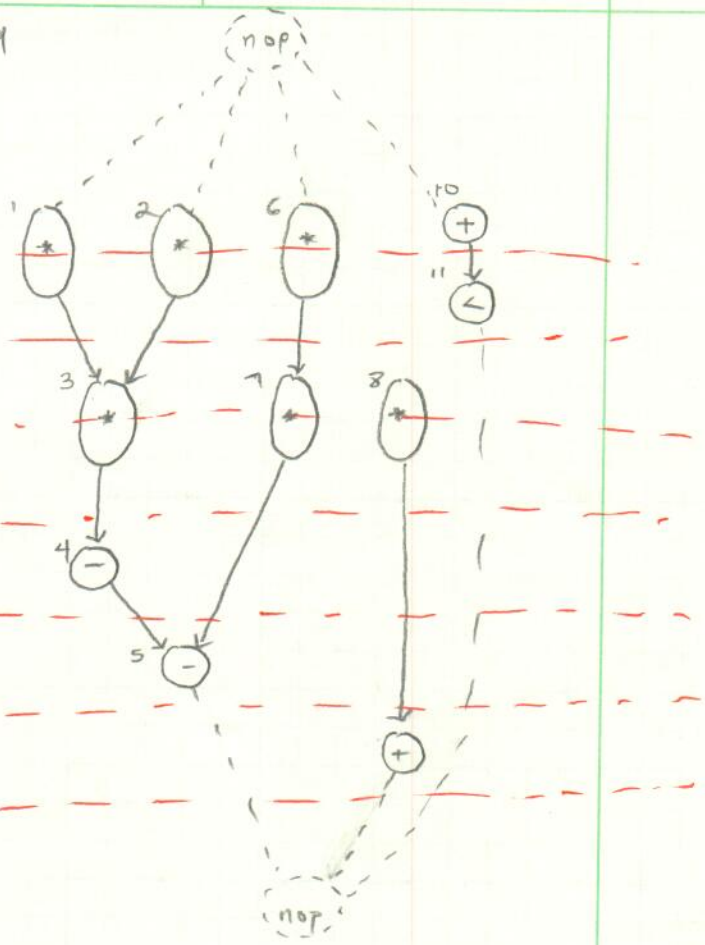
List_L, example 2 - slide 9

Time	Mult	ALU
1	u = 1, 2, 6, 8 s = 1, 2, 6 T = 1, 2, 6	u = 10 s = 10 u = 11 s = 11
2		
3	u = 3, 7, 8 s = 3, 7, 8 T = 3, 7, 8	
4		
5		u = 4, 9 s = 4
6		u = 5, 9 s = 5
7		u = 9 s = 9



List_L scheduling example

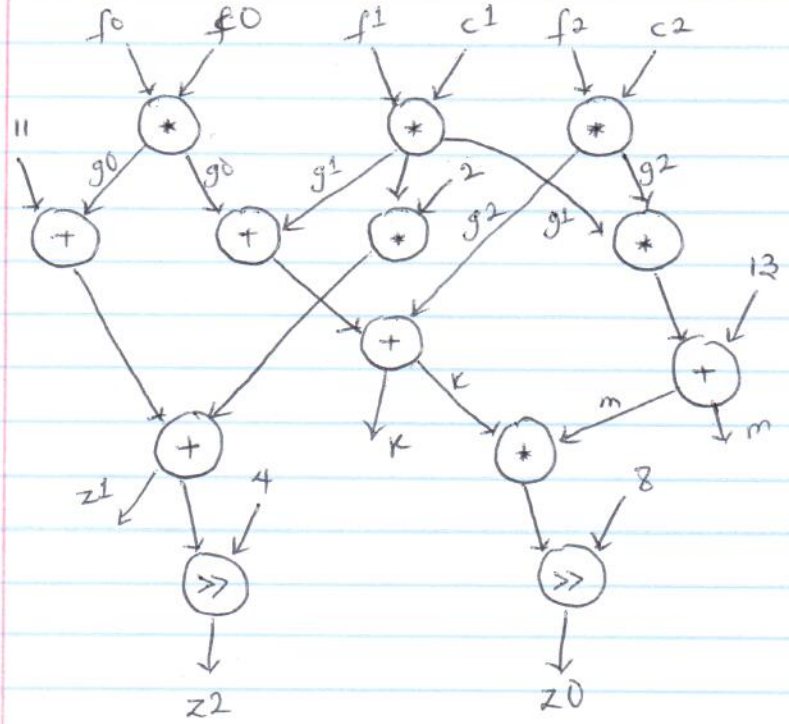
Homework 12

C code:

