UiO : Institutt for informatikk

5. gruppetime IN1020

Maskinvare

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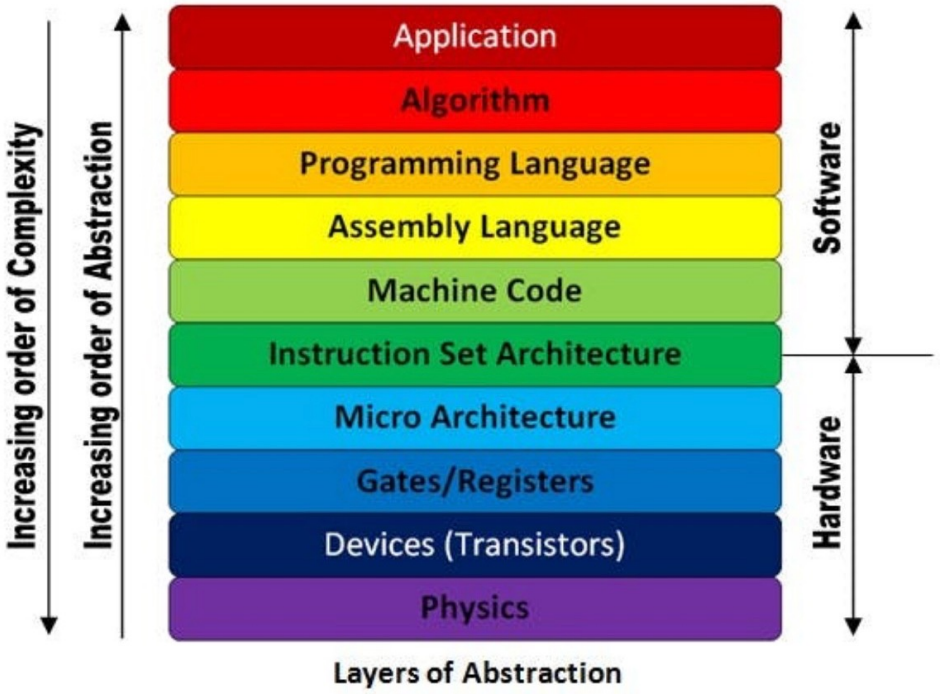
Plan for gruppetimen

- Hva er abstraksjonsnivåer?
- Eksempel på abstraksjonsnivåer
- Hva er en ALU?
- Oppgave i gruppe: ranger abstraksjonsnivåene
- Porter og sannhetsverditabeller
- Mentimeter-quiz

Abstraksjonsnivåer



Abstraksjonsnivåer for datamaskin

Eksempel: program i Python

Applikasjon

```
def add_numbers():
    a = 5;
    b = 8;
    c = a + b;
    print("a + c =", c)
}

def main():
    add_numbers()

main()
```

Assembly kode

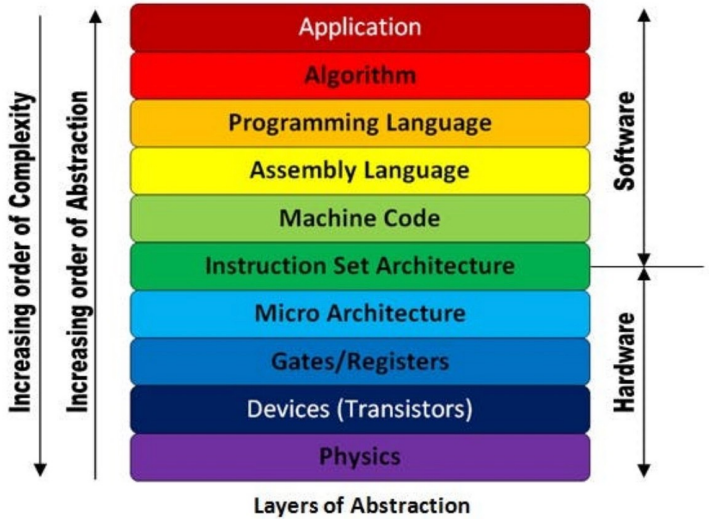
```
LDA a
ADD b
STA c
OUT
HLT

a DAT 5
b DAT 8
c DAT 0
```

