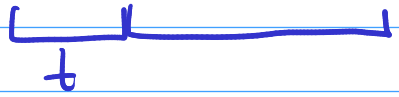
25% q



$$\frac{1}{0.75+\frac{0.25}{2}} = \frac{2}{1.75} = \frac{8}{7}$$

$$\frac{1}{\frac{0.75}{2}+0.25} = \frac{2}{1.25} = \frac{8}{5}$$

Instruction Type	Inst Count	CCC
int Arithmetic	45000	1
Data transfer	32000	2
FP	15000	2
Control transfer	8000	2

94
16
110
145

$$\frac{45000\times1 + 32000\times2 + 15000\times2 + 8000\times2}{100{,}000}$$

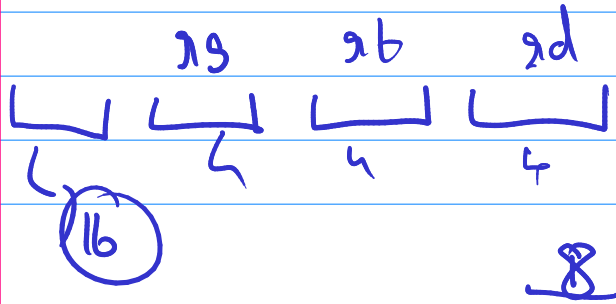
1.55

1550

400MHz: 1.55 CPI

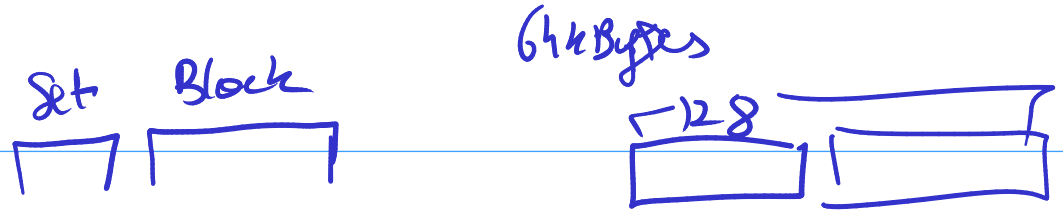
$\frac{1.55}{400\times10^6}$ SPI $\quad \frac{400\times10^6}{1.55}$ IPS

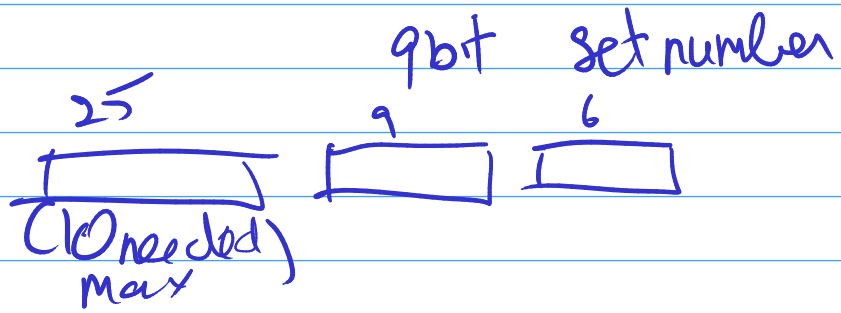
$\frac{400}{1.55}$ MIPS



8 Stage

$\frac{8}{2\times10^9}$ (4ns)





⇒ 10+9+4 = 23 bits for a word.

---

jmodn

0.6 X(10ms)
+0.4X(80+80+10)

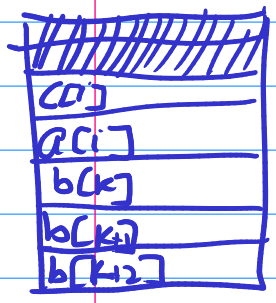
(6) int a[1024][1024] 2^{20} : 2^{12}
b[1024][1024] 2^{20} : 2^{12}
2^{20}

1024 integers

1024^2

1024

C[i][j] += a[i][k] + b[k][j]