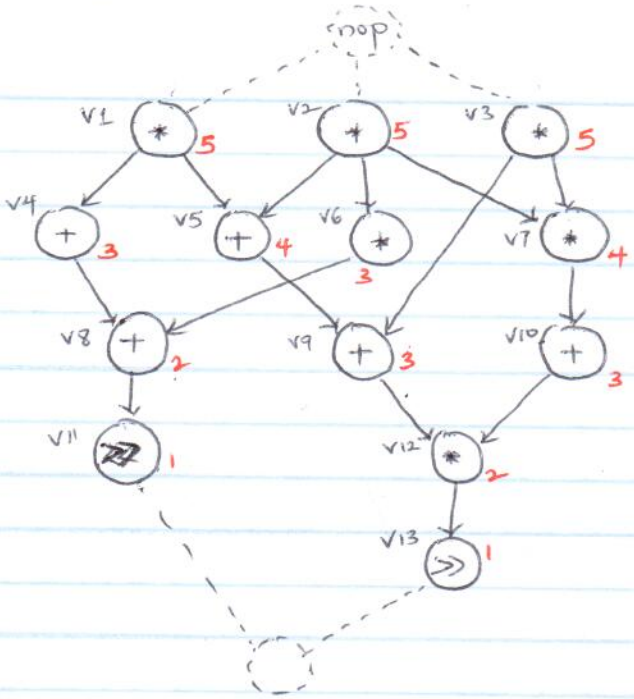
```
g0 = f0 * c0
g1 = f1 * c1
g2 = f2 * c2

k = g0 + g1 + g2
m = (g1 * g2) + 13
z0 = (k * m) >> 8
z1 = (g0 + 11) + (g1 * 2)
z2 = z1 >> 4
```

CDFG:



Sequencing graph:

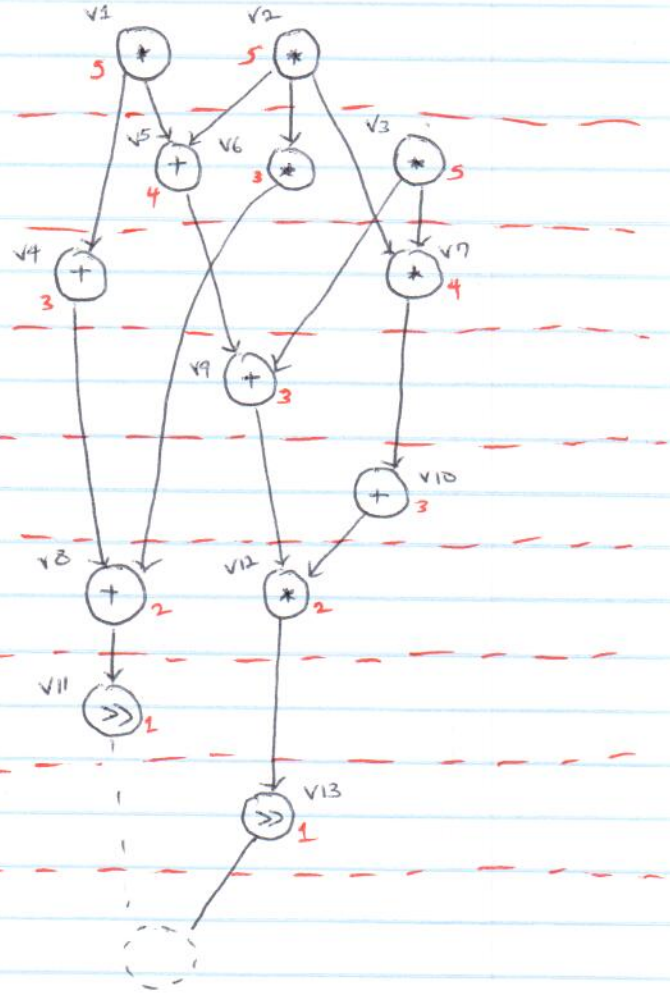


Red Labels: max distance from sink vertex

List_L schedule :

