Third Laboratory Assignment — Zeckendorf Number
CS130 (Section 27623)

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Overview

ARMv7 (Cortex-A9) implementation of:

- `fib(k)` — largest Fibonacci number $\leq k$; returns 0 if $k = 0$, `-1` if $k < 0$ or $k > 1836311903$.
- `zeck(k)` — Zeckendorf count using greedy subtraction: repeatedly call `fib(k)`, subtract, and count.

Executed on CPUlator (DE1-SoC): `https://cpulator.01xz.net/?sys=arm-de1soc`. Results read from register `R0`.

Test Plan & Expected Results

Input k	**Rationale**	**Expected `R0`**
33	Sample (33 = 21+8+3+1)	4
1836311902	Just below max Fibonacci	22
1836311903	Max 31-bit Fibonacci	1
1836311904	Just above max (reject)	-1
0	Zero case	0
−7	Negative input	-1

Checklist

- Functions named exactly `fib` and `zeck`.
- `zeck` calls `fib`; only nonnegative arithmetic for running state.
- Correct handling for $k = 0$, $k < 0$, and $k > 1836311903$.
- All required tests match expected `R0` values.

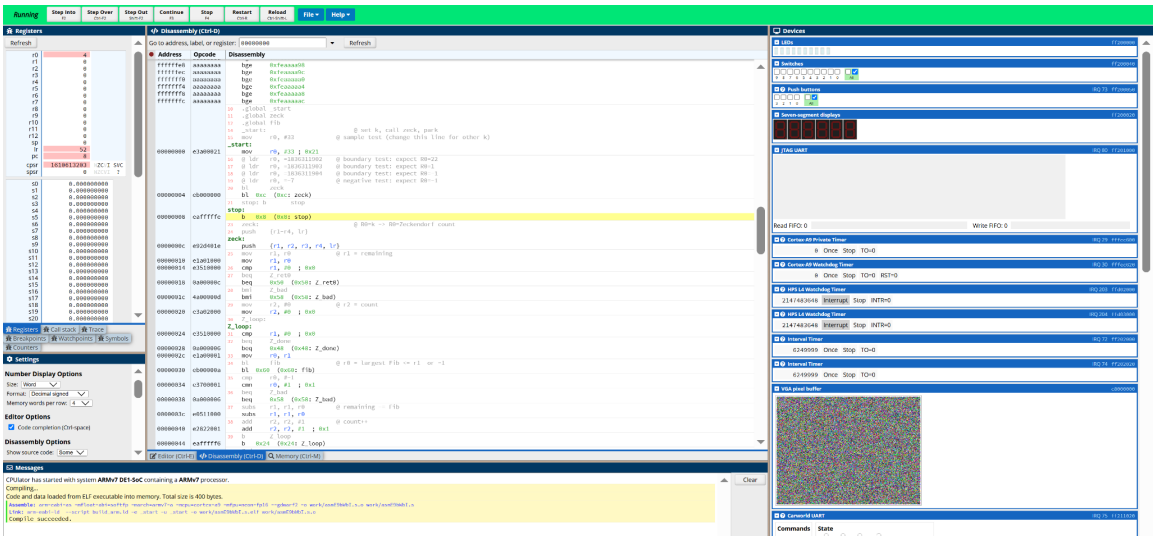

Figure 1: Sample: $k = 33 \Rightarrow$ `R0` $= 4$.

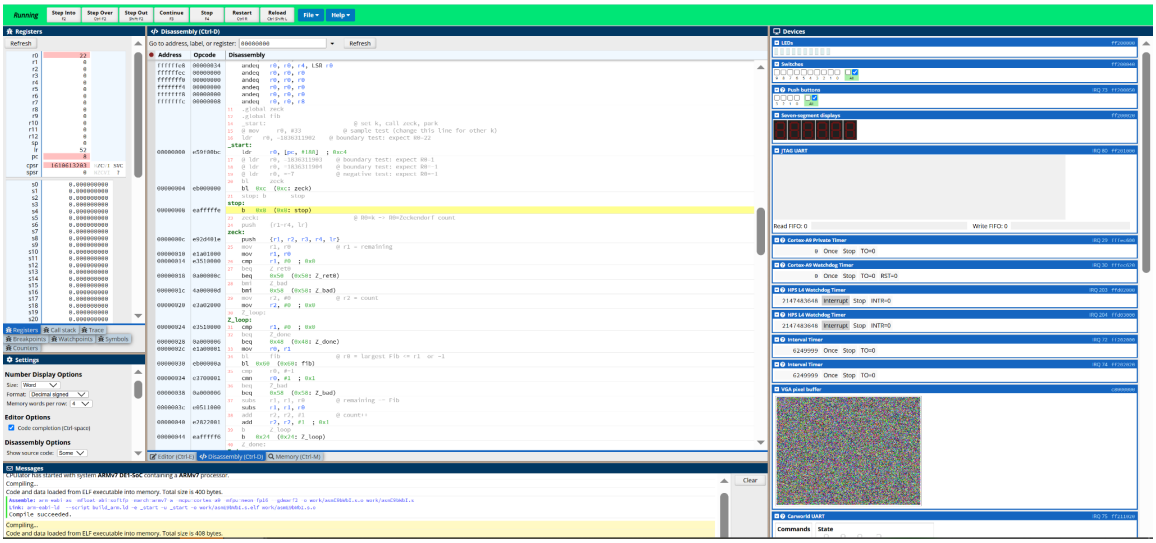

Figure 2: Boundary: $k = 1836311902 \Rightarrow$ `R0` $= 22$.

