```
// Java al code :

int positive = 0

for ( i = 0 ; i < n ; i ++ )
{
      positive = 1 ;
}
```

Mar 10, 09

\+ Thursday 3/12
  \- Go over problems
  \- Quiz Mini test

\+ Friday 3/13 ~~D~~CM 7:30 am ~~pm~~ / College Eng

Spring Break. T : 3/24
R : 3/26

Turn in

Project Progress Report !

Luc Longpre

Problem : We need to separate feasible algorithm from non-feasible ones.

Examples : $t \sim n^2, n^3 \rightarrow$ feasible
$t \sim 2^n \rightarrow$ not feasible

Definition :

$$t_U^{w}(n) = \max t_U(x)$$

$$x : len(x) = n.$$

An algorithm U is called feasible if there exists a polynomial $P(n)$ s.t.

$$\forall n \quad t_u^w(n) \leq P(n)$$

+ Important facts

This definition does not fully reflect the notion of feasibility.

- Ex 1. $t_u^w(n) = 10^{300} \cdot n$

→ common sense - viewpoint : not feasible
→ definition - still polynomial : feasible !

- Ex 2. $t_u^w(n) = \exp(\cancel{1}0.0000001\, n)$
→ common sense - feasible
→ definition - NOT feasible

Problem : No one knows how to produce a better definition.

We can use the knowingly imperfect definition of feasibility.

what is a problem.

$$\text{input} \longrightarrow \boxed{} \longrightarrow \text{output}$$

$$x \xleftrightarrow[\text{condition}]{\qquad\qquad} y$$

Mathematics :
x - statement
y - proof of x or $\neg x$.

+ comments:
checking where y is the correct proof of x.
is relatively easy.

+ The length of the proof should be feasible.

- Condition $R(x, y)$ is feasible.
$$len(y) \leq P_e(len(x))$$

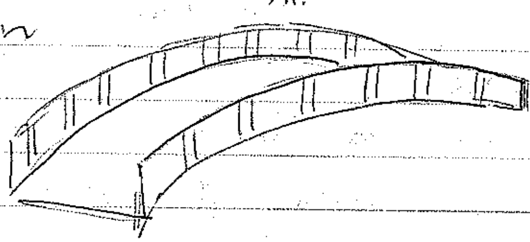
we have
+ feasible predicate $R(x, y) \rightarrow$ returns T/F.
+ Polynomial P_e:

Given X: statement
we want find y such that
$$R(x, y) \text{ and } len(y) \leq P_e(len(X))$$

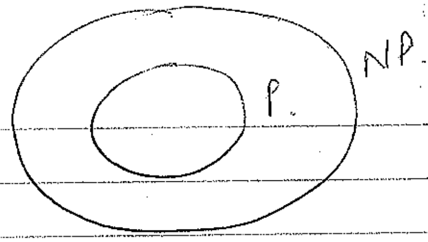
+ Physics:
X- observations:
y- theory that explains observation.

$R(x,y)$: check whether the observations are consistent with the data.
$$len(y) \ll len(x)$$

Engineers
X- specification (cost, how much it weight, wind)
y- design



$R(X, y)$:
- feasible.



+ Humanity X - emotions
y - a poem

In principle, every practical problem can be algorithmically solved, by trying all binary strings y of length $\leq \ell(\mathrm{len}(x))$.

+ Problem : We need 2^n time. not feasible.

+ Good news : if we guess an answer then we can check its correctness in polynomial time

A pr. problem = can be solved on a non-deterministic TM in a polynomial time.

+ NP = Non-deterministic Polynomial
≡ class of all practical problems.

- CS problems X - original list
y - sorted list
$R(x, y)$, $\mathrm{len}(y) = \mathrm{len}(x)$

+ P : class of all problems which can be solved by a feasible algorithm.

Is it possible to solve any practical problem in reasonable time ?
→ Open problem / Don't know.

Reduction : if there is an algorithm to solve a problem in class A → also can be used to solve other problems in the same class A.

$NP \stackrel{?}{=} P.$

$ax^2 + bx + c = 0$

$ax + b$