.0013	
Venty	Thinkpad T61, 2Ghz Core Duo	gforth, Linux	Integer Calc	0.0019	
Venty		gforth-fast, Linux	Nesting 32Mil	3.9	

	Nokia N900				
	ARM A8				
	600Mhz				
Venty	Nokia N900	gforth-fast,	Sieve Bench	0.015	
Volley	ARM A8	Linux	Olovo Bollon	0.010	
	600Mhz	LITUX			
Venty	Nokia N900	gforth-fast,	6502emu	1	
Verity	ARM A8		0502emu	l l	
		Linux			
	600Mhz		N 0014"	<u> </u>	
Venty	Nokia N900	gforth-dtc, Linux	Nesting 32Mil	5.5	
	ARM A8				
	600Mhz				
Venty	Nokia N900	gforth-dtc, Linux	Sieve Bench	0.025	
	ARM A8				
	600Mhz				
Venty	Nokia N900	gforth-dtc, Linux	6502emu	1.8	
	ARM A8				
	600Mhz				
Venty	Nokia N900	gforth-itc, Linux	Nesting 32Mil	6.9	
Volity	ARM A8	giorai ito, Eiriax	Trooting oziviii	0.5	
	600Mhz				
Vantu			Ciava Danah	0.000	
Venty	Nokia N900	gforth-itc, Linux	Sieve Bench	0.028	
	ARM A8				
	600Mhz				
Venty	Nokia N900	gforth-itc, Linux	6502emu	2.2	
	ARM A8				
	600Mhz				
Thorsten	Amiga 3000	jforth	Integer Bench	0.24	
Kuphaldt	68030 25Mhz				
Thorsten	Amiga 3000	iforth	Nesting 1Mil	1.32	
Kuphaldt	68030 25Mhz	ĺ			
Thorsten	Amiga 3000	iforth	Memory Move	0.67	
Kuphaldt	68030 25Mhz				
Thorsten	Amiga 3000	iforth	Sieve Bench	0.148	
	68030 25Mhz		Sieve Delicii	0.140	
Kuphaldt		:f()-	000 4	0.04	
Thorsten	Amiga 3000	jforth	GCD 1	0.64	
Kuphaldt	68030 25Mhz				
Stefan Herold	Amstrad 6128+	Uniforth	Integer Calc	17	
	Z80A 4Mhz				
Stefan Herold	Amstrad 6128+	Uniforth	Fibonacci 2	0.23	
	Z80A 4Mhz				
Stefan Herold	Amstrad 6128+	Uniforth	Nesting 1Mil	206	
	Z80A 4Mhz				
Stefan Herold	Amstrad 6128+	Uniforth	Sieve Bench	12	
Otoran Horola	Z80A 4Mhz	O'mora'i	Diovo Borion	-	
Ingo Soetebier	iBook PPC	OpenFirmware	Integer Calc	0.03	
ingo Soetebler		OpenFilliwate	integer Calc	0.03	
	750lx (G3)				
	600Mhz	<u></u>			
Ingo Soetebier	iBook PPC	OpenFirmware	Fibonacci 1	0.0026	
	750lx (G3)				
	600Mhz				
Ingo Soetebier		OpenFirmware	Fibonacci 2	0.0027	
Ingo Soetebier		OpenFirmware	Fibonacci 2	0.0027	

	iBook PPC				
	750lx (G3)				
	600Mhz				
Ingo Cootobios		On an Firmurara	Nooting 4Mil	4	
Ingo Soetebier	1	OpenFirmware	Nesting 1Mil	1	
	750lx (G3)				
	600Mhz	0 5	6: 5	0.004	
Ingo Soetebier	1	OpenFirmware	Sieve Bench	0.031	
	750lx (G3)				
	600Mhz				
Ingo Soetebier	1	OpenFirmware	GCD 1	0.024	
	750lx (G3)				
	600Mhz				
Michael Kalus	Rockwell	RSC-Forth	Fibonacci 1	16.09	
	R1200-14, 2Mhz				
	65F12				
Michael Kalus	Rockwell	RSC-Forth	Fibonacci 2	0.05	
	R1200-14, 2Mhz				
	65F12				
Michael Kalus		RSC-Forth	Nesting 1Mil	149	
l la	R1200-14, 2Mhz		i tootii ig i iiiii		
	65F12				
Michael Kalus		RSC-Forth	Integer Calc	31	
IVIICIIaei Naius	R1200-14, 2Mhz		integer Calc	31	
	65F12				
Matthias Truta		and Courts 4.4	Intonor Colo	1.50	
Matthias Trute	5	amForth 4.4	Integer Calc	1.56	
	8MHz		F.,		
Matthias Trute	5	amForth 4.4	Fibonacci 1	1.46	
	8MHz				
Matthias Trute	5	amForth 4.4	Fibonacci 2	0.0047	
	8MHz				
Matthias Trute	Atmega16	amForth 4.4	Nesting 1Mil	15.4	
	8MHz				
Matthias Trute	Atmega16	amForth 4.4	Nesting 32Mil	489	
	8MHz				
Matthias Trute	Atmega16	amForth 4.4	GCD 1	7.12	
	8MHz				
Matthias Trute	Atmega16	amForth 4.4	GCD 2	10.5	
	8MHz				
Matthias Trute		amForth 4.4	Takeuchi	0.7	
Matthias Trate	8MHz		Tanodom	0.7	
Michael Kalus	MSP430FR5739	CamelForth	Integer Calc	02'45':10	
IVIICIIaei Kaius	8Mhz DCO		100x	0245.10	
	intern MSP-		TOOX		
	EXP430FR5739				
	Experimenter				
Minharl	Board	O a rea a ! E = :: !!	FID4 400	001401-00	
Michael Kalus	MSP430FR5739	∟ame⊩orth	FIB1 100x	00'46':39	
	8Mhz DCO				
	intern MSP-				
	EXP430FR5739				
	Experimenter				
	Board				
Michael Kalus		CamelForth	FIB2 10000x	00'16':91	
		-	-	-	

