4.31.5

Using the solution from 4.31.4, we have the following instructions

```
(a) beqz x13, DONE
(b) li x12, 0
TOP:
(c) slli x5, x12, 3
(d) add x6, x10, x5
(e) ld x7, 0(x6)
(f) add x31, x11, x5
(g) ld x29, 8(x6)
(h) addi x12, x12, 2
(i) sub x30, x7, x29
(j) sd x30, 0(x31)
(k) bne x12, x13, TOP
DONE:
```

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
a	IF	ID	EX	ME	WB																		
b		IF	ID	.	EX	ME	WB																
c			IF	.	ID	EX	ME	WB															
d			IF	.	ID	.	EX	ME	WB														
e					IF	.	ID	EX	ME	WB													
f					IF	.	ID	EX	ME	WB													
g						IF	ID	EX	ME	WB													
h						IF	ID	EX	ME	WB													
i							IF	ID	.	EX	ME	WB											
j							IF	ID	.	EX	ME	WB											
k								IF	ID	.	.	EX	ME	WB									

4.31.6

1 issue machine = 7 cycles

2 issue machine = 8 cycles

hence speedup = $\frac{8}{7}$ = 1.14

==speedup = 1.14==

4.31.7

beqz x13, Done

li x12, 0

Top:

slli x5, x12, 3	}	ld x29, 8(x6)	}	Sub x30, x7, x29
add x6, x10, x6		ld x5, 16(x6)		sd x30, 0(x31)
add x31, x11, x5		ld x15, 24(x6)		bne x12, x13, Top
ld x7, 0(x6)		addi x12, x12, 2		Done: