New Additions in zeptoforth 1.9.0

Floating Point

- zeptoforth 1.9.0 adds support for hardware single-precision floating point numerics.

- It is not supported on the RP2040 or STM32F411 (on the latter to save precious flash space, due to it having only 512 KB of flash).

- Floating-point values live on the same stacks as other data; there is no separate floating-point stack.

- Conversions to and from strings are supported.

- Common functions, including exp and ln and trigonometric and hyperbolic functions, are supported.

Welcome to zeptoforth
Built for rp2350, version 1.9.0, on Thu Nov 14 01:33:19 PM CST 2024
zeptoforth comes with ABSOLUTELY NO WARRANTY: for details type `license'
 ok
enable-line ok
float32 import ok
vpi 2e0 v/ vsin v. 1e0 ok
1e0 vasin v. 1.570797e0 ok
1e0 vexp v. 2.718281e0 ok
0.5e0 0.5e0 vatan2 v. 7.853981e-1 ok
0.5e0 0.5e0 vatan2 vtan v. 1e0 ok
3e0 vsqrt v. 1.73205e0 ok
3e0 vln v. 1.098612e0 ok
3e0 vln vexp v. 3e0 ok
2e0 3e0 v+ 5e0 v+ v. 1e1 ok
5e0 2e0 v* 3e0 v/ v. 3.333333e0 ok

Complex Numbers

- zeptoforth 1.9.0 adds optional support for complex numbers on platforms which support hardware single-precision floating point.

- It is not supported on the RP2040 or STM32F411, due to hardware single-precision floating point not being supported on these platforms.

- Complex numbers are represented as double cells.

- Conversions to and from strings are supported.

- Common functions, including exp and ln and trigonometric and hyperbolic functions, are supported.

Complex Numbers in Action

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 ok
enable-line ok
float32 import complex-float32 import ok
-1e0 cvreal cvsqrt cv. 0e0+1e0i ok
1e0 cvimag 2dup cv* cv. -1e0+0e0i ok
-1+0i cvnegate cv. 1e0+0e0i ok
-1e0 cvreal cvsqrt cvabs v. 1e0 ok
-1e0 cvreal cvsqrt cvarg v. 1.570797e0 ok
-1e0 cvreal cvsqrt cvexp cv. 5.403022e-1+8.41471e-1i ok
-1e0 cvreal cvsqrt cvexp cvln cv. -5.960464e-8+1e0i ok
-1e0 cvreal cvsqrt cvexp cvln 2dup cv* cv. -1e0-1.192092e-7i ok
-1e0 cvreal cvsqrt cvsin cv. 0e0+1.175201e0i ok
-1e0 cvreal cvsqrt cvsin cvasin cv. 0e0+1e0i ok
-1e0 cvreal cvsqrt cvcos cv. 1.54308e0+0e0i ok
-1e0 cvreal cvsqrt cvcos cvacos cv. 0e0+9.999998e-1i ok
-1e0 cvreal cvsqrt cvtan cv. 0e0+7.615941e-1i ok

Filesystems

- zeptoforth 1.9.0 adds a current directory concept.

- It is by default applied across all tasks.

- However, current directories can be set within particular xt's, which separate them and tasks started by them from any outside shared current directory.

- zeptoforth 1.9.0 adds optional support for FAT32 filesystems in PSRAM on RP2350 boards with PSRAM such as the Pimoroni Pico Plus 2.

