

HW2 Report B07902082

2.8

$x30 = \&A[0] + 8 = \&A[1]$

$x31 = \&A[0] + 0 = \&A[0]$

$\&A[1] = \&A[0]$

$\&A[1] = A[1] = \&A[0]$

$f = \&A[0] + \&A[0] = 2*\&A$

2.9

	Type	opcode, funct 3, 7	rs1	rs2	rd	imm
addi x30, x10, 8	I-type	0x13 or 0010011, 0x0	10		30	8
addi x31, x10, 0	R-type	0x13 or 0010011, 0x0	10		31	0
sd x31, 0(x30)	S-type	0x23, 0x3	31	31		0
ld x30, 0(x30)	I-type	0x3, 0x3	30		30	0
add x5, x30, x31	R-type	0x0, 0x0	30	30	5	

2.16

2.16.1

First off the rs1, rs2 and rd fields would be increased from 5 to 7 bits while the opcode should be increased from 7 to 9 bits. That way the opcode can actually hold 4 times more instructions.

2.16.2

The opcode would similarly need 2 more bits while rs1 and rd would need a total of 4 more. This leaves the immediate to only needing 6 bits. Because the immediate field was decreased, it would only make the instruction longer, which is usually unpreferred.

2.16.3

There could be 2 scenarios. While each field size was increased, it could make the instruction longer which elongates the code. However, this could decrease the chances of register error or spillage which would reduce the total amount of instructions operated.

Report on Matrix Multiplication

```
root@725a5912df78:~/Problems/matrix# make test
spike pk ./matrix
bbl loader
Took 11275759 cycles
```

- I only got my program to run at most 11,275,759 cycles; however, the naive matrix multiplication ran 16,892,677 cycles.
- With my program code literally using 5 loops to run, but with 128 SIZE for each loop, the total amount of actual loops the program runs is 128^3 . Therefore load runs $128^3 \cdot 2$ and store runs 128^3
- I used blocked matrix multiplication and essentially separated the matrix into multiple blocks. I loaded a block of B, supposedly into the L1 cache to use it up then discard after all of the block was processed. This way we do not have to redo repetitive steps for each individual element in the matrix but rather a block at a time.
- I used 5 loops for the bijk blocked implementation; however, there are other methods involving 6 such as bkij or bikj blocked implementation.