Assignment 2- Report

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Overview:

We were asked to implement a MIPS Processor (non-pipelined) using any programming language. We used Python to implement the various features of a MIPS
processor, like control signals, MUX to decide inputs and outputs conditionally, ALU,
Hazard Detection and forwarding unit, and pipeline flush. The program for non-pipelined processors takes machine code, here a sorting algorithm, and executes the
code in 5 phases: Instruction Fetch, Instruction Decode, Execute, Memory and Write Back.

Non-Pipelined Processor

The machine_code dictionary has the instruction memory address as the key and the
instruction as the value. When the program calls the fetch function it fetches the instructions
from the dictionary one by one and returns it to main. From there the instruction is passed on
to decode phase where the decode function identifies the type of instruction and decodes the
binary instruction into fields like rs, rt, rd, funct, etc. The control unit is also called in the
decode phase which generates control signals according to which the flow of the

program is
decided. Depending on the control signals, the execute phase performs the various operations
and forwards them to mem and write back phase. The ALU control unit generates ALU
control signal which decides which operation is performed in the ALU. In the mem phase
data is written to memory or extracted from memory which is later written back to the
register file.

The program also prints the number of clock cycles taken to execute all instructions.

Assumptions and Limitations:

The number of inputs and outputs is restricted to 10.

We are initializing the input to specific registers as done in Assignment-1

Result:

```
PS C:\Users\subha\OneDrive - iiit-b\College docs\semester 3\Computer Architecture> python -u "c:\Users\subha\OneDrive - iiit-b\College docs\semester 3\Computer Architecture\Assignments\Assignment 2\non-pipelined.py"
Enter the number of inputs: 3
Enter input: 3
Enter input: 2
Enter input: 1
The sorted array is:
1
2
3
Number of clock cycles:  505
PS C:\Users\subha\OneDrive - iiit-b\College docs\semester 3\Computer Architecture> python -u "c:\Users\subha\OneDrive - iiit-b\College docs\semester 3\Computer Architecture\Assignments\Assignment 2\non-pipelined.py"
Enter the number of inputs: 5
Enter input: -20
Enter input: 45
Enter input: 32
Enter input: 0
Enter input: 1
The sorted array is:
-20
0
1
32
45
Number of clock cycles:  1055
PS C:\Users\subha\OneDrive - iiit-b\College docs\semester 3\Computer Architecture> python -u "c:\Users\subha\OneDrive - iiit-b\College docs\semester 3\Computer Architecture\Assignments\Assignment 2\non-pipelined.py"
Enter the number of inputs: 10
Enter input: 43
Enter input: 23
Enter input: -67
Enter input: -100
Enter input: 65
Enter input: 0
Enter input: 2
Enter input: 85
Enter input: -2
Enter input: 41
The sorted array is:
-100
-67
-2
0
2
23
41
43
65
85
Number of clock cycles:  3470
```