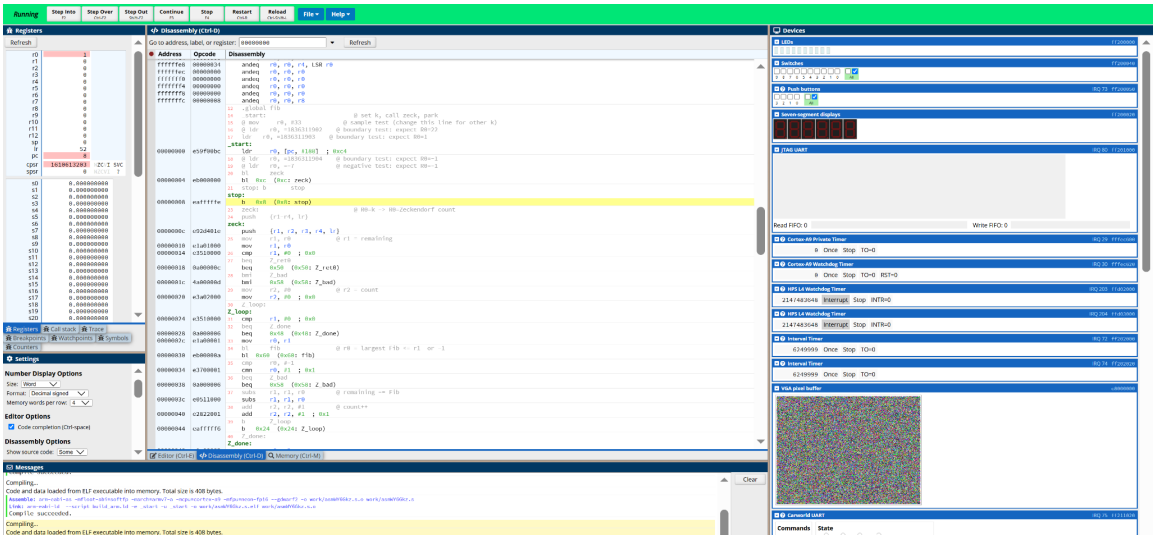

Figure 3: Boundary: $k = 1836311903 \Rightarrow$ `R0` $= 1$.

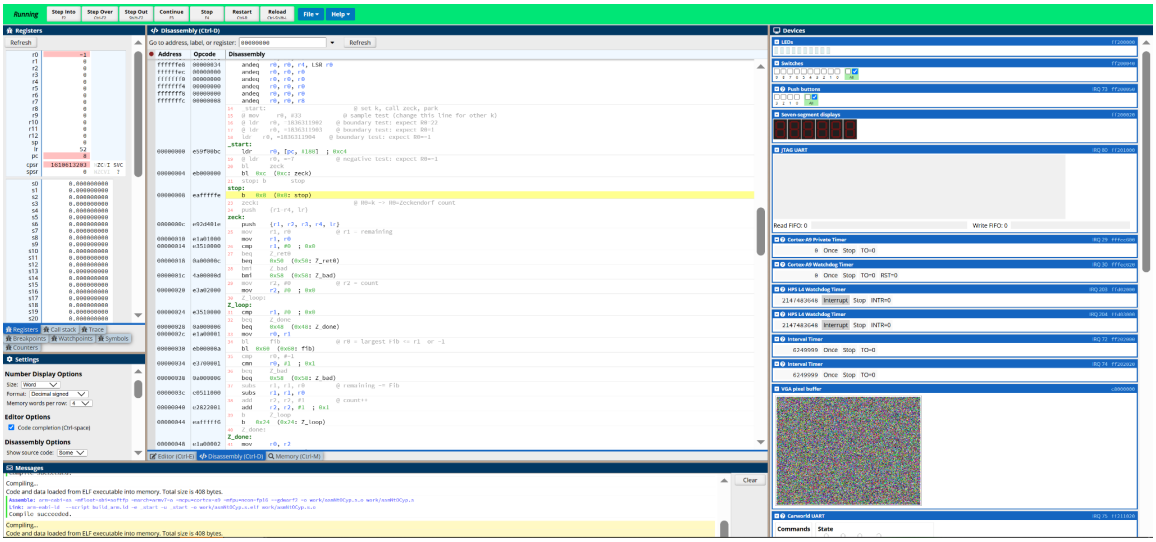

Figure 4: Boundary: $k = 1836311904 \Rightarrow$ `R0` $= -1$ (too large).