	MCD420EDE720				
	MSP430FR5739	,			
	8Mhz DCO				
	intern MSP-				
	EXP430FR5739				
	Experimenter				
	Board				
Michael Kalus	MSP430FR5739	CamelForth	Nesting 32Mil	02'31':23	
	8Mhz DCO				
	intern MSP-				
	EXP430FR5739				
	Experimenter				
	Board				
Carsten	IBM L40S	mina (Fig-Forth)	Fib2 (1000)	8s	
Strotmann	(386SX)				
Carsten	IBM L40X	F83 (Laxen &	Fib2 (1000)	8s	
Strotmann		Perry)	,		
Carsten	IBM L40X	GNU Forth 0.5.0	Fib2 (1000)	24s	
Strotmann		ec8086	(,		
Carsten	IBM L40X	VolksForth MS-	Fibonacci 1	0.36s	
Strotmann	(386SX)	DOS		0.000	
Thorsten	,	Aber Forth (FIG-	Integer	25s	
Schoeler	Spectrum+	Forth)	linogoi	203	
Thorsten	"	"	prime	11s	
Schoeler			prime	113	
Thorsten	 II	 H	Nesting 1m	3m17s	
Schoeler			ivesting iiii	3111175	
	lii	 	CCD4	Om 1.4a	
Thorsten Schoeler			GCD1	2m14s	
	lii	lu	F:h0 (4000)	4.55.405	
Thorsten			Fib2 (1000)	1m46s	
Schoeler	11)/ 00	F F d	E'' 0 (4000)	0 40 .	
Thorsten	HX-20	Epson Forth	Fib2 (1000)	3m16s	
Schoeler	11)/ 00	E1.0	N	01.10.10	
Thorsten	HX-20	"	Nesting 32mil	2h43m49s	
Schoeler					
Thorsten	HX-20	"	Nesting 1mil	5m08s	
Schoeler					
Thorsten	HX-20	"	Integer 32tsd	1m03s	
Schoeler					
Thorsten	HX-20 6301	"	Prime	23s	
Schoeler	614khz				
Wolfgang Stief	SUN	OpenFirmware	Integer	0,14s	
	SparcStation 10				
	TI TMS390255				
Wolfgang Stief	SUN	OpenFirmware	Fib1	0,005s	
	SparcStation 10				
	Tİ TMS390255				
Wolfgang Stief	SUN	OpenFirmware	Fib2	0,2s	
3. 9. 1	SparcStation 10				
	Ti TMS390255				
Wolfgang Stief	SUN	OpenFirmware	Memory Move	143s	
	SparcStation 10	- - - - - - - - - - - - -			
	TI TMS390255				
Wolfgang Stief		OpenFirmware	Prime	0,11s	
1.75545 001		-	<u></u>	l-, .	

