

CIS 351 Sample SS4 Problem Solutions

Sun 19th Oct, 2025

SS4: Modify the Single-Cycle CPU

Consider this following code:

```
for(int x = 0; x < 1000; x++) {  
    array[x] = x*x;  
}
```

We could save one cycle per loop by combining the storing of data into `array` with the increment of `x` into a new instruction *store word and increment* (`swi R1, R2, increment`). This new instruction will do the following in a single cycle: (1) store the contents of R1 into the memory location contained in R2, and (2) add `increment` to R2 and store the result back in R2. In other words, the instruction does this:

`M[R2] = R1; R2 += increment.`

1. Design this instruction. Specify how each bit of the instruction is used. For example, specify which bits contain R1, which contain R2, and which contain the `increment`.
2. Make any necessary changes to the CPU to support this new instruction. You may add additional muxes and control wires if necessary.
3. Specify how each control wire is set for this instruction (including any new control wires you added).

