

Susmitha Shailesh

I pledge my honor that I have abided by the Stevens Honor System.

2.1

```
SUB X3, X2, #5
ADD X0, X1, X3
```

2.3

```
SUB X9, X3, X4
LSL X9, X9, #3
ADD X9, X9, X6
LDUR X10, [X9, #0]
STUR X10, [X7, #64]
```

2.4

$B[g] = A[f] + A[f+1];$

2.5

```
//Get reference for B[g]
LSL X10, X1, #3
ADD X10, X7, X10
```

```
//Get reference for A[f]
LSL X9, X0, #3
ADD X9, X6, X9
```

```
//Get value of A[f]
LDUR X0, [X9, #0]
```

```
//Get value of A[f+1]
LDUR X11, [X9, #8]
```

```
//Add A[f] and A[f+1]
ADD X9, X0, X11
STUR X9, [X10, #0]
```

2.9

$f = A[0] + A[0]$

2.10

Code	opcode	Rn	Rd/Rt	Value of immediate field for I-Type	Value of Rm for R-Type
ADDI X9, X6, #8	580 _{ten}	6	9	8	
ADD X10, X6, XZR	1112 _{ten}	6	10		31
STUR X10, [X9, #0]	1984 _{ten}	9	10	0	
LDUR X9, [X9, #0]	1986 _{ten}	9	9	0	
ADD X0, X9, X10	1112 _{ten}	9	0		10

2.22

X1 = 2

2.25.1

X0 = 20

2.41.1

$$CPI_0 = 1 * \frac{500}{900} + 10 * \frac{300}{900} + 3 * \frac{100}{900} = 4.2222...$$

$$Arithmetic\ Instructions = 0.75 * 500 = 375$$

$$Execution\ Time_0 = CPI_0 * f * 900 = 3800f$$

$$CPI_1 = 1 * \frac{375}{775} + 10 * \frac{300}{775} + 3 * \frac{100}{775} = 4.74$$

$$Execution\ Time_1 = CPI_1 * f * 775 * 1.10 = 4042.5f$$

This is not a good design choice because it caused the total execution time to increase.

2.41.2

$$\text{Arithmetic } CPI_1 = 1 * \frac{1}{2} = \frac{1}{2}$$

$$CPI_1 = \frac{1}{2} * \frac{500}{900} + 10 * \frac{300}{900} + 3 * \frac{100}{900} = 3.94444...$$

$$\text{Speedup} = \frac{4.222}{3.944} = 1.07$$

To improve the performance of arithmetic instructions by 10 times:

$$\text{Arithmetic } CPI = 1 * \frac{1}{10} = \frac{1}{10}$$

$$CPI = \frac{1}{10} * \frac{500}{900} + 10 * \frac{300}{900} + 3 * \frac{100}{900}$$

$$\text{Speedup} = \frac{4.222}{3.722} = 1.13$$

2.42.1

$$CPI_{avg} = 0.7 * 2 + 0.1 * 6 + 0.2 * 3 = 2.6$$

2.42.2

$$IPC_0 = \frac{1}{2.6} = 0.3846$$

$$IPC_1 = IPC_0 * 1.25 = 0.4808$$

$$CPI_1 = \frac{1}{IPC_1} = 2.08$$

$$CPI_1 = 0.7 * \text{Arithmetic Cycles} + 0.1 * 6 + 0.2 * 3$$

$$2.08 = 0.7 * \text{Arithmetic Cycles} + 1.2$$

$$0.7 * \text{Arithmetic Cycles} = 0.88$$

$$\text{Arithmetic Cycles} = 1.2571$$