SparcStation 10		SUN			
Wolfgang Stief		1			
Wolfgang Stief SUN SparcStation 10 T1 TMS390255 OpenFirmware GCD2 O,65s SparcStation 10 T1 TMS390255 OpenFirmware SparcStation 10 T1 TMS390255 OpenFirmware SparcStation 10 T1 TMS390255 SUN OpenFirmware SparcStation 10 T1 TMS390255 SUN Ultra 1 200 OpenBoot 3.25 Integer O,33s Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Mtz UltraSprac Mtz UltraSprac Mtz UltraSprac Sun Ultra 1 200 OpenBoot 3.25 Mtz UltraSprac Mtz UltraSprac Sun Ultra 1 200 OpenBoot 3.25 Sun Ultra 1 200 OpenBoot 3.		1 '			
SparcStation 10	Wolfgong Ctiof		OpanFirmwara	CCD1	0.510
Wolfgang Stief SUN Sun SparcStation 10 Ti TMS390255 SUN SparcStation 10 Sun Ultra 1 200 OpenBoot 3.25 Maz UltraSprac Sun Ultra 1 200 OpenBoot 3.25 Sun Ultra	wongang Suei		OpenFilmwaie	GCDT	0,518
Wolfgang Stief SUN SparcStation 10 IT TMS390255 OpenFirmware OpenFirmware SparcStation 10 IT TMS390255 GCD2 0,65s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Integer 0,33s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Fib1 0,014s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Fib2 0,06s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Mesting 32mil 9s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Mempry Move 0,014s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Prime 0,03s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Prime 0,08s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac GCD1 0,08s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Takeuchi 0,009s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Takeuchi 0,009s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Takeuchi 0,009s Wo		1 '			
SparcStation 10	Malforna a Otiaf		O Fi	0000	0.05-
Ti TMS390255 SUN SparcStation 10 Ti TMS390255 SUN Ultra 1 200 OpenBoot 3.25 Integer 0,33s Mz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Fib1 0,014s Mnz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Fib2 0,06s Mnz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Fib2 0,06s Mnz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mmz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 OpenBoot 3.2	vvoligang Stier	1	OpenFirmware	GCD2	0,658
Wolfgang Stief SUN SparcStation 10 Ti TMS390255 SUN Ultra 1 200 OpenBoot 3.25 Integer O,33s Mbz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Fib1 O,014s Mbz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Fib2 O,06s Mbz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Fib2 O,06s Mbz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mempry Move Mbz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mempry Move O,014s Mbz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Prime O,03s Mbz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 GCD1 O,08s Mbz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 GCD2 O,11s Mbz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 GCD2 O,11s Mbz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 GCD2 O,11s Mbz UltraSprac Mbz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 GCD2 O,11s Mbz UltraSprac Mbz UltraSprac Mbz UltraSprac Mbz UltraSprac Fignition Fign		1 '			
SparcStation 10					
Ti TMS390255 SUN Ultra 1 200 OpenBoot 3.25 Integer 0,33s Mrz UltraSprac Mrz Ult	Wolfgang Stief		OpenFirmware	Takeuchi	0,06s
Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Integer 0,33s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Fib1 0,014s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Takeuchi 0,009s Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac Mhz UltraSprac Takeuchi 0,009s Mhz UltraSprac Mhz UltraSp		1 '			
Molfgang Stief					
Wolfgang Stief	Wolfgang Stief	SUN Ultra 1 200	OpenBoot 3.25	Integer	0,33s
Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Fib2 0,06s Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mempry Move Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mempry Move 0,014s Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Prime 0,03s Mempry Move Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 GCD1 0,08s Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 GCD2 0,11s Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 GCD2 0,11s Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Takeuchi 0,009s Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Takeuchi 0,009s Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Takeuchi 0,009s Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Takeuchi 0,009s Mhz UltraSprac Schoeler Atari Falcon Fignition Fignition Forth Fignition Fignition Forth Sekans Integer 0,022s Setfan Atari Falcon Mestegge S8060 100mhz Stefan Atari Falcon Mestegge S8060 100mhz Stefan Atari Falcon Mestegge S8060 Stefan Mestegge S8060		Mhz UltraSprac			
Wolfgang Stief	Wolfgang Stief	SUN Ultra 1 200	OpenBoot 3.25	Fib1	0,014s
Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mesting 32mil 9s		Mhz UltraSprac			
Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mesting 32mil 9s	Wolfgang Stief	SUN Ultra 1 200	OpenBoot 3.25	Fib2	0,06s
Wolfgang Stief			•		
Mhz UltraSprac	Wolfgang Stief		OpenBoot 3.25	Nesting 32mil	9s
Wolfgang Stief					
Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Mrz UltraSprac Mrz Ul	Wolfgang Stief		OpenBoot 3 25	Memory Move	0.014s
Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mnz UltraSprac Prime 0,03s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mnz UltraSprac GCD1 0,08s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mnz UltraSprac GCD2 0,11s Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Mnz UltraSprac Takeuchi 0,009s Thorsten Fignition Fignition Forth fib2 (1000) 13s Schoeler (ATMEL) Fignition Forth fib2 (1000) 13s Stefan Atari Falcom fe8kans Integer 0,022s Niestegge 68060 100mhz Fib2 0,0012s Stefan Atari Falcon fe8kans Countbits 0,05s Niestegge 68060 G8060 O,063s Stefan Atari Falcon fe8kans GCD1 0,063s Niestegge 68060 G8060 O,067s Stefan Atari Falcon fe8kans GCD2 0,067s Niestegge 68060 Forth64 Nesting 32mil 7,4s Niestegge 68060 Nesting 1m	Wongang Cao		OponBoot 0.20	wompry wove	0,0110
Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 GCD1 O,08s Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 GCD2 O,11s Mhz UltraSprac Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 Takeuchi O,009s Mhz UltraSprac Mhz UltraSprac Takeuchi O,009s Mhz UltraSprac Takeuchi O,002s Mazin Takeuchi O,003s Mazin Takeuchi O,003s Mizesegge Mhz UltraSprac Takeuchi O,003s Mizesegge Takeuchi O,003s Mizesegge Mhz UltraSprac Takeuchi O,003s Mizesegge Wolfgang Stief		OpenBoot 3 25	Prima	0.03e	
Wolfgang Stief SUN Ultra 1 200	Wongarig Stier		Ореньоог 3.23	i iiiiG	0,033
Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 GCD2 O,11s	Wolfgong Stiof		OpenPoet 2.25	CCD1	0.090
Wolfgang Stief SUN Ultra 1 200 OpenBoot 3.25 GCD2 O,11s	wollgang Silei		OpenBoot 3.25	GCDT	0,088
Mhz UltraSprac SUN Ultra 1 200 OpenBoot 3.25 Takeuchi 0,009s Mhz UltraSprac Sun Ultra 1 200 OpenBoot 3.25 Takeuchi 0,009s Mhz UltraSprac Fignition Fignition Forth Fib2 (1000) 13s Schoeler ATMEL) Stefan Atari Falcom Fib2 Atari Falcon Fib2 Atari Falcon Fib2 O,0012s Fib2 O,00012s Fib2	Malfara a Otiaf		O D+ 0.05	0000	0.44-
Wolfgang Stief SUN Ultra 1 200 Mhz UltraSprac OpenBoot 3.25 Mhz Ultra 1 200 Mhz UltraSprac Takeuchi 0,009s Thorsten Fignition (ATMEL) Fignition Forth fib2 (1000) 13s Stefan Atari Falcom 68060 100mhz f68kans Integer 0,022s Stefan Atari Falcon 68060 100mhz f68kans Fib2 0,0012s Stefan Atari Falcon 68060 f68kans Countbits 0,05s Stefan Atari Falcon 68060 f68kans GCD1 0,063s Stefan Atari Falcon 68060 f68kans GCD2 0,067s Niestegge 68060 F68kans GCD2 0,067s Niestegge 68060 Resting 32mil 7,4s Niestegge 68060 Resting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 6m20 Kuphaldt C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 16s " C64 (Tur	vvoirgang Stier		OpenBoot 3.25	GCD2	0,118
