

Answers for Session 4

Group 00: Stephan Holljes, Yannick Keller, Tim Buecher

Ex. 2.7:

a)

Simulator	No. of cycles
dlxSim	326792
modelSim	647560

Ex. 5.19:¹

b)

Implementation method	No. of cycles
No special instructions	3754 cycles
With special instruction	2059 cycles

c) 82.3 % speedup in dlxsim

Accumulated No. of cycles using software and hardware implementations:

Software implementation

Function	Accumulated No. of cycles
AVG	959
AVG+SWAP	1699
AVG+SWAP+MINMAX	3754
AVG+SWAP+MINMAX+ROTATE	4394

Hardware implementation

Function	Accumulated No. of cycles
AVG	879
AVG+SWAP	1279
AVG+SWAP+MINMAX	2059

¹Please note that we could not verify all results using ModelSim as the simulation would continue indefinitely.

Code used to test the implementation

```
#define ASIP
#ifndef ASIP
    #include <stdio.h>
#else
    #include "lib_lcd.h"
#endif

#define LENGTH 20

int input1[LENGTH] = {321,51,890345,75,78,7,34478651,2342,568,7894578,7,3461,1235,3467753,75,
int input2[LENGTH] = {45,765,12,78,74,42,1253,236377,5683,79,86,643,52314576,3461,57,785,79,

int resultAvg [LENGTH];
int resultSwap[LENGTH];
int resultMax [LENGTH];
int resultMin [LENGTH];
int resultRor [LENGTH];

int main() {
    int i;

    for (i=0; i<LENGTH; i++) {
        resultAvg[i] = __builtin_brownie32_AVG(input1[i], input2[i]);

        resultSwap[i] = __builtin_brownie32_SWAP(input1[i]);

        __asm__ volatile (
            "minmax %[my_out1], %[my_out2], %[my_op1], %[my_op2]\n\t"
            : [my_out1] "=&r" (resultMin[i]), [my_out2] "=&r" (resultMax[i])
            : [my_op1] "r" (input1[i]), [my_op2] "r" (input2[i])
        );
    }

    return 0;
}
```