Probeklausur ROrg

1)

a)

2.1 → 2.2 : Data Hazard, $sp

1 → 3 : Data Hazard, $sp

3 → 4 : Load-Use-Hazard, $t2

5 → 6 : Load-Use-Hazard, $t2

b)

```
add
        2 NOPs
slt
        0 NOPs
lb
        2 NOPs
sub
        0 NOPs
lw
        2 NOPs
add
```

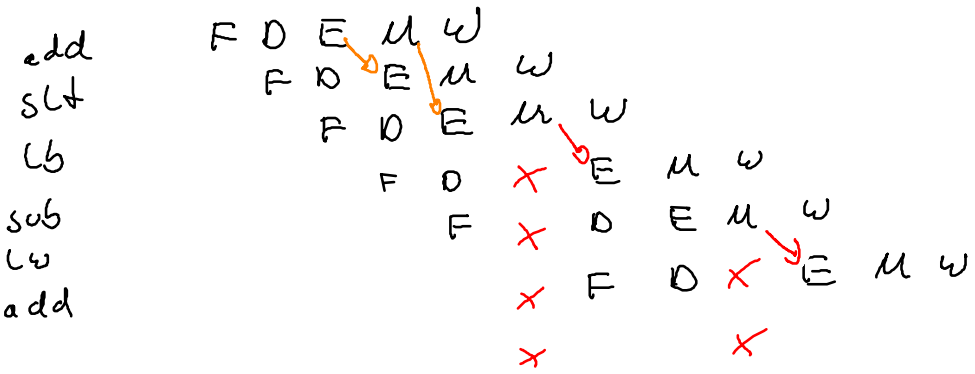
c)

takte = 4 + 6 + 6 = 16

$$CPI = \frac{16\ takte}{6\ inst} = 2,\overline{6}$$

12

d)



d)

$$CPI = \frac{12\ takte}{6\ inst} = 2$$

$$S = \frac{CPI_{SC}}{CPI_{PL}} = \frac{2,\overline{6}}{2} = 1,\overline{3}$$

2 (a) 150ps + 50ps + 100ps + 150ps + 50ps = 500ps = t_{SC}

2(b) $\max(150, 100, 60) = 150\,ps = t_{pipe}$

2(c) $S = \frac{t_{sc}}{t_{pipe}} = \frac{600}{150} = 3\frac{1}{3}$

2(d)
- Füllen der Pipeline
- Load-use data hazards
- Structural hazards

2(e)

	Eintakt			Pipelined
Komponente	Speicher	ALU	Registersatz	Speicher
Neue Latenz	17,4	34,8	17,4	130,4 ps

Lösungsweg: $S = \frac{t_{sc}}{t_{new}} \Rightarrow 1{,}15 = \frac{600}{t_{new}} \Rightarrow t_{new} = 434{,}8\,ps$