Mhz UltraSprac	10.16		<u> </u>	-	
Thorsten Schoeler Fignition (ATMEL) Fignition Forth fib2 (1000) 13s Stefan Atari Falcom Niestegge 68060 100mhz f68kans Integer 0,022s Stefan Atari Falcon Niestegge 68060 100mhz f68kans Fib2 0,0012s Stefan Atari Falcon Niestegge 68060 f68kans Countbits 0,05s Stefan Atari Falcon Niestegge 68060 f68kans GCD1 0,063s Stefan Atari Falcon Niestegge 68060 f68kans GCD2 0,067s Niestegge 68060 Stefan Atari Falcon Niestegge f68kans Nesting 32mil 7,4s Niestegge 68060 Nesting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 6m20 Kuphaldt FOGA (Turbo FORTh64 Nesting 1mill 25s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s	Wolfgang Stief	SUN Ultra 1 200	OpenBoot 3.25	l akeuchi	0,009s
Schoeler (ATMEL) Stefan Atari Falcom 68060 100mhz f68kans Integer 0,022s Stefan Atari Falcon 68060 100mhz f68kans Fib2 0,0012s Stefan Atari Falcon 68060 f68kans Countbits 0,05s Stefan Atari Falcon 68060 f68kans GCD1 0,063s Stefan Atari Falcon 68060 f68kans GCD2 0,067s Niestegge 68060 F68kans Nesting 32mil 7,4s Stefan Atari Falcon 68060 Forth64 Nesting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 6m20 Kuphaldt " C64 (Turbo Forth64 Nesting 1mill 25s " C64 (normal) Forth64 Fib2 (1000) 3m50s " C64 (Turbo Forth64 Fib2 (1000) 16s FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s		Minz UltraSprac		(1,000)	
Stefan Atari Falcom 68060 100mhz f68kans Integer 0,022s Stefan Atari Falcon 68060 100mhz f68kans Fib2 0,0012s Stefan Atari Falcon 68060 100mhz f68kans Countbits 0,05s Stefan Atari Falcon 68060 68060 f68kans GCD1 0,063s Stefan Atari Falcon 68060 68060 GCD2 0,067s Stefan Atari Falcon 68080 68060 F68kans Nesting 32mil 7,4s Stefan Atari Falcon 68080 68060 Forth64 Nesting 1mill 6m20 Thorsten Kuphaldt C64 (normal) Forth64 Nesting 1mill 25s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s		-	Fignition Forth	fib2 (1000)	138
Niestegge 68060 100mhz 68kans Fib2 0,0012s Stefan Atari Falcon f68kans Fib2 0,0012s Stefan Atari Falcon f68kans Countbits 0,05s Niestegge 68060 f68kans GCD1 0,063s Stefan Atari Falcon f68kans GCD2 0,067s Niestegge 68060 f68kans GCD2 0,067s Stefan Atari Falcon f68kans Nesting 32mil 7,4s Niestegge 68060 F04 (normal) Forth64 Nesting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 25s Kuphaldt FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (normal) Forth64 Fib2 (1000) 16s " C64 (Turbo FORA 6502) Forth64 Fib2 (1000) 16s " C64 (Turbo FORA 6502) Forth64 Fib2 (1000) 16s		, ,		-	
Stefan Atari Falcon f68kans Fib2 0,0012s Stefan Atari Falcon f68kans Countbits 0,05s Niestegge 68060 68060 0,063s Stefan Atari Falcon f68kans GCD1 0,063s Niestegge 68060 68060 0,067s 0,067s Stefan Atari Falcon f68kans GCD2 0,067s Niestegge 68060 Resting 32mil 7,4s Niestegge 68060 Resting 32mil 7,4s Niestegge 68060 Resting 1mill 6m20 Kuphaldt Resting 1mill 6m20 " C64 (Turbo Forth64 Resting 1mill 25s " C64 (normal) Forth64 Fib2 (1000) 3m50s " C64 (Turbo Forth64 Fib2 (1000) 16s FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s		1	f68kans	Integer	0,022s
Niestegge 68060 100mhz Countbits 0,05s Stefan Atari Falcon f68kans Countbits 0,05s Niestegge 68060 GCD1 0,063s Stefan Atari Falcon f68kans GCD2 0,067s Niestegge 68060 G8060 Nesting 32mil 7,4s Stefan Atari Falcon f68kans Nesting 32mil 7,4s Niestegge 68060 Roscon Nesting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 25s Kuphaldt C64 (Turbo Forth64 Fib2 (1000) 3m50s " C64 (normal) Forth64 Fib2 (1000) 16s " C64 (Turbo FORTh64 Fib2 (1000) 16s FPGA 6502) FreeBSD 9 FICL Integer 0,00075s					
Stefan Atari Falcon f68kans Countbits 0,05s Niestegge 68060 68060 0,063s Stefan Atari Falcon f68kans GCD1 0,063s Niestegge 68060 68060 0,067s 0,067s Stefan Atari Falcon f68kans Nesting 32mil 7,4s Niestegge 68060 68060 Nesting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 25s Kuphaldt FOFDA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo Forth64 Fib2 (1000) 16s " C64 (Turbo FORTh64 Fib2 (1000) 16s FPGA 6502) FreeBSD 9 FICL Integer 0,00075s	1	1	f68kans	Fib2	0,0012s
Niestegge 68060 GCD1 0,063s Stefan Atari Falcon f68kans GCD1 0,063s Stefan Atari Falcon f68kans GCD2 0,067s Niestegge 68060 F68kans Nesting 32mil 7,4s Niestegge 68060 Forth64 Nesting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 25s Kuphaldt FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo Forth64 Fib2 (1000) 16s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s 0,00075s	Niestegge	68060 100mhz			
Stefan Atari Falcon f68kans GCD1 0,063s Niestegge 68060 GCD2 0,067s Stefan Atari Falcon f68kans GCD2 0,067s Niestegge 68060 F68kans Nesting 32mil 7,4s Niestegge 68060 Forth64 Nesting 1mill 6m20 Kuphaldt Forth64 Nesting 1mill 25s FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo Forth64 Fib2 (1000) 16s FPGA 6502) FreeBSD 9 FICL Integer 0,00075s	Stefan	Atari Falcon	f68kans	Countbits	0,05s
Niestegge 68060 GCD2 0,067s Stefan Atari Falcon f68kans GCD2 0,067s Niestegge 68060 f68kans Nesting 32mil 7,4s Niestegge 68060 Forth64 Nesting 1mill 6m20 Kuphaldt Forth64 Nesting 1mill 25s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s	Niestegge	68060			
Stefan Atari Falcon f68kans GCD2 0,067s Niestegge 68060 F68kans Nesting 32mil 7,4s Niestegge 68060 Nesting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 25s Kuphaldt FORA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo Forth64 Fib2 (1000) 16s " C64 (Turbo FORA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s	Stefan	Atari Falcon	f68kans	GCD1	0,063s
Niestegge 68060 Nesting 32mil 7,4s Stefan Atari Falcon f68kans Nesting 32mil 7,4s Niestegge 68060 Nesting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 25s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s	Niestegge	68060			
Niestegge 68060 Nesting 32mil 7,4s Stefan Atari Falcon f68kans Nesting 32mil 7,4s Niestegge 68060 Nesting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 25s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s	Stefan	Atari Falcon	f68kans	GCD2	0.067s
Stefan Atari Falcon f68kans Nesting 32mil 7,4s Niestegge 68060 Forth64 Nesting 1mill 6m20 Thorsten C64 (normal) Forth64 Nesting 1mill 25s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s	Niestegge	1			,
Niestegge 68060 Forth64 Nesting 1mill 6m20 Kuphaldt C64 (Turbo Forth64 Forth64 Fib2 (1000) Porth64 Fib2 (1000) Sm50s " C64 (normal) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FORTh64 Fib2 (1000) Fib2 (1000) 16s FPGA 6502) FreeBSD 9 FICL Integer 0,00075s			f68kans	Nestina 32mil	7.4s
Thorsten C64 (normal) Forth64 Nesting 1mill 6m20 " C64 (Turbo Forth64 Nesting 1mill 25s FPGA 6502) " C64 (normal) Forth64 Fib2 (1000) 3m50s " C64 (Turbo Forth64 Fib2 (1000) 16s FPGA 6502) Martin Neitzel FreeBSD 9 FICL Integer 0,00075s		1			
Kuphaldt C64 (Turbo Forth64 Forth64 Fib2 (1000) Nesting 1mill 25s " C64 (normal) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FORTh64 Fib2 (1000) Fib2 (1000) 16s FPGA 6502) FreeBSD 9 FICL Integer 0,00075s			Forth64	Nestina 1mill	6m20
C64 (Turbo Forth64 Nesting 1mill 25s	1		. Jilliot	1 1000119 1111111	
FPGA 6502) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s	"	C64 (Turbo	Forth64	Necting 1 mill	25c
" C64 (normal) Forth64 Fib2 (1000) 3m50s " C64 (Turbo FPGA 6502) Forth64 Fib2 (1000) 16s Martin Neitzel FreeBSD 9 FICL Integer 0,00075s			1 011110 1	incoming iiiiiii	
C64 (Turbo Forth64 Fib2 (1000) Fib2 (1000) 16s FPGA 6502) FreeBSD 9 FICL Integer 0,00075s	II	·	Forth64	Eibo (4000)	2m50a
FPGA 6502) Martin Neitzel FreeBSD 9 FICL Integer 0,00075s		,		, ,	
Martin Neitzel FreeBSD 9 FICL Integer 0,00075s	ļ"	1 '	Fortn64	rib2 (1000)	108
		/		•	
Bootloader	Martin Neitzel			Integer	0,00075s
			Bootloader		