} $\frac{1024}{3} = (1024^3 + 1024 + 1024)$

(b) 1.25×10^{-306} $-306x$ 3

1.23×10^{-306}

A 0.02×10^{-306}

2×10^{-308}

.5 .25 .125 .0625 .03125 .015625

.000000.01

1.1×2^{-6}

3.32

1023

$2x$ 2

1.00×2^{-1024} 1/1

Y	NT	1	Y	NT
N	T	1	Y	NT
N	T	2	N	T

M1: Ideal

M2: EX stage ⇒ 2 penalty cycles predict not taken

ID ⇒ Branch Delay

M1: CPI 1

20% → 5% → stall

$1 + 2(0.05) = 1.1$ CPI

$1 + 1 \times (0.05)(0.7)$

1.035

Q(6) (a)

(b) O(1) (Lots of threading)
set OCKs (serial each)
fully OCN

nB
32
16

(Q7)(a) -176.375_{10}

11

10110000

01001111
01010000
FF50.0110

-1.76375

. 110000

C3B06000

10110000.011_2
1.01100000011×2^7

1.10000110. 01100000110000000000000

C 3 3 0 6 0 0 0 0

$(a+b)+c$

$= 0 + 1.0 = 1.0$

$a+(b+c) = -2.7\times10^{23} + (2.7\times10^{23} + 1)$

$= 2.7\times10^{23}$

$= 0$

9.76×10^{25} 2.59×10^{24}

9.76×10^{25} $.25\times10^{25}$

10.01×10^{25}

1×10^{26}

9.7600×10^{25}

$.2590\times10^{25}$

10.0190×10^{25}

1.0019×10^{26}

$\{1.00\times10^{26}\}$

6.019

interrupt

exception

$s0$ a

$s1$ b

gcd(a,b)

ged(a,a-b)

```
lw $s0, 0($t0)
lw $s1, 4($t0)

L1: beq $s0,$s1, exit
    sub $s1, $1, $0
    slt $t3, $s0, $s1
    beq $t3, zero, L2
    j L1

L2: sub $s0,$0,$s1
    j L1
exit
```

(1, 2, 9, 3, 6, 4, 7, 5, 8, 10, 11)

(1) bge $s0, $s1,

$s1 ≤ $s0
$s0 > $s1

1) B)

2) A)

3) D)

4) C)

(11)

11

11

4GB , 3GB , 0.75×2^{20} , 3MB

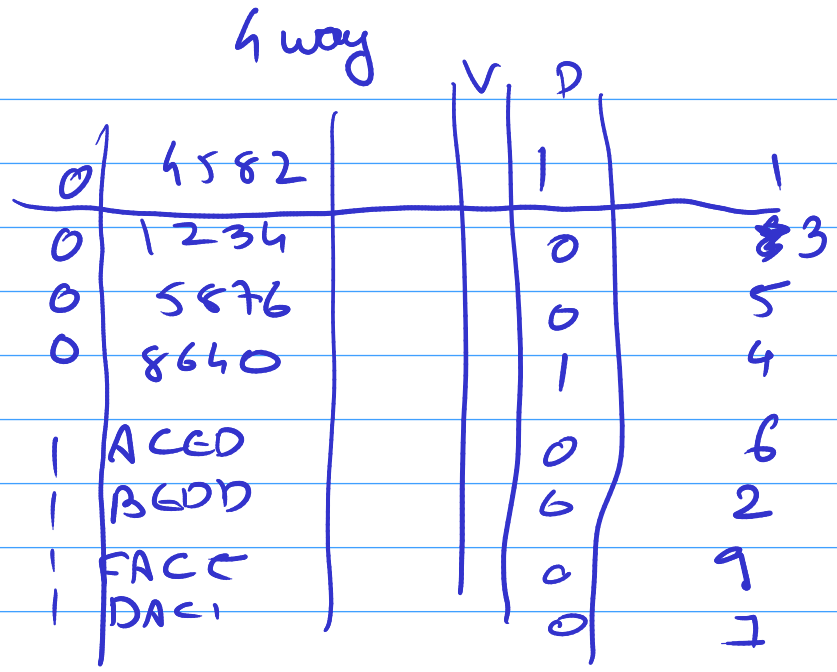
(i) 2-way set associative

2-way

	Address	Data	V	D	LRU
0	1234		1	0	3
0	8640		1	1	4
1	BEDD		1	0	2
1	ACED		1	0	6
2	5876		1	0	5
2	4582		1	1	1
3	6767		1	0	8
3	CBBB		1	0	7