Maskinkode

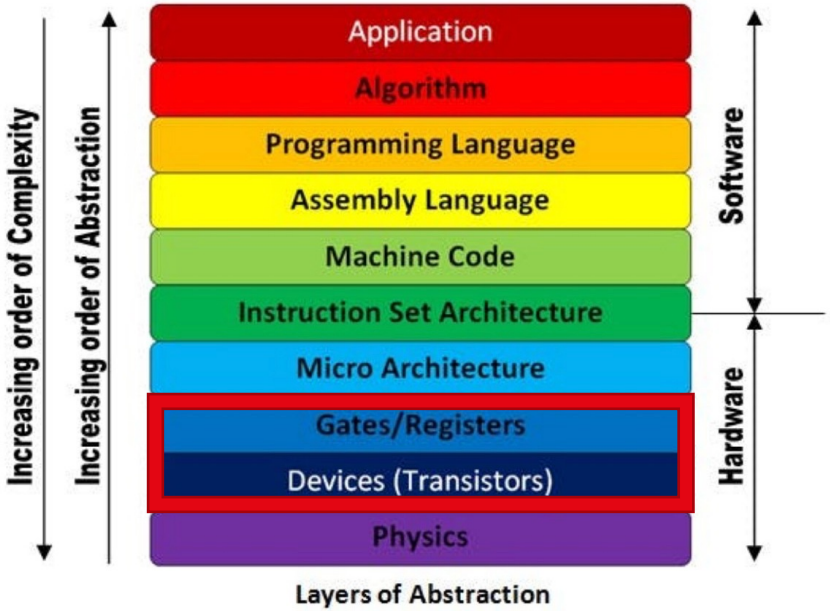
```
505
106
307
902
000

005
008
000
```



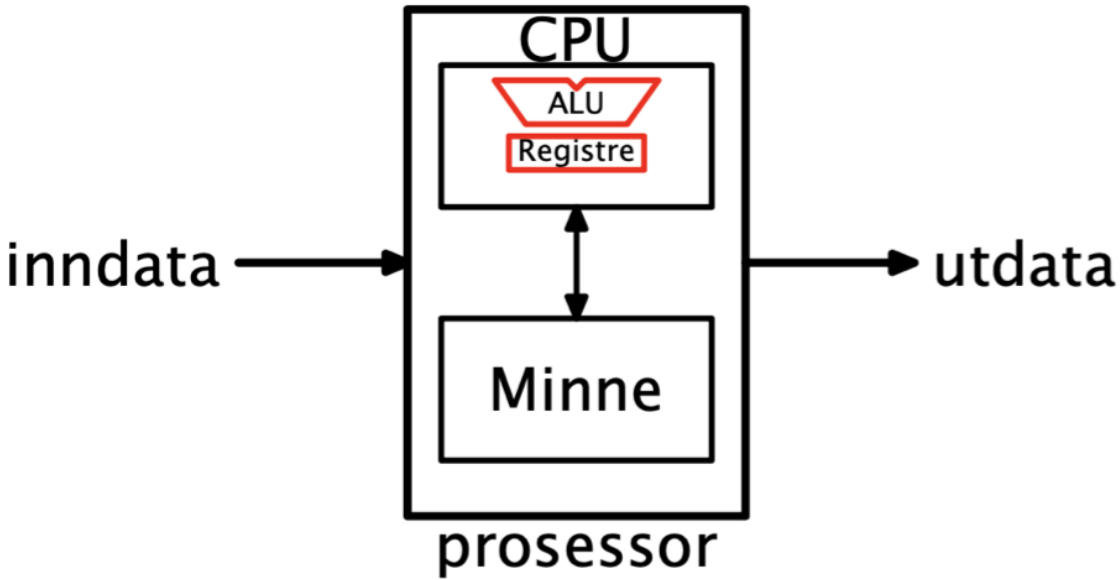
Abstraksjonsnivåer for datamaskin

Disse ukene skal vi gå enda dypere!