- This enables using PSRAM as a large RAM disk.

```
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Built for rp2350, version 1.9.0, on Thu Nov 14 01:33:19 PM CST 2024
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 ok
fat32-tools import enable-line  ok
psram-fat32::psram-fs@ current-fs!  ok
s" " list-dir
filename    creation date           modification date       file size
------------ ------------------------- ------------------------- ---------- ok
s" FOO" create-dir  ok
s" BAR" create-dir  ok
s" BAZ" create-dir  ok
s" This is only a test!" s" FOO/TEST.TXT" create-file  ok
s" This is still only a test!" s" FOO/TEST1.TXT" create-file  ok
s" FOO" list-dir
filename    creation date           modification date       file size
------------ ------------------------- ------------------------- ----------
./          Tue, 01 Jan 1980 00:09:42 Tue, 01 Jan 1980 00:09:42
../         Tue, 01 Jan 1980 00:09:42 Tue, 01 Jan 1980 00:09:42
TEST.TXT    Tue, 01 Jan 1980 00:10:48 Tue, 01 Jan 1980 00:10:48      20
TEST1.TXT   Tue, 01 Jan 1980 00:11:12 Tue, 01 Jan 1980 00:11:12      26 ok
s" FOO" change-dir  ok
s" " list-dir
filename    creation date           modification date       file size
------------ ------------------------- ------------------------- ----------
./          Tue, 01 Jan 1980 00:09:42 Tue, 01 Jan 1980 00:09:42
../         Tue, 01 Jan 1980 00:09:42 Tue, 01 Jan 1980 00:09:42
TEST.TXT    Tue, 01 Jan 1980 00:10:48 Tue, 01 Jan 1980 00:10:48      20
TEST1.TXT   Tue, 01 Jan 1980 00:11:12 Tue, 01 Jan 1980 00:11:12      26 ok
s" .." list-dir
filename    creation date           modification date       file size
------------ ------------------------- ------------------------- ----------
FOO/        Tue, 01 Jan 1980 00:09:42 Tue, 01 Jan 1980 00:11:12
BAR/        Tue, 01 Jan 1980 00:09:45 Tue, 01 Jan 1980 00:09:44
```

String Constants and Buffers

- zeptoforth 1.9.0 adds a new kind of string, which is essentially a counted string but with a cell rather than byte storing the string length.

- This enables strings of any possible length to be trivially stored without resorting to null-termination.

- These strings are automatically cell-aligned.

- These strings can be compiled to the dictionary with STRING,.

- These strings can be read with STRING@ and written with STRING!.

Working with String Constants and Buffers

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 ok
enable-line ok
create test s" This is only a test, repeat, this is only a test!" string, ok
test string@ type This is only a test, repeat, this is only a test! ok
256 cell + buffer: my-buffer ok
test string@ my-buffer string! ok
my-buffer string@ type This is only a test, repeat, this is only a test! ok
s" This is still only a test!" my-buffer string! ok
my-buffer string@ type This is still only a test! ok
create test1 s" foo" string, s" bar" string, s" baz" string, s" quux" string, ok
test1 string@ type foo ok
test1 string@ + string@ type bar ok
test1 string@ + string@ + string@ type baz ok
test1 string@ + string@ + string@ + string@ type quux ok

Deadline Task Scheduling

- zeptoforth 1.9.0 reworks the multitasker to use task deadlines for scheduling.

- Tasks are sorted first by priority and then by deadline.

- This enables finer-grained control over scheduling than previously possible

- Tasks can have intervals between deadlines in ticks set with TASK-INTERVAL! and gotten with TASK-INTERVAL@.

- Tasks can have deadlines in ticks manually set with TASK-DEADLINE! and gotten with TASK-DEADLINE@.

Deadline Task Scheduling in Action

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 ok
enable-line ok
task import ok
variable task0 variable task1 variable task2 ok
0 :noname begin ." *" pause again ; 320 128 512 spawn task0 ! ok
0 :noname begin ." x" pause again ; 320 128 512 spawn task1 ! ok
0 :noname begin ." @" pause again ; 320 128 512 spawn task2 ! ok
1 task0 @ task-interval! ok
5 task1 @ task-interval! ok
10 task2 @ task-interval! ok
task2 @ run task1 @ run task0 @ run ok
@@xx@x****x***@*x*****x***@*x*****x****@x****x****@*x*****x****@*x*********x********@*x****