	Asus EeePC 1000h (Atom			
	N270 1.6Ghz)			
Martin Neitzel	Asus EeePC	FreeBSD 9 FICL	Fib2	66s
	1000h (Atom N270 1.6Ghz)	Bootloader		
Martin Neitzel	Asus EeePC 1000h (Atom N270 1.6Ghz)	FreeBSD 9 FICL Bootloader	Nesting 1mil	0.66s
Martin Neitzel	Asus EeePC 1000h (Atom N270 1.6Ghz)	FreeBSD 9 FICL Bootloader	Nesting 32mil	21s
Martin Neitzel	Asus EeePC 1000h (Atom N270 1.6Ghz)	FreeBSD 9 FICL Bootloader	GCD2	0.57s
Sabine "Atari Frosch" Engelhardt	Atari Portfolio	VolksForth 3.81	Fib2	35s
Sabine "Atari Frosch" Engelhardt	Atari Portfolio	VolksForth 3.81	Prime	6s
Sabine "Atari Frosch" Engelhardt	Atari Portfolio	VolksForth 3.81	Takeuchi	17s
Herbert Lange	Compaq Deskpro P166	pForth V27	Integer Calc	0,052s
Herbert Lange	Compaq Deskpro P166	pForth V27	Fib1	0,061s
Herbert Lange	Compaq Deskpro P166	pForth V27	Fib2	0,001s
Herbert Lange	Compaq Deskpro P166	pForth V27	Nesting 32mil	15,42s
Herbert Lange	Compaq Deskpro P166	pForth V27	Memory Move	0,124s
Herbert Lange	Compaq Deskpro P166	pForth V27	Prime	0,007s
Herbert Lange	Compaq Deskpro P166	pForth V27	GCD1	0,002s
Herbert Lange	Apple iMac G3 400Mhz	pForth V27	Integer Calc	0,013s
Herbert Lange	Apple iMac G3 400Mhz	pForth V27	Fib1	0,015s
Herbert Lange	Apple iMac G3 400Mhz	pForth V27	Fib2	0,001s
Herbert Lange	Apple iMac G3 400Mhz	pForth V27	Nesting 32mil	4,335s
Herbert Lange	Apple iMac G3 400Mhz	pForth V27	Memory Move	0,028s
Herbert Lange	Apple iMac G3 400Mhz	pForth V27	Prime	0,017s
Herbert Lange	Apple iMac G3 400Mhz	pForth V27	GCD1	0,063s
Herbert Lange	DEC 3000 400s	pForth V27	Integer	0,123s