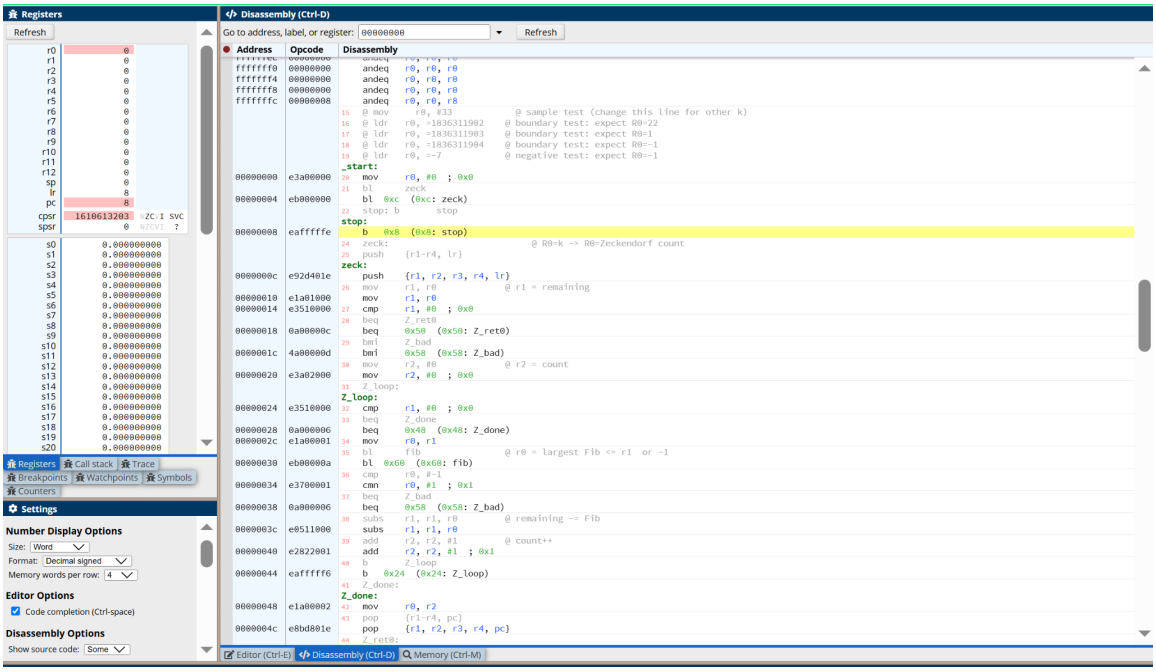

Figure 5: Zero case: $k = 0 \Rightarrow \texttt{R0} = 0$.

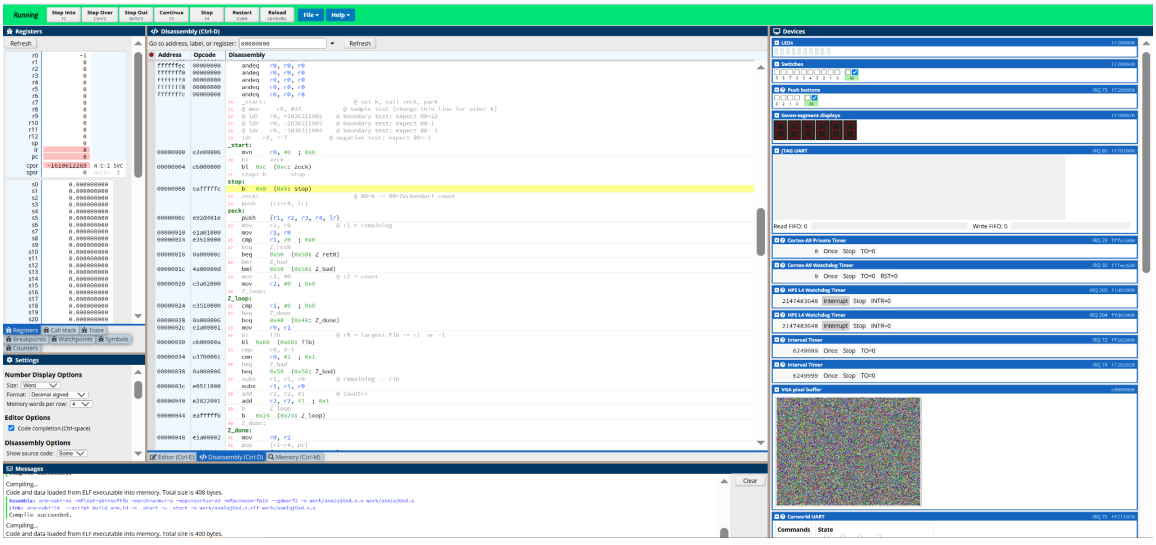

Figure 6: Negative case: $k = -7 \Rightarrow \texttt{R0} = -1$.