$434{,}8\,ps = 100\,ps + 2 \cdot 50 + 2 \cdot x$

$x = 117{,}4\,ps$

$434{,}8\,ps = 2 \cdot 150\,ps + 2 \cdot 50 + x$

$x = 34{,}8\,ps$

$\frac{150}{1{,}15}$

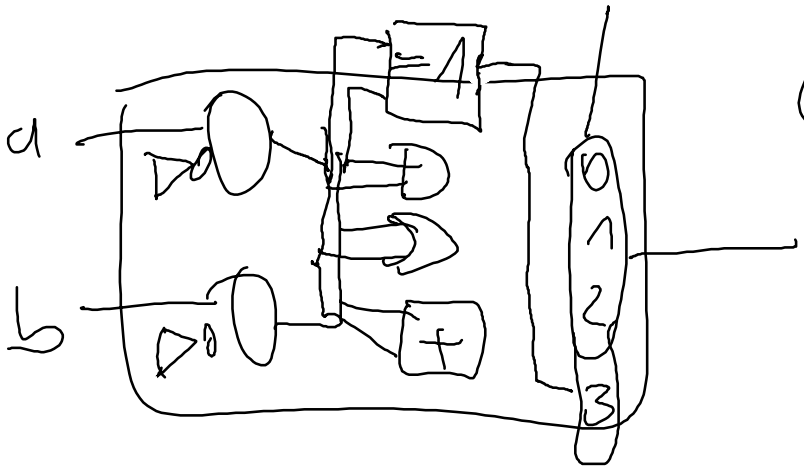
$t0 = a, $t1 = b

a b	a xor b
00	0
01	1
10	1
11	0

a) not $t2, $t1 # $\bar{b}$
→ and $t3, $t2, $t0 # $a\bar{b}$
not $t0, $t0 # $\bar{a}$
→ and $t4, $t0, $t1 # $\bar{a} \cdot b$
or $t5, $t3, $t4 # xor

→ $a\bar{b} + \bar{a}b$

b)



c) $A_{inv} = 0$
$B_{inv} = 0$
$Op = 11$

d)

	ALUOp	func		
R	xor	10	100	110	0011	xor

e)

RegDst = 1	MemR = 0	ALUOp = 10
jump = 0	MemW = 0	RegW = 1
branch = 0	MemtoReg = 0	AluSrc = ?

3 Caches

a) Adressgröße = |Tag| + |Index| + |Blockoffset|

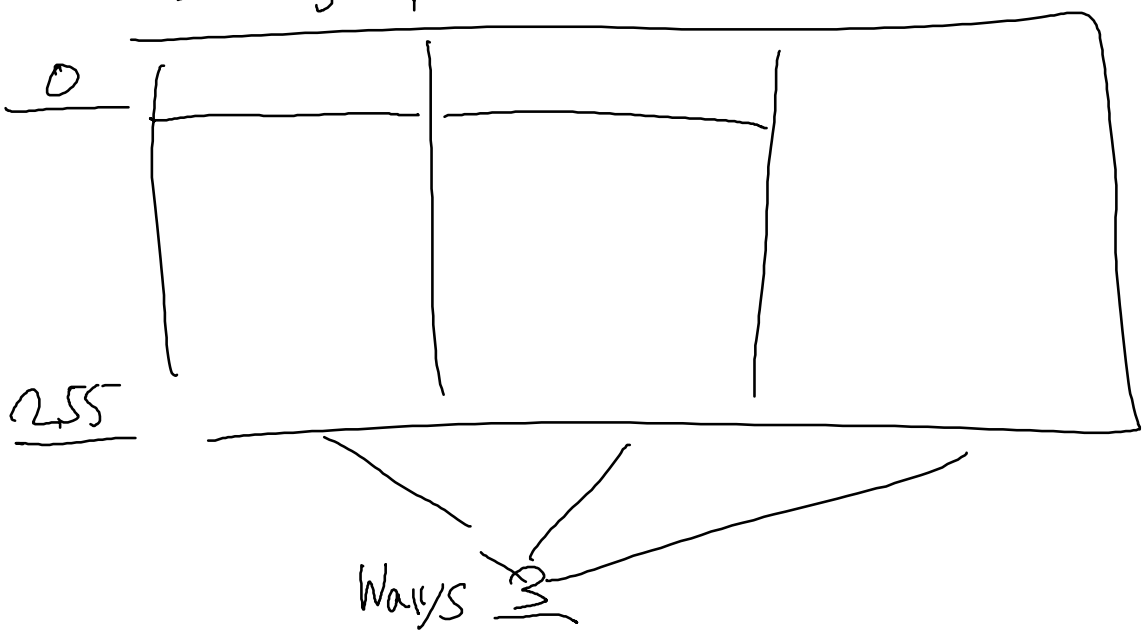
= 36 bit + 8 bit + 4 bit

= 48 bit

b) # Sätze = $2^{|Index|} = 2^8 = 256$

Block = $2^{\text{Blockoffsetlänge}} = 2^4 = 16$ Byte

Satzgröße = 3 × 16 = 48 Byte



Kapazität = # Sätze × Assoziativität × Blockgröße

= 256 × 3 × 16 Byte

= 12288 Byte = 12 kB