Herbert Lange	DEC 3000 400s	pForth V27	Fib1	0,098s
Herbert Lange	DEC 3000 400s	pForth V27	Fib21	0,001s
Herbert Lange	DEC 3000 400s	pForth V27	Nesting 32mil	30,694s
Herbert Lange	DEC 3000 400s	pForth V27	Memory Move	0,207s
Herbert Lange	DEC 3000 400s	pForth V27	Prime	0,117s
Herbert Lange	DEC 3000 400s	pForth V27	GCD1	0,483
Herbert Lange	SUN Ultra 1 Creator 3D	pForth V27	Integer	0,049s
Herbert Lange	SUN Ultra 1 Creator 3D	pForth V27	Fib1	0,052s
Herbert Lange	SUN Ultra 1 Creator 3D	pForth V27	Fib2	0,001s
Herbert Lange	SUN Ultra 1 Creator 3D	pForth V27	Nesting 32mil	15,631s
Herbert Lange	SUN Ultra 1 Creator 3D	pForth V27	Memory Move	0,093s
Herbert Lange	SUN Ultra 1 Creator 3D	pForth V27	Prime	0,060s
Herbert Lange	SUN Ultra 1 Creator 3D	pForth V27	GCD1	0,022s
Ralf Neumann	mc-CP/M Z80 4Mhz	FIG-Forth 1.1	Fib2	1m19s
Ralf Neumann	Prof80 CP/M Z80 6Mhz	FIG-Forth 1.1	Fib2	53s