Resource constraints, latency
Multipliers: 2, 1 cycle
Adder/subtractor: 1, 1 cycle
Logic : 1, 1 cycle

Time	Multipher	Adder/ subtractor	Logic
1	u = {1, 2, 3}	u = { }	u = { }
	s = {1, 2}	s = { }	s = { }
2	u = {3, 6}	u = {4, 5}	
	s = {3, 6}	s = {5}	
3	u = {7}	u = {4, 9}	
	s = {7}	s = {4}	
4		u = {8, 9, 10}	
		s = {9}	
5		u = {8, 10}	
		s = {10}	
6	u = {12}	u = {8}	
	s = {12}	s = {8}	
7			u = {11, 13}
			s = {11}
8			u = {13}
			s = {13}



Is this the minimum latency schedule?

Homework: Find a lower latency schedule!

What if multipher latency is ~~was~~ 2 cycles?

List_R example

$d = (a+b) * c$

$e = (3*x + 4*y) / 8$

$f = e + 7$

$g = (f+d) / 2$

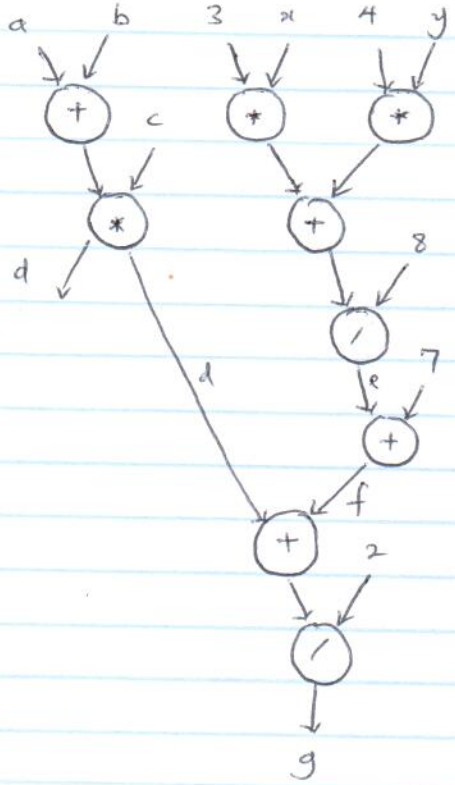
Latency constraint: 11

Multipliers : 2 cycle

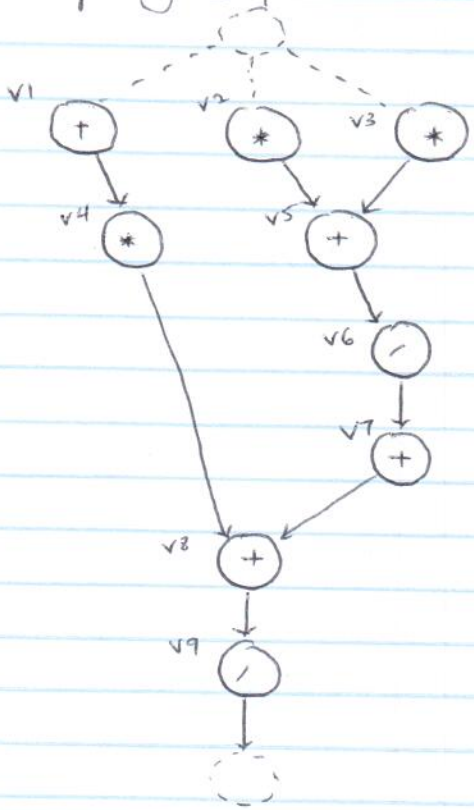
Adders : 1 cycle

Dividers : 2 cycle

CDFG:



Sequencing graph

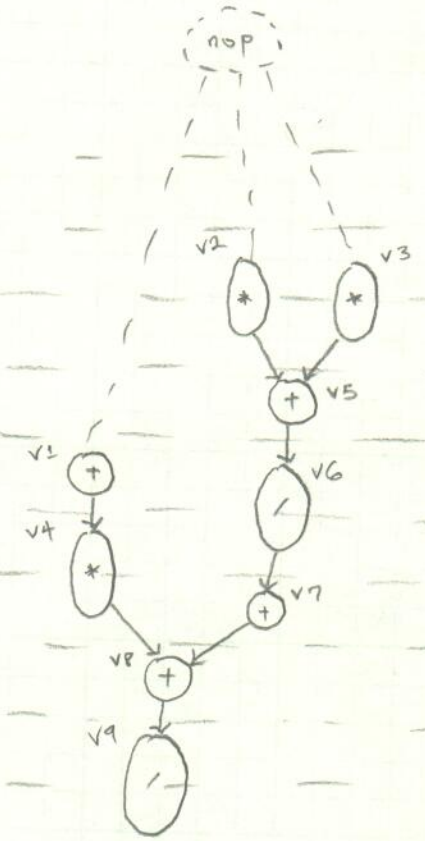


ALAP:

Node	Time	
1	4	6
2	2	3
3	2	3
4	5	7
5	3	5
6	4	6
7	5	8
8	6	9
9	7	10

List_R example Cont'd

ALAP:



List_R:

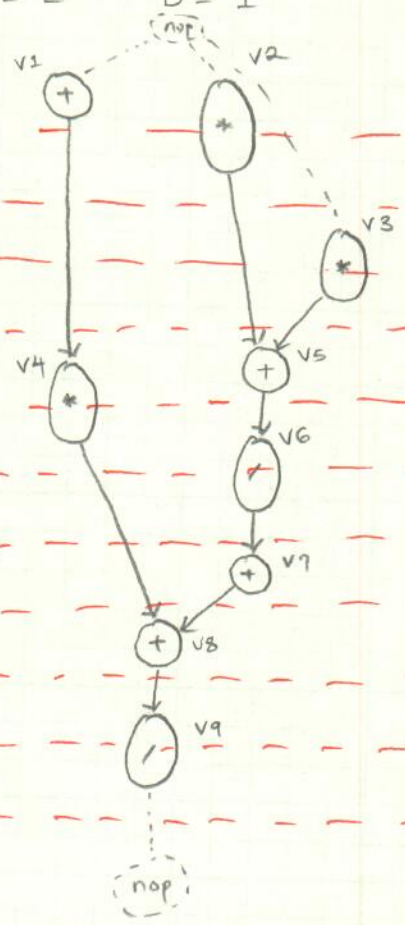
M = 1 Div

A = 1

D = 1

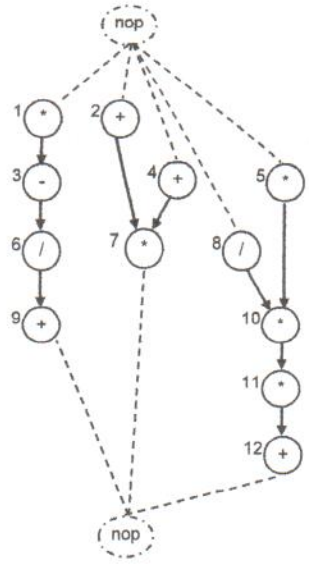
L: slack

	Mult	Adder
1	u = 2, 3 L = 2, 2 s = 2	u = 1 L = 5 s = 1
2	u = 3, 4 L = 1, 6 s = ∅	
3	u = 3, 4 L = 0, 4 s = 3	
4		
5	u = 4 L = 2 s = 4	u = 5 L = 0 s = 5
6	u = 6 L = 0 s = 6	
7		
8	u = 7 L = 0 s = 7	
9	u = 8 L = 0 s = 8	
10	u = 9 L = 0 s = 9	
11		

