CSL216: Assignment 1
Getting Familiar with ARMSim Simulator

Sahil Bansal (2016CSJ0008)

February 5, 2018

Abstract

In this assignment, an assembly program is provided in which the energy and latency(time taken in clock cycles) is specified for each instruction. To analyze the performance of the program, we need to calculate the Cycles per instruction (CPI), total energy and average power dissipation. The no. of instructions are displayed in the output screen of the simulator which have also been calculated manually and found to be the same. Then, latency for the entire program is calculated and CPI is thus calcuated. Total energy is found similarly. To calculate the avg. power, we find the execution time of the program by using the clock frequency(1 GHz) and then divide total energy by it.

1 Assembly Instructions Table

Line No	Assembly Instruction	Latency (cycles)	Times executed	Total cycles	Energy (pJ)	Total Energy(**nJ**)
12	**mov** r1 , #1000	1	1	1	100	0.100
13	**mov** r2 , #1	1	1	1	100	0.100
14	ldr r3 , =AA	1	1	1	110	0.110
17	**str** r2 , [r3]	20	1000	20000	2000	2000
18	**add** r3 , r3 , #4	1	1000	1000	100	100
19	**add** r2 , r2 , #1	1	1000	1000	100	100
20	**sub** r1 , r1 , #1	1	1000	1000	100	100
21	**cmp** r1 , #0	1	1000	1000	100	100
22	bne StoreIntegers	2	1000	2000	180	180
30	**mov** r1 , #1000	1	1	1	100	0.100
31	**mov** r4 , #0	1	1	1	100	0.100
32	ldr r3 , =AA	1	1	1	110	0.110
34	ldr r2 , [r3]	20	1000	20000	2000	2000
35	**add** r4 , r4 , r2	1	1000	1000	100	100
36	**add** r3 , r3 , #4	1	1000	1000	100	100
37	**sub** r1 , r1 , #1	1	1000	1000	100	100
38	**cmp** r1 , #0	1	1000	1000	100	100
39	bne LoadAddIntegers	2	1000	2000	180	180
41	swi SWI_Exit	100	1	100	10000	10
	TOTAL		12007	52106		5170.620

2 Cycles Per Instruction (CPI)

The average value of CPI is calculated as follows :

$$CPI = \frac{Total\ CPU\ clock\ cycles}{Instruction\ count} = \frac{52106}{12007} = \boxed{4.34 \frac{cycles}{instruction}}$$

3 Total energy

The total energy is straight forward to tell, as calculated in the table :

$$Total\ Energy = \boxed{5.17\ \mu J}$$

4 Average power dissipation

Execution time of program is required to calculate it, which is :

$$CPU\ Execution\ Time = \frac{Total\ Clock\ Cycles}{Clock\ Frequency} = \frac{52106\ cycles}{10^9\ cycles/s} = \boxed{52.1\ \mu s}$$

So, average power is given by :

$$Avg\ Power = \frac{Total\ Energy}{Total\ Execution\ Time} = \frac{5.17\ \mu J}{52.1\ \mu s} = \boxed{0.099\ W}$$