Abstraksjonsnivåer for datamaskin

Von Neumann-arkitekturen

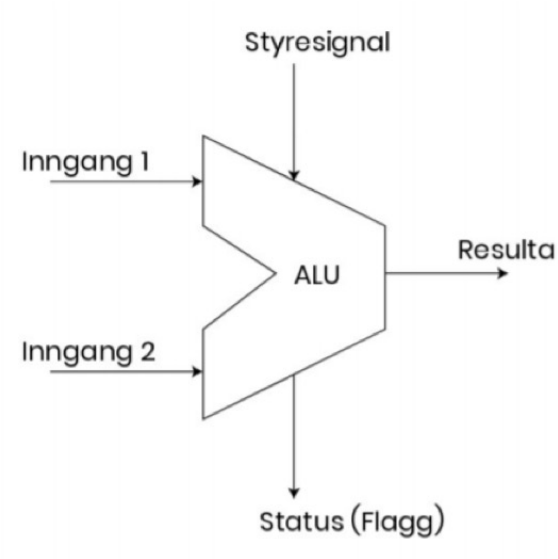


CPU - Central processing unit

- Består av blant annet ALU og en rekke registere
- CPUen er på mange måter sjefen i datamaskinen

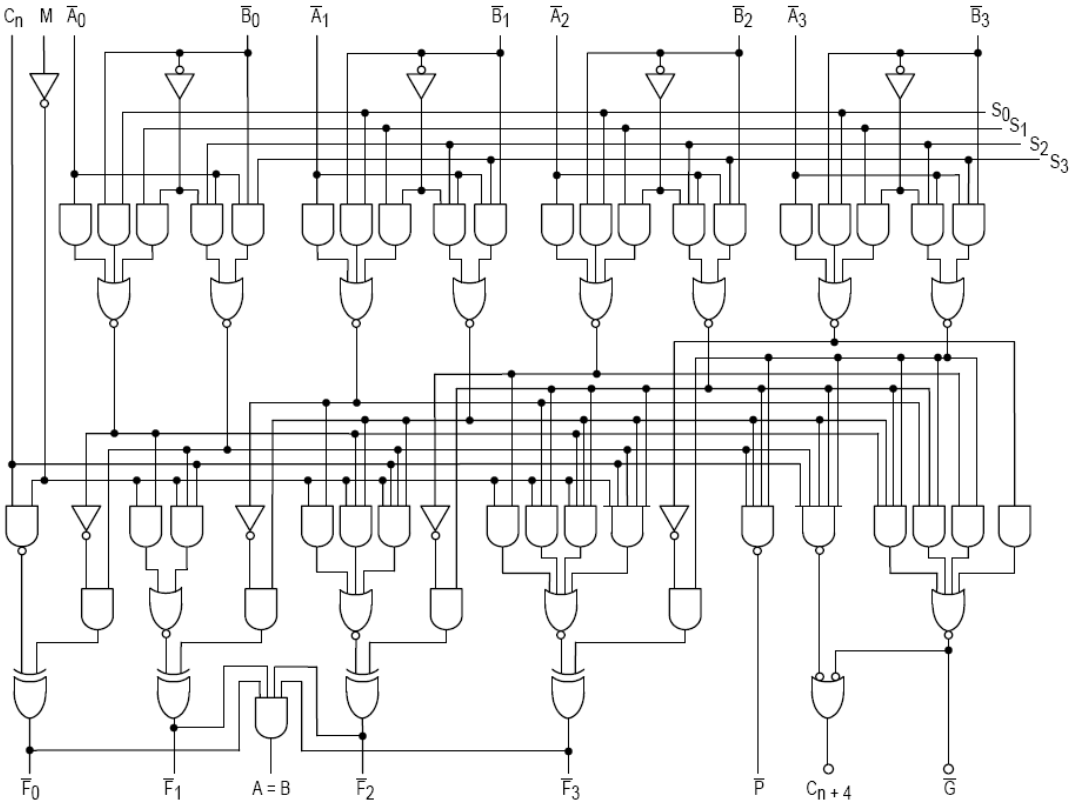
ALU – Aritmetisk logisk enhet

- Tre innganger:
  - Styresignal: bestemmer operasjonen som ALU-en skal gjøre
  - Inngang 1: 1 bit
  - Inngang 2: 1 bit
- To utganger:
  - Status (flagg): gjør at vi kan ha mente
  - Resultat: resultat av operasjonen



1-bits ALU

ALU-en består av mange porter!



