

# Runtime Library Notes

## Directory Structure

|            |                                                   |
|------------|---------------------------------------------------|
| sd8516/    | project root                                      |
| runtime/   |                                                   |
| crt0.sda   | startup stub -- CALL main                         |
| librt/     | runtime functions                                 |
| divhi3.c   |                                                   |
| modhi3.c   |                                                   |
| divsi3.c   |                                                   |
| muldi3.c   |                                                   |
| ...        |                                                   |
| softfloat/ | the SF/DF families                                |
| include/   | freestanding headers (mine & what clang supplies) |
| tests/     | tests with checks                                 |

## Prep Work

- Helper scripts were created this time: c2sda, c2ll, ll2sda and runtests.
- Next I had to modify VC-4 to take .sda files at the command line (to speed the dev cycle).
- Next I created the above directory.
- I will have to modify vc4 to look in ~/.vc4 if the files it needs are not in the pwd.

## Fleshing it out

Many standard implementations reveal deficiencies in instrinfo and iseltargetlowering.

## Test Suite

I collected all the tests into one file.

## Roadmap

- putchar.sda (the only assembly only file so far – similar to tinyc v1)
- print\_str
- print\_dec
- lib1 (stuff for missing instructions)
- libctype
- libstr
- libstdlib

then

- stdint.h, limits.h, stddef.h, stdbool.h
- stdalign/stdnoreturn/iso646
- finish string.h (memchr, strncat, strpbrk, strspn, strcspn, strtok)
- safe-string extras (strncpy/strlcat, strcasecmp/strncasecmp, memmem),
- div/ldiv, rand/srand, qsort/bsearch, assert.h
- official puts/getchar.

Roadmap which requires additional development:

- malloc/free/calloc/realloc
- then strdup/strndup

Phase III

- stdarg.h for varargs and formatted output. very high value target (enables printf)
- printf/sprintf/snprintf/vsnprintf and sscanf.

Later:

- compiler-facing primitives LEA, MOVSX, CMOV, get CASETAB to emit.
- 64-bit integers. muldi3, udivdi3/umoddi3, divdi3/moddi3.

Floating Point Roadmap:

- Start writing math.h and see what happens.
- strtod/atof, %f for printf.

File IO Roadmap:

- fopen/fread/fwrite/fseek/fclose and FILE\* streams wrapping \*(see INT 15h/OPFS/FCB)

Other:

- time.h, calendar math, binding time() to the hardware clock
- Graphics and Sound libraries
- access to PPU and ASU

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