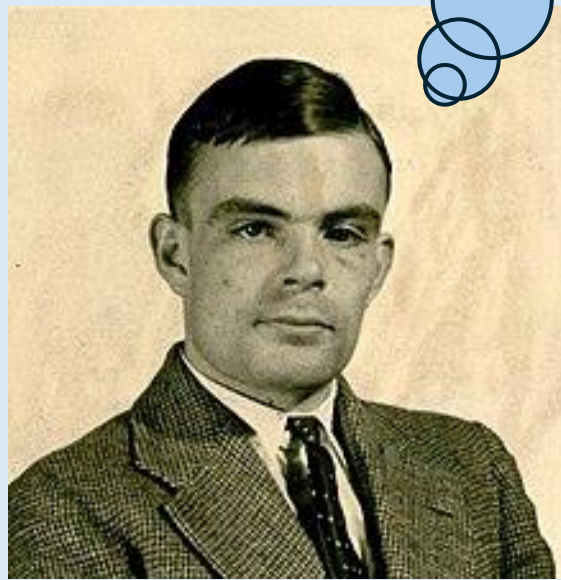




Parameteriserte algoritmer: Løser vanskelige problemer raskt

HVA ER UMULIG? HVA ER VANSKELIG?



STOPPEPROBLEMET
Q: Kan vi lage et program som sjekker om et annet program stopper opp?
A: Nei!
← Bevis av Alan Turing

TRE TYPER PROBLEMER

P: Lett å finne en løsning.

NP: Lett å sjekke at en løsning stemmer.

NP-KOMPLETT: Lett å løse bare dersom $P = NP$.

Clay Mathematics Institute
About Programs & Awards People The Millennium Problems

Home – Millennium Problems – P vs NP
Unsolved
P vs NP

Following the decision of the Scientific Advisory Board, the Board of Directors of CMI designated a \$7 million prize fund for the solutions to these problems, with \$1 million allocated to the solution of each problem.

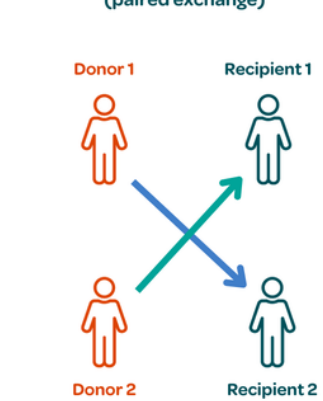
\$1 million



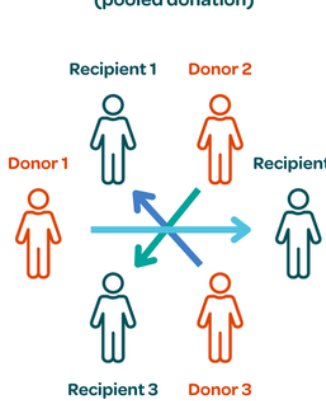
NOEN NP-KOMPLETTE PROBLEM



Two-way exchange (paired exchange)



Three-way exchange (pooled donation)



ER DETTE NYTTIG? JA!

Her kan du miste jobben av...



Dette klarer du (sannsynligvis) ikke...



Men dette kan du få til!



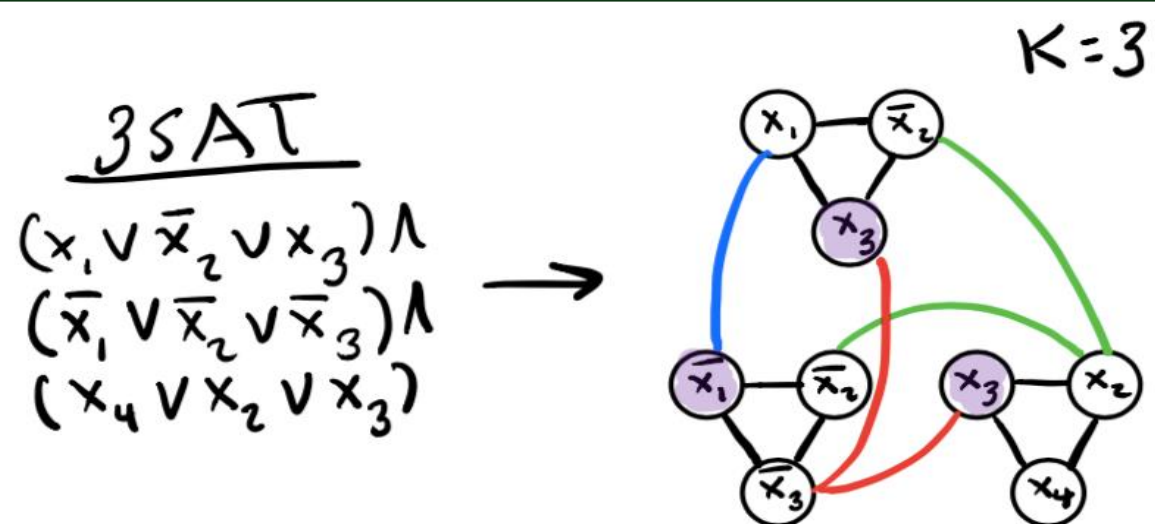
"I can't find an efficient algorithm, I guess I'm just too dumb." "I can't find an efficient algorithm, because no such algorithm is possible!"

