

I pledge my honor that I have abided by the Stevens Honor System.

### **Project 1: Fibonacci**

1. I started by using `.equ` to take in the `n` value
2. After this I made space for 4 variables on the stack:
  - a. The `n` value is held in `x0`
  - b. Fibonacci current is held in `x1`
  - c. Fibonacci previous is held in `x2`
  - d. Temporary value is held in `x3`
3. Then I used `mov` to store the `n` value in register `x0`, so `x0 = n`
4. Then I set the initial values of all the registers:
  - a. `x1 = 1`
  - b. `x2 = 0`
  - c. `x3 = 0`
5. After this I compared the value in `x0` with 1 using `cmp`, and if the value is greater than 1, branch to the fibonacci function called “fibo”, if not move the Fibonacci current value from `x1` to `x0`, print the result, restore the stack pointers, and branch to the link register `x30`
6. When “fibo” is called, it executes the recursive  $O(n)$  fibonacci algorithm:
  - a. Set the temporary variable in `x3` to fibonacci previous from `x2`
  - b. Set fibonacci previous in `x2` to fibonacci current from `x1`
  - c. Set fibonacci current in `x1` to the sum of fibonacci current from `x1` + temporary variable from `x3`, (`x1 = x1+x3`)
  - d. Decrease `n` by 1 and check if `n > 1`:
    - i. if `n > 1`, branch to “fibo” again
    - ii. if `n ≤ 1`, move the Fibonacci current value from `x1` to `x0`, print the result, restore the stack pointers, and branch to the link register `x30`

## Before Link Register Changes Value (for n = 2):

DS-5 Workspace - DS-5 Debug - fibonacci/fibonacci.s - Eclipse Platform

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Debug Control | Project Explorer | Remote Systems

fibonacci\_configuration connected

ARMv8-A #1 stopped on step1 (EL3h)

Commands | History | Scripts

next

Execution stopped in EL3h mode at EL3:0x000000008004619C

EL3:0x000000008004619C 50,0 ldr x0, =string

wait

next

Execution stopped in EL3h mode at EL3:0x00000000800461A0

EL3:0x00000000800461A0 51,0 bl printf //print the result

Status: connected

Command: Press (Ctrl+Space) for Content Assist

Submit

Register Set: All registers

Name	Value	Size	Access
X28	0x0000000000000000	64	R/W
X29	0x00000000FFFFFFF0	64	R/W
LR	0x0000000080046138	64	R/W
PC	0x00000000800461A0	64	R/W
SP	0x00000000FFFFFFF0	64	R/W
W0	0x80046138	32	R/W

Disassembly

Address	Opcode	Disassembly
EL3:0x0000000080046194	AA0103E0	MOV x0, x1
EL3:0x0000000080046198	910083FF	ADD sp, sp, #
EL3:0x000000008004619C	58000060	LDR x0, [pc,
EL3:0x00000000800461A0	97FE67F5	BL printf
EL3:0x00000000800461A4	D61F03C0	BR x30
EL3:0x00000000800461A8	80046138	DCD 0x80046
EL3:0x00000000800461AC	00000000	DCD 0x000000
EL3:0x00000000800461B0	00000000	DCD 0x000000

App Console | Target Console | Error Log

Info: Foundation\_AEMv8A: CADI Debug Server started

CADI server is reported on port 7000

fibonacci\_configuration connected (ARM Model - ARMv8-Ax1 Foundation Platform)

## After Link Register Changes Value (for n = 2):

DS-5 Workspace - DS-5 Debug - fibonacci/fibonacci.s - Eclipse Platform

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Debug Control | Project Explorer | Remote Systems

fibonacci\_configuration connected

ARMv8-A #1 stopped on step1 (EL3h)

Commands | History | Scripts

next

Execution stopped in EL3h mode at EL3:0x00000000800461A0

EL3:0x00000000800461A0 51,0 bl printf //print the result

wait

next

Execution stopped in EL3h mode at EL3:0x00000000800461A4

EL3:0x00000000800461A4 52,0 br x30 //branch to link register x30

Status: connected

Command: Press (Ctrl+Space) for Content Assist

Submit

Register Set: All registers

Name	Value	Size	Access
X28	0x0000000000000000	64	R/W
X29	0x00000000FFFFFFF0	64	R/W
LR	0x00000000800461A4	64	R/W
PC	0x00000000800461A4	64	R/W
SP	0x00000000FFFFFFF0	64	R/W
W0	0x00000002	32	R/W

Disassembly

Address	Opcode	Disassembly
EL3:0x0000000080046194	AA0103E0	MOV x0, x1
EL3:0x0000000080046198	910083FF	ADD sp, sp, #
EL3:0x000000008004619C	58000060	LDR x0, [pc,
EL3:0x00000000800461A0	97FE67F5	BL printf
EL3:0x00000000800461A4	D61F03C0	BR x30
EL3:0x00000000800461A8	80046138	DCD 0x80046
EL3:0x00000000800461AC	00000000	DCD 0x000000
EL3:0x00000000800461B0	00000000	DCD 0x000000

App Console | Target Console | Error Log

Info: Foundation\_AEMv8A: CADI Debug Server started

CADI server is reported on port 7000

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fibonacci\_configuration connected (ARM Model - ARMv8-Ax1 Foundation Platform)