Benchme Helper#

Integer Calculations

```
32000 constant intMax

variable intResult

: DoInt
   1 dup intResult dup >r !
   begin
     dup intMax <
   while
     dup negate r@ +! 1+
     dup r@ +! 1+
     r@ @ over * r@ ! 1+
     r@ @ over / r@ ! 1+
   repeat
   r> drop drop
;
```

Fibonacci 1#

This version uses a recursive call. Recursive calls are not standardized in early Forth systems. The word to call the current definition can have different names in your forth (recurse, self, ...). Please check you system documentation (if available) or the wordlist (using WORDS or VLIST).

```
: fib1 ( n1 -- n2 )
    dup 2 < if drop 1 exit then
    dup 1- recursive
    swap 2- recursive + ;
: fib1-bench 1000 0 do i fib1 drop loop ;</pre>
```

Fibonacci 2#

```
: fib2 ( n1 -- n2 )
   0 1 rot 0 do
      over + swap loop
   drop ;
: fib2-bench 1000 0 do i fib2 drop loop ;
```

Forth Nesting Benchmark#

```
\ Forth nesting (NEXT) Benchmark
                                                         cas20101204
: bottom ;
: 1st bottom bottom; : 2nd 1st 1st; : 3rd 2nd 2nd;
: 4th 3rd 3rd ; : 5th 4th 4th ;
                                              : 6th 5th 5th ;
: 7th 6th 6th ;
                       : 8th 7th 7th ;
                                              : 9th 8th 8th ;
: 10th 9th 9th;
                       : 11th 10th 10th; : 12th 11th 11th;
: 10th 9th 9th; : 11th 10th 10th; : 12th 11th 11th; : 13th 12th 12th; : 14th 13th 13th; : 15th 14th 14th; : 16th 15th 15th; : 17th 16th 16th; : 18th 17th 17th;
: 19th 18th 18th;
                       : 20th 19th 19th; : 21th 20th 20th;
: 22th 21th 21th; : 23th 22th 22th; : 24th 23th 23th;
: 25th 24th 24th ;
: 32million CR ." 32 million nest/unnest operations" 25th ;
   1million CR ." 1 million nest/unnest operations" 20th ;
CR .( enter 1million or 32million )
```

Forth Memory Move Benchmark#

```
Forth Memory Move Benchmark cas 20101204 8192 CONSTANT bufsize

VARIABLE buf1 HERE bufsize 1+ allot BUF1 !

VARIABLE buf2 HERE bufsize 1+ allot BUF2 !

: test-CMOVE 49 0 DO BUF1 @ BUF2 @ bufsize CMOVE LOOP;

: test-CMOVE> 49 0 DO BUF2 @ BUF1 @ bufsize CMOVE> LOOP;

: test-MOVE> 49 0 DO BUF1 @ BUF2 @ bufsize MOVE LOOP;

: test-<MOVE 49 0 DO BUF2 @ BUF1 @ bufsize MOVE LOOP;
```

```
: move-bench test-CMOVE test-CMOVE> test-MOVE> test-<MOVE ;
```

count bits in byte#

```
"BOUNDS" can be defined with:
```

```
( Convert str len to range for DO-loop )
: bounds ( str len -- str+len str )
 over + swap ;
"OFF" can be defined with:
( stores zero into address )
: OFF ( addr -- )
 0 SWAP ! ;
 \ Forth Benchmark - count bits in byte
                                                      cas 20101204
VARIABLE cnt.
HEX
 : countbits ( uu -- #bits )
   cnt off
   8 0 DO dup 01010101 and cnt +!
          2/
  LOOP drop
   0 cnt 4 bounds DO i C@ + LOOP;
DECIMAL
 : bench5
   8192 DO I countbits . LOOP ;
```

Sieve Benchmark#

FIG-Forth derived systems or Forth-79 Systems require the initial value of a variable on the stack.