"I can't find an efficient algorithm, but neither can all these famous people."

HVORDAN BEVISE A NOE ER NP-KOMPLETT?

IDE:

Vi vet at et problem som heter «3SAT» er NP-komplett. Hvis vi kan kode 3SAT som et annet problem er vi i mål!

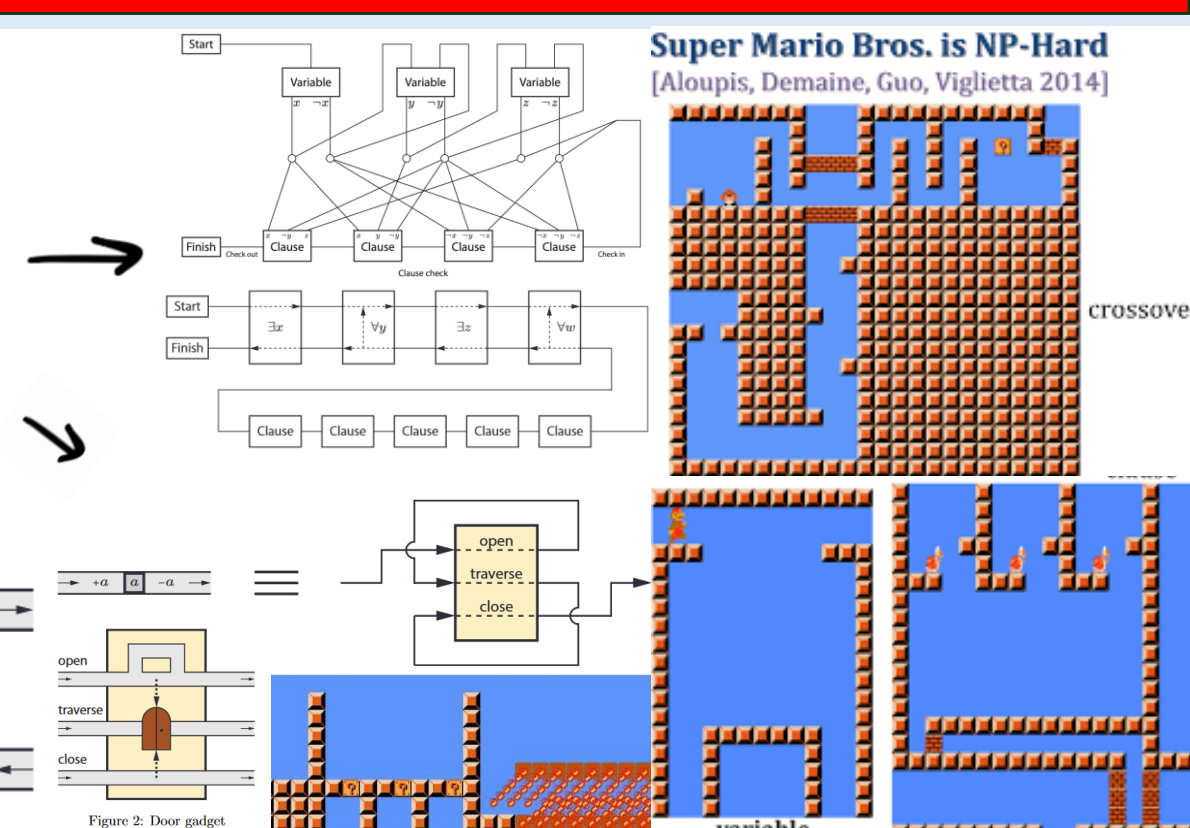
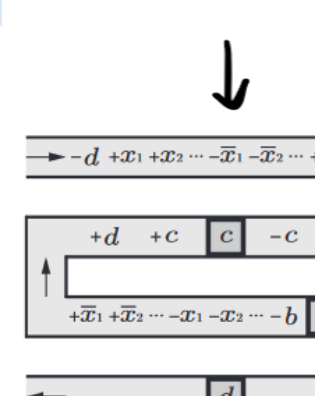


Noen ganger er dette ganske enkelt...