Vanlig addisjon

	1	1 1
53	53	53
+ 13	+ 19	+ 68
= 66	= 72	= 121

Binær addisjon

Akkurat på samme måte, men her er det i det binære tallsystemet

	1	1 1
10	01	01
+ 01	+ 01	+ 11
= 11	= 10	= 100

Abstraksjonsnivåer

LMC

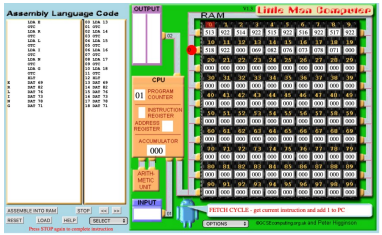
CPU

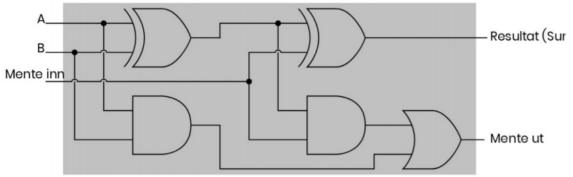
ALU

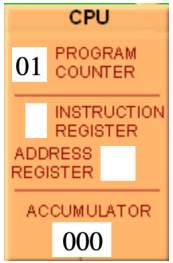
Fulladder

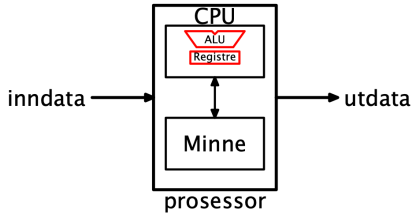
NAND

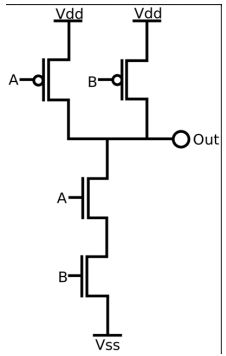
Transistor

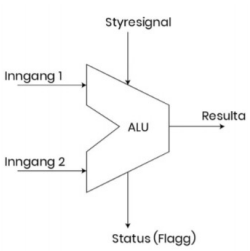


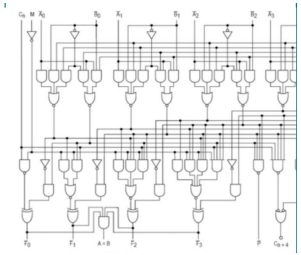


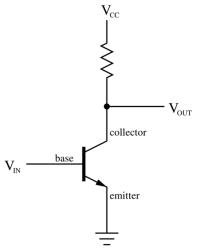












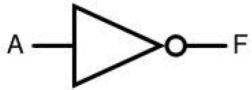
Mentimeter

Alle logiske port-typer

INV - port

$F = A'$

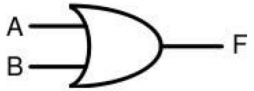
A	F
0	1
1	0



OR - port

$F = A+B$

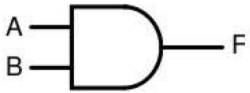
A	B	F
0	0	0
0	1	1
1	0	1
1	1	1



AND - port

$F = AB$

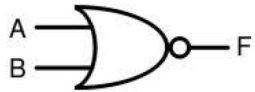
A	B	F
0	0	0
0	1	0
1	0	0
1	1	1



NOR - port

$F = (A + B)'$

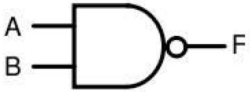
A	B	F
0	0	1
0	1	0
1	0	0
1	1	0



NAND - port

$F = (AB)'$

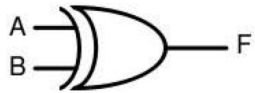
A	B	F
0	0	1
0	1	1
1	0	1
1	1	0



XOR - port

$F = A \oplus B$

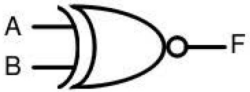
A	B	F
0	0	0
0	1	1
1	0	1
1	1	0



XNOR - port

$F = (A \oplus B)'$

A	B	F
0	0	1
0	1	0
1	0	0
1	1	1



Boolsk algebra

- Veldig likt som pythons booleans
- 1 = True og 0 = False

```
print("INV")
print(not False)
print(not True)
```

```
INV
True
False
```

```
print("OR")
print(False or False)
print(False or True)
print(True or False)
print(True or True)
```

```
OR
False
True
True
True
```

```
print("AND")
print(False and False)
print(False and True)
print(True and False)
print(True and True)
```

```
AND
False
False
False
True
```

```
print("NOR")
print(not (False or False))
print(not (False or True))
print(not (True or False))
print(not (True or True))
```

```
NOR
True
False
False
False
```

```
print("NAND")
print(not (False and False))
print(not (False and True))
print(not (True and False))
print(not (True and True))
```

```
NAND
True
True
True
False
```

Takk for i dag!

Spørsmål eller innspill? Send mail til erlinhol@uio.no