Langages formels
(11X003)

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Traitement de l'information

$$\texttt{Entrée} \longrightarrow \boxed{\text{Algorithme}} \longrightarrow \texttt{Sortie}$$

Factorisation de nombres :

$$120 \longrightarrow \boxed{\text{Factoriser}} \longrightarrow 2^3 \cdot 3 \cdot 5$$

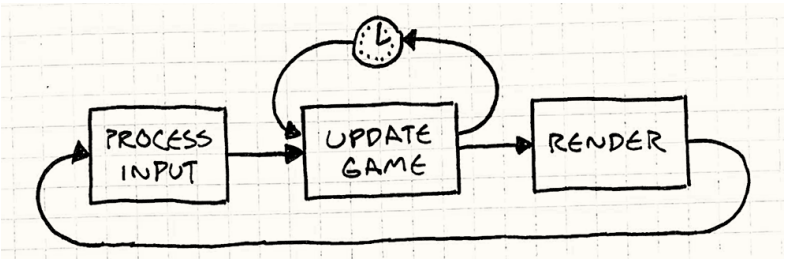
Tri de données :

$$(4, 9, 2, 13, 0) \longrightarrow \boxed{\text{Trier}} \longrightarrow (0, 2, 4, 9, 13)$$

Reconnaissance d'image :

$$\longrightarrow \boxed{\text{Reconnaître}} \longrightarrow \text{Chat}$$

Jeux vidéos :



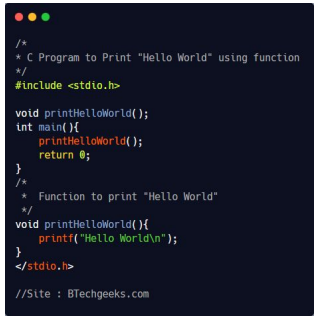
Plus généralement

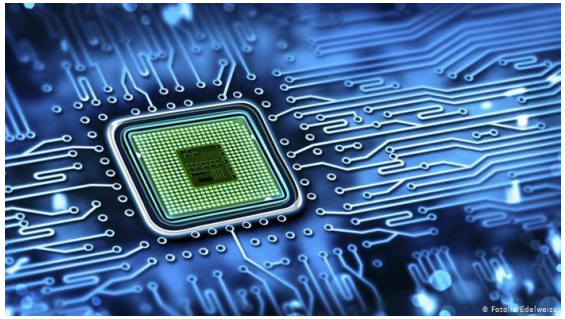
$$001011100110010 \longrightarrow \boxed{\text{Algorithme}} \longrightarrow 1100110$$

Un algorithme prend en entrée une suite de **symboles** et produit en sortie une autre suite de **symboles**. Il réalise un **traitement**.

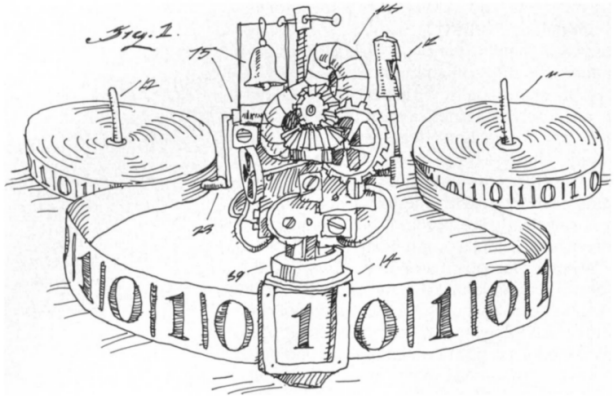
Mais en fait, qu'est-ce qu'un algorithme ?

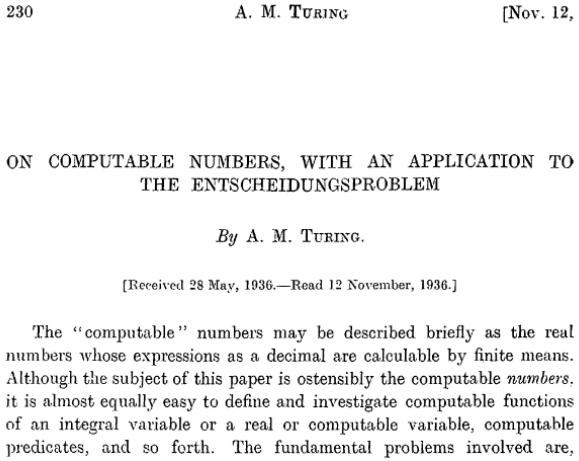
Programme ? Algorithme ?





