

Models of Computation, Complexity Theory and Tetris

A Very Brief Introduction to Theoretical Computer Science
(Maths in Disguise!)

December 4, 2015

What is Computer Science?



Models of Computation

Compass and Straightedge Constructions

- I Start with two points. Distance between them is unit length.
- II Can draw a line between any two points.
- III Can draw a circle given centre and a point on its circumference.
- IV Can draw a point at the intersection of any two lines.
 - ▶ Rule II: $y = \frac{d-b}{c-a}x + \frac{ad-bc}{a-c}$
 - ▶ Rule III: $(x-a)^2 + (y-b)^2 = (a-c)^2 + (b-d)^2$

Models of Computation

Logic and Circuits

▶ $A \implies B$

▶ $\boxed{C} \boxed{D} \boxed{1} \boxed{2}$

“If there’s an C on one side there’s a 1 on the other”

▶ $W \implies X$

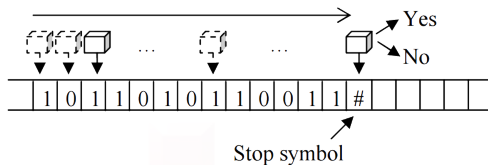
▶ $\neg Y \implies W$

▶ $\neg W \implies \neg Y$

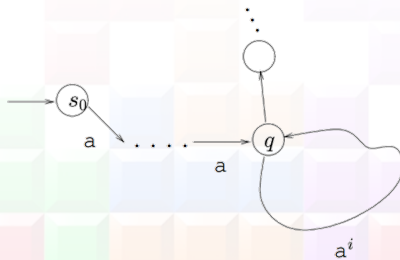
▶ $X \implies \neg W$

Models of Computation

Finite Automata and Regular Expressions



► $\{\Sigma, Q, q_0, \delta, F\}$



Models of Computation

Turing Machines

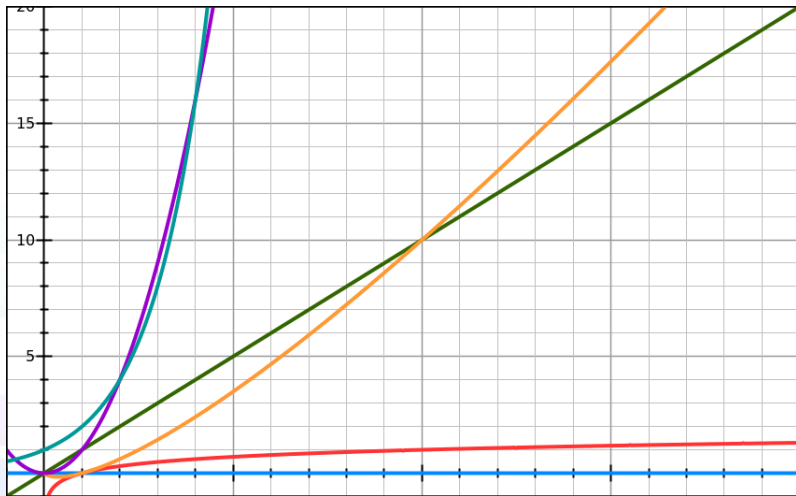
► $\{s, q, s', q', d\}$

for $i = 2$ to infinity:

if $2*i$ is not a sum of two primes
then halt

Complexity Theory

Big-O Notation



Complexity Theory

Complexity Classes