Andre ganger er det mye arbeid...

3SAT

$(x_1 \vee \bar{x}_2 \vee x_3) \wedge$
 $(\bar{x}_1 \vee \bar{x}_2 \vee \bar{x}_3) \wedge$
 $(x_4 \vee x_2 \vee x_3)$



Heldigvis er jobben ofte gjort av noen andre!

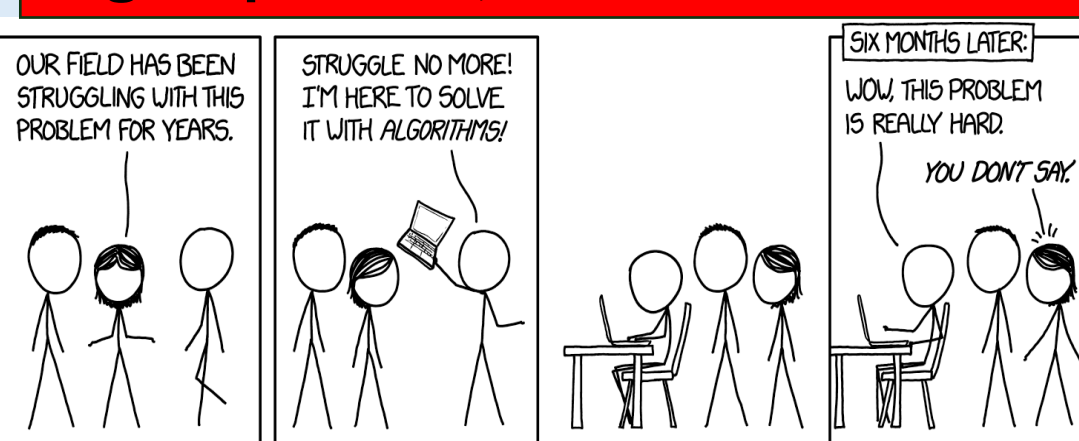


V E I E N V I D E R E ->

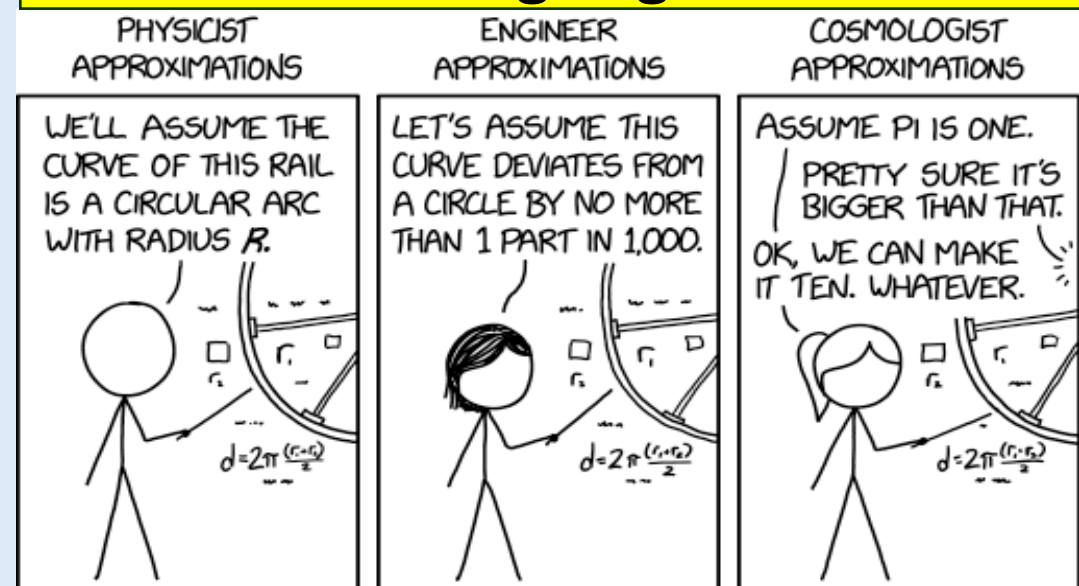
HVORDAN LØSE VANSKELIGE PROBLEM?

Ingen quick-fix, men vi kan bruke...