Machine de Turing





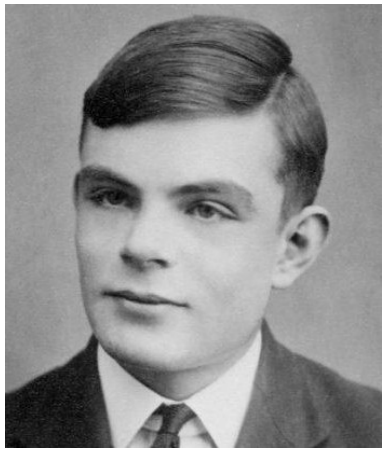
230 A. M. Turing [Nov. 12,

ON COMPUTABLE NUMBERS, WITH AN APPLICATION TO THE ENTSCHEIDUNGSPROBLEM

By A. M. Turing.

[Received 28 May, 1936.—Read 12 November, 1936.]

The "computable" numbers may be described briefly as the real numbers whose expressions as a decimal are calculable by finite means. Although the subject of this paper is ostensibly the computable *numbers*, it is almost equally easy to define and investigate computable functions of an integral variable or a real or computable variable, computable predicates, and so forth. The fundamental problems involved are,



"On computable numbers, with an application to the Entscheidungsproblem" (Alan Turing, **1936**)

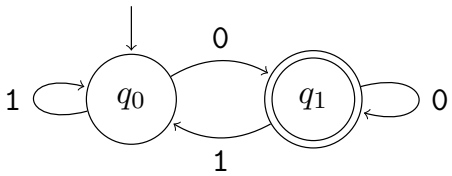
→ Modèle **mathématique** d'algorithme, capable de représenter **n'importe quel traitement** physiquement réalisable (Conjecture de Church-Turing).

Plan du cours

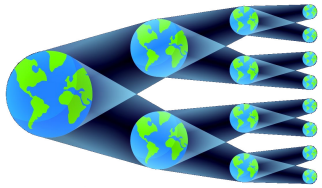
Mots et Langages

$L \subseteq \{0,1\}^*$

Automate fini



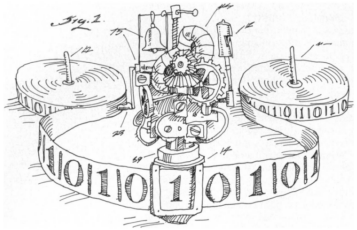
Non-déterminisme



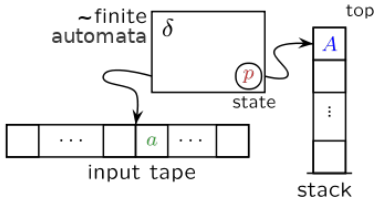
Expressions régulières

$(a + b^*)^+ca^*$

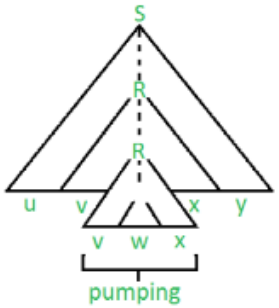
Machine de turing



Automate à pile



Lemme d'itération



Grammaires formelles

$$S \rightarrow aSb$$
$$S \rightarrow \varepsilon$$

Au passage...

- Langages réguliers, langages algébriques, langages contextuels
- Hiérarchie de Chomsky
- Applications : recherche textuelle, langages de programmation, compilateurs
- **Comprendre ce qu'un ordinateur ne pourra jamais faire !**

Modalités du cours

- Principalement **au tableau**
- L'équipe enseignante :
  - Arnaud Casteigts - cours
  - Alexandre Berger | Matteo De Francesco - exercices (assistants)
  - Léa Heiniger | Aylin Tekkoyun - exercices (monitrices)

Arnaud

Alexandre

Matteo

Léa

Aylin

- Emploi du temps (x 14 semaines)
  - Mercredi matin (cours - A150)
  - Lundi matin (exercices - A300)
- Évaluation
  - Examen + Test bonus (0.5 points)

Questions ?