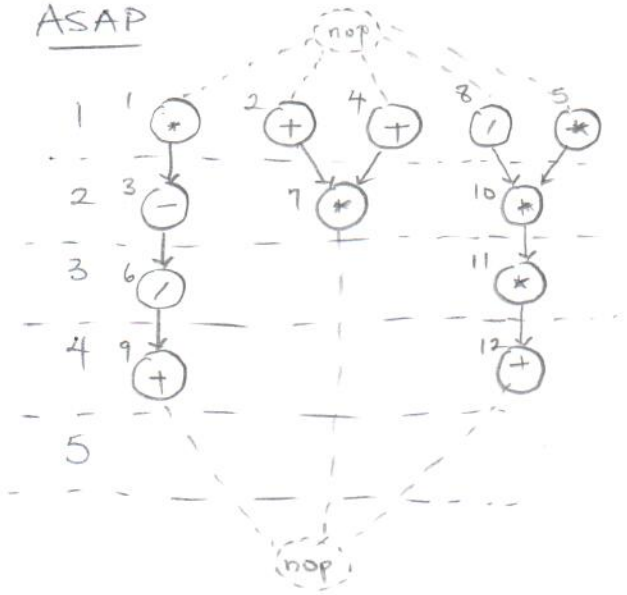


1 mult, 1 adder, 1 div.

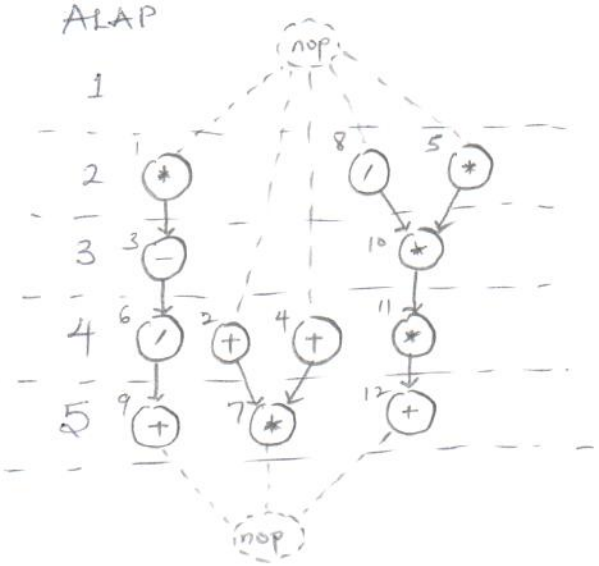
Given a latency constraint of 5, and assuming all resources (multiplier, adder/subtractor, and divider) have a 1 cycle delay, calculate the total force for the following vertex.



ASAP



ALAP



Time frames:

v1	[1, 2]
v2	[1, 4]
v3	[2, 3]
v4	[1, 4]
v5	[1, 2]
v6	[3, 4]
v7	[2, 5]
v8	[1, 2]
v9	[4, 5]
v10	[2, 3]
v11	[3, 4]
v12	[4, 5]

Operation probabilities and type distribution

Multiplier	P(1)	P(2)	P(3)	P(4)	P(5)
v1	0.5	0.5	0	0	0
v5	0.5	0.5	0	0	0
v7	0	0.25	0.25	0.25	0.25
v10	0	0.5	0.5	0	0
v11	0	0	0.5	0.5	0
Type dist:	1	1.75	1.25	0.75	0.25

Divider	P(1)	P(2)	P(3)	P(4)	P(5)
v6	0	0	0.5	0.5	0
v8	0.5	0.5	0	0	0
Type dist:	0.5	0.5	0.5	0.5	0

Adder/Subt	P(1)	P(2)	P(3)	P(4)	P(5)
v2	0.25	0.25	0.25	0.25	0
v3	0	0.5	0.5	0	0
v4	0.25	0.25	0.25	0.25	0
v9	0	0	0	0.5	0.5
v12	0	0	0	0.5	0.5
Type dist	0.5	1	1	1.5	1

Total forces Iteration 1

	1	2	3	4	5
v1	-0.375	0.375			
v2	-0.5	0	0	-0.25	
v3		-0.375	0		
v4	-0.5	0	0	-0.25	
v5	-0.375	0.125			
v6			0	-0.25	
v7		-0.25	0.25	-0.25	-0.75
v8	0	-0.25			
v9				0.25	-0.25
v10		-0.125	-0.5		
v11			0.5	0.5	
v12				0.5	-0.25

- Schedule v_7 in time 5
- Update operator probabilities for v_7 (New time frame = [5,5])
- Update type probabilities