Heuristikker



Tilnærmingsalgoritmer



Restriksjoner



Randomisering

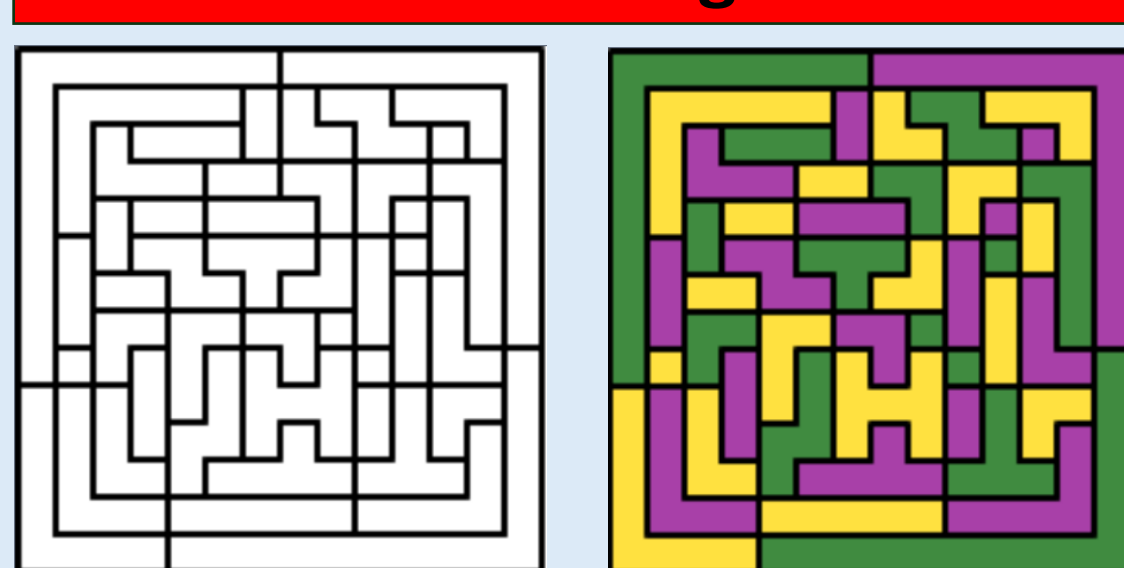
```
int getRandomNumber()  
{  
    return 4; // chosen by fair dice roll.  
             // guaranteed to be random.  
}
```

ELLER...

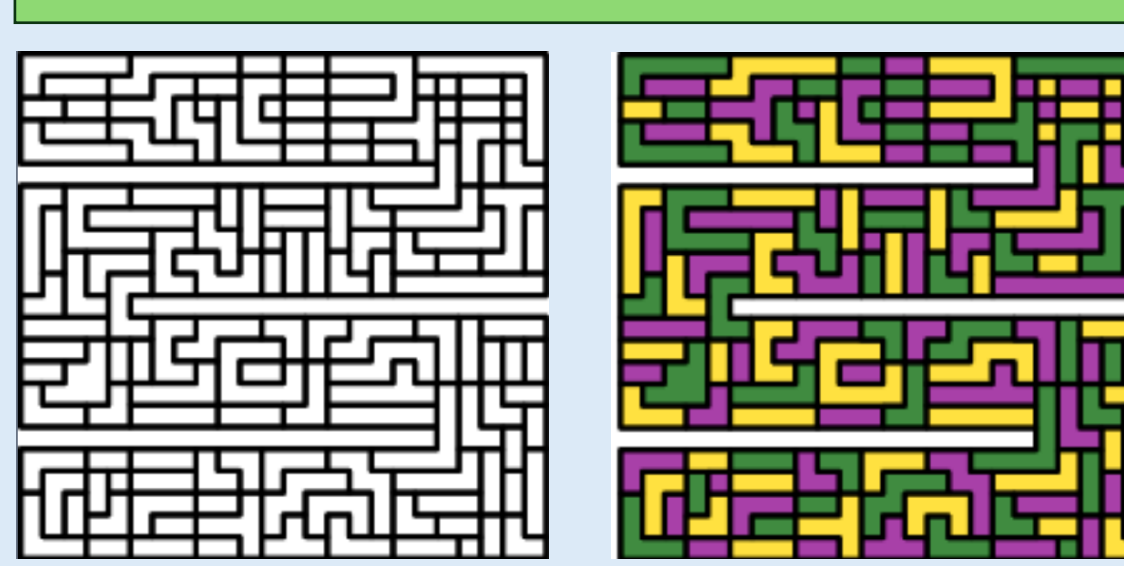
PARAMETERISERTE ALGORITMER!

IDE: Å utnytte «strukturer» i problemet til å finne løsninger som er effektive i praksis.

Vanskelig



Enkelt



Parameterisert kompleksitetsteori
Når parameteriserte algoritmer ikke kan hjelpe oss.

