CSE141-Summer2003

Homework Number 4

This homework is based on the chapter 5.1-5.3 of the text and focuses primarily on computer arithmetic issues related to multipliers and floating point numbers.

We recommend solving the following problems from the textbook (Patterson and Hennessy, Computer Organization and Design: The hardware software interface, 2nd edition).

Additional Problem

(Note: this problems is a smaller version of the problem described on page 373 of the text.)

Consider the operation time for the major functional units of the single cycle datapath shown on page 372 of the text (Fig. 5.29). Assume the following operation times:
- ALU (and adders): 2 ns
- Memory Units: 2ns
- Register File (read & write): 1 ns

(a): describe the functional elements that are used during the following instructions
- load word
- store word
- branch
- add (or any other R-format instruction)
- jump

(b): Calculate the time required to compute each of these instructions. If you had only one cycle per instruction, how fast could you run this processor?

(c): Given the above processor, calculate how long would it take to do the following code fragment

```c
    for(int i=0; i<n;i++) s[i] = c;
```

in terms of ‘n’. Assume that you have $a0 = s$ and $a1 = c$ and $a2 = n$.

Assume that the array $s[i]$ needs to be “loaded” from memory and stored in memory.

(d): If you were allowed to change the clock speed per instruction (don’t worry about implementation here!) and tune the clock cycle to each individual instruction, how fast could you run the code fragment in (c).

Textbook Problems

5.5: Work on the datapath created in class to include an additional instruction `addi`.

5.12-5.13: Calculate the performance of this instruction.