

COL216 Assignment 3

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Problem: Write a C++ program that reads a MIPS assembly language program as input and interprets (“executes”) it by maintaining internal data structures representing processor components such as Register File and Memory, and executing the operations indicated by the instructions. Your interpreter should handle the following instructions: add, sub, mul, beq, bne, slt, j, lw, sw, addi.

Input: MIPS assembly language program

Output:

- Print the Register File contents (32 register values in Hexadecimal format) after executing each instruction.
- After execution completes, print the relevant statistics such as the number of clock cycles and the number of times each instruction was executed.

Approach:

- **Integer is 2⁵ bits, total memory available is 2²³ bits** so total size of array to be created for memory is $2^{18}=262144$. Data will be stored after storing instructions. So, size of memory array is 262144- (number of instructions). Assumption: each instruction and data stored takes 2⁵ bits.
- Registers, instructions etc are initialised as maps to 0.
- Helper functions: decimal to hex convertor, print registers.
- Input is given as filename and file is then read.
- Commas “,” are ignored.
- If colon “:” is found, then line number is stored so that we know where to go.
- As we read lines, after doing above, we store them in instructions. A counter for number of instructions is also kept.
- Now we run a while loop to compute all the instructions. First the instruction type (add or sub etc) is recognised, then respective computation is made, and counter is increased.
- If any branch or jump is encountered, then counter is evaluated to where we had stored it earlier.
- Type “g++ code.cpp” and then “a <filename>” to execute code.
- For every iteration, values of registers are printed and cycle number is printed.

Testing:

- If the code has extra symbols, it will show error.
- If there is a typo, it will show error.
- If there are more arguments than required, then error.
- If register is used in addi\subi it will show error.
- If arguments are not separated by commas then it will show error.