(13)

D=



10000 x 1

$t1

```
lb   $a0, 0($t1)
add  $a0, $a0, 3
shl  $a0, $a0, 2
sb   $a0, 0($t1)
lb   $a1, 1($t1)
add  $a1, $a1, 3
shl  $a1, $a1, 2
sb   $a1, 1($t1)
```

1 pixel = 4 instr
10000 = 40000 instr

5 + 39999 x 1

137

(1) 0 | 10001001 | 1111100 0110001110101110

$2^{10} \times 1.1111100011000011$

3

$= 11111100011.00011$

$= 2019.066$

101.10000101

6
15625
78125
390625

③
28
112

9

0.52 0.100001
0.04 0100001111
.28 01100
.12
.92
.84
.68
.34

0

128
4 132
−127

0x41080000
425E0000

1.1011110 0 | 10000010 | 0000 1000 0
10001000 0 | 10000100 | 1011110
10.0000000000

$10 \cdot 2^5$ $2^6 = 64$ 01000000 0x40

0 1 0 0 0 0 1 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

4 2 8 0 3 0 0 0

0x42800000

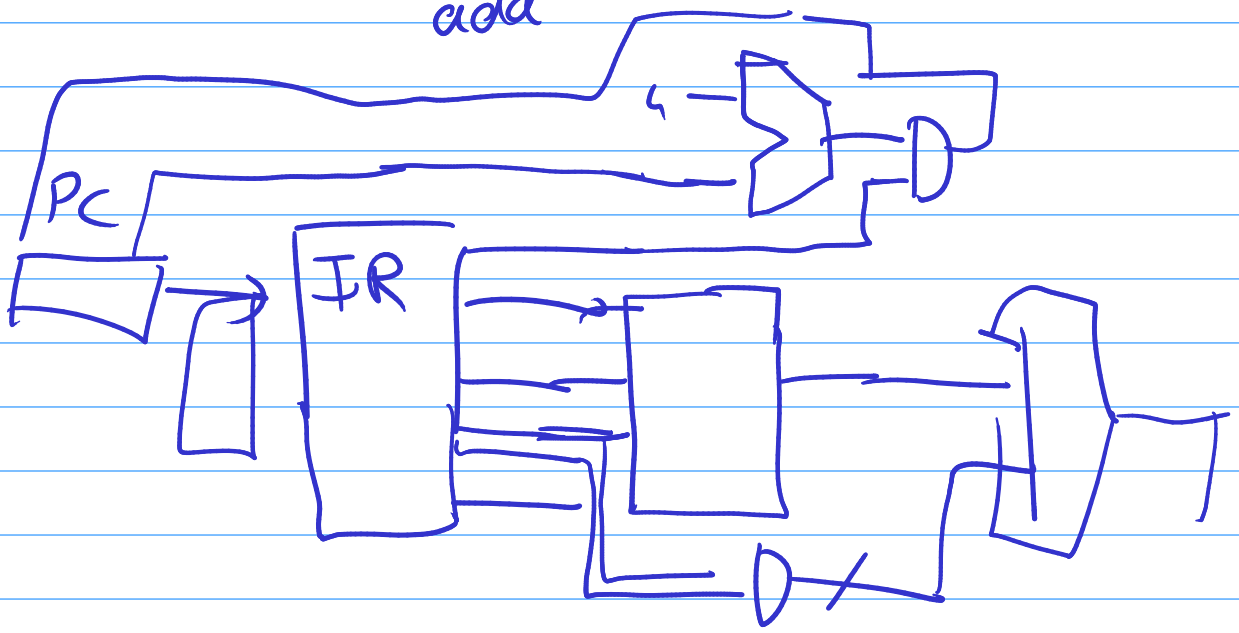
a+B

C=a+b

D=(A+B)*C

lda A

add



(i) B=A

(ii)

E $t0

E $t1