

Programming Practices
Assignment 1
Getting familiar with assembly language
and ARMSim

ABHISHEK GUPTA (*2016CSJ0012*)

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1 Assumed Frequency

Frequency = 1 GHz

2 Instruction

There are total 12007 number of instructions.

3 Observed Time Elapsed(According to computer)

The screenshot shows the ARMSim interface with the following components:

- Registers:** R0-R15, CPSR, and Thumb(T) are listed. R15 (PC) is highlighted at address 00001048 with value 4168.
- Assembly Code:** The code is displayed in the center pane, including instructions like `str r2, [r3]`, `add r3, r3, #4`, `add r2, r2, #1`, `sub r1, r1, #1`, `cmp r1, #0`, `bne LoadAddIntegers`, `mov r1, #1000`, `mov r4, #0`, `ldr r3, =AA`, `LoadAddIntegers:`, `ldr_r2, [r3]`, `add r4, r4, r2`, `add r3, r3, #4`, `sub r1, r1, #1`, `cmp r1, #0`, `bne LoadAddIntegers`, `swi SWI Exit`, and memory allocation instructions.
- OutputView:** The bottom pane shows the execution log: "Loading assembly language file /home/abhi607/Documents/SEM 4/CSL216/A1/sum_1_to_n.s", "Execution starting ...", and "Execution ending, Instruction Count:12007 Elapsed Time:00:00:00.0151240 Instructions per second:793903".

Time Elapsed is equal to 0.0151240 seconds.

4 Theoretical time elapsed

$$\text{Theoretically time elapsed} = \frac{\text{TotalLatency}}{\text{Frequency}} = \frac{52106 \text{ Cycles}}{10^9 \text{ sec}^{-1}} = 5.21 \times 10^{-5} \text{ s}$$

5 Total Energy

The total energy is equal to $(100+100+110+(2000+100+100+100+100)*1000+1000*180+100+100+110+(2000+100+100+100+100)*1000+1000*180+10000) = 5170620 \text{ pJ}$ i.e. $5.170620 \times 10^{-6} \text{ J}$.

6 Total Latency

The Total Latency is equal to $(1 + 1 + 1 + 1000 * (20 + 1 + 1 + 1 + 1) + 1000 * 2 + 1 + 1 + 1 + 1000 * (20 + 1 + 1 + 1 + 1) + 1000 * 2 + 100) = 52106 \text{ cycles}$.

7 Theoretical Average Power Dissipation

The Average Power Dissipation is equal to $\frac{TotalEnergy}{TheoreticalTimeElapsed} = \frac{5.170620}{52} \frac{\mu J}{\mu s} = 0.0994 \text{ J/s}$
i.e. 0.0994 W.

8 Observed Average Power Dissipation

The observed average power dissipation $\frac{TotalEnergy}{ObservedTimeElapsed} = \frac{5.170620}{0.0159} \frac{\mu J}{s} = 325.19 \mu J/s \text{ i.e. } 0.325 \times 10^{-3} \text{ J/s}$

9 Cycles per Instruction

Cycles per Instruction = $\frac{TotalLatency}{TotalnumberofInstructions} = \frac{52106s}{12007} \frac{Cycles}{Instruction} = 4.34 \text{ Cycles/Instruction}$.

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