So instead of "VARIABLE FLAGS 0 FLAGS!" use "0 VARIABLE FLAGS".

```
cas 20101204
\ gcd - greatest common divisor
 : gcd ( a b -- gcd )
   OVER IF
    BEGIN
      DUP WHILE
          2DUP U> IF SWAP THEN OVER -
    REPEAT DROP ELSE
    DUP IF NIP ELSE 2DROP 1 THEN
   THEN ;
: gcdl-bench 100 0 DO
      100 0 DO j i gcd drop loop
      loop ;
"D0=" compares a double integer against zero. It can be defined as:
: D0 = (dd -- f)
  + 0= ;
\ another gcd O(2) runtime speed
                                                   cas 20101204
 : gcd2 ( a b -- gcd )
   2DUP
             D0= IF 2DROP 1 EXIT
                                      THEN
   DUP
               0= IF
                      DROP EXIT
                                      THEN
   SWAP DUP 0= IF DROP EXIT
                                      THEN
  BEGIN 2DUP -
   WHILE 2DUP < IF OVER -
                ELSE SWAP OVER - SWAP
                 THEN
   REPEAT NIP ;
: gcd2-bench 100 0 DO
      100 0 DO j i gcd2 drop loop
      loop ;
Takeuchi#
( takeuchi benchmark in volksForth Forth-83 )
( see http://en.wikipedia.org/wiki/Tak_(function) )
DECIMAL
 : 3dup 2 pick 2 pick 2 pick;
 : tak ( x y z -- t )
   over 3 pick < NEGATE IF nip nip exit then
   3dup rot 1- -rot recursive >r
   3dup swap 1- -rot swap recursive >r
             1- -rot recursive
  r> swap r> -rot recursive ;
 : takbench ( -- )
   0 1000 0 DO DROP 18 12 6 tak LOOP ;
```

simple 6502 emulator#

```
\ A simple 6502 emulattion benchmark
                                                             cas
\ only 11 opcodes are implemented. The memory layout is:
  2kB RAM at 0000-07FF, mirrored throughout 0800-7FFF
\ 16kB ROM at 8000-BFFF, mirrored at C000
decimal
create ram 2048 allot : >ram $7FF and ram + ;
create rom 16384 allot : >rom $3FFF and rom + ;
\ 6502 registers
variable reg-a
               variable reg-x variable reg-y
variable reg-s variable reg-pc : reg-pc+ reg-pc +! ;
\ 6502 flags
variable flag-c variable flag-n variable cycle
variable flag-z variable flag-v : cycle+ cycle +! ;
hex
: w@ dup c@ swap 1+ c@ 100 * or ;
: cs@ c@ dup 80 and if 100 - then ;
: read-byte ( address -- )
  dup 8000 < if >ram c@ else >rom c@ then ;
: read-word ( address -- )
  dup 8000 < if >ram w@ else >rom w@ then ;
: dojmp ( JMP aaaa )
  reg-pc @ >rom w@ reg-pc ! 3 cycle+ ;
: dolda ( LDA aa )
 reg-pc @ >rom c@ ram + c@ dup dup reg-a !
  flag-z ! 80 and flag-n ! 1 reg-pc+ 3 cycle+;
: dosta ( STA aa )
  reg-a @ reg-pc @ >rom c@ ram + c! 1 reg-pc+ 3 cycle+ ;
: dobeq ( BEQ <aa )
  flag-z @ 0= if reg-pc @ >rom cs@ 1+ reg-pc+ else 1 reg-pc+ then 3 cycle+ ;
: doldai ( LDA #aa )
  reg-pc @ >rom c@ dup dup reg-a ! flag-z ! 80 and flag-n !
  1 reg-pc+ 2 cycle+;
: dodex ( DEX )
  reg-x @ 1- FF and dup dup reg-x ! flag-z ! 80 and flag-n !
  2 cycle+ ;
: dodey ( DEY )
  reg-y @ 1- ff and dup dup reg-y ! flag-z ! 80 and flag-n !
  2 cycle+ ;
: doinc ( INC aa )
  reg-pc @ >rom c@ ram + dup c@ 1+ FF and dup -rot swap c! dup
  flag-z ! 80 and flag-n ! 1 reg-pc+ 3 cycle+;
: doldy ( LDY aa )
  reg-pc @ >rom c@ dup dup reg-y ! flag-z ! 80 and flag-n !
  1 reg-pc+ 2 cycle+ ;
: doldx ( LDX #aa )
  reg-pc @ >rom c@ dup dup reg-x ! flag-z ! 80 and flag-n !
  1 reg-pc+ 2 cycle+ ;
: dobne ( BNE <aa )
  flag-z @ if reg-pc @ >rom cs@ 1+ reg-pc+ else 1 reg-pc+ then
  3 cycle+ ;
: 6502emu ( cycles -- )
  begin cycle @ over < while
    reg-pc @ >rom c@ 1 reg-pc+
    dup 4C = if dojmp then
                                dup A5 = if dolda then
    dup 85 = if dosta then
                                dup F0 = if dobeq then
    dup D0 = if dobne then
                                dup A9 = if doldai then
```