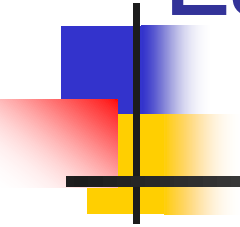# CSC 2204 Finite Automata Theory and Formal Languages

Learning Outcomes

- Describe the fundamental concepts of formal language theory and their properties.

- Design languages and machines using different representations.

- Transform between equivalent notations and machines.

- Implement machines.

Why?

- Designing and Checking the behavior of Digital Circuits.

- Components of Compilers.

- Scanning large bodies of text (e.g. Web Pages)

- Communication protocols

Background

- David Hilbert
  - German mathematician.
  - Discovered and developed a broad range of fundamental ideas.
  - Put forth a most influential list of 23 unsolved problems.

Background

- Alan Mathison Turing
  - English mathematician.
  - Development of theoretical computer science.
  - Turin Machine, can be considered a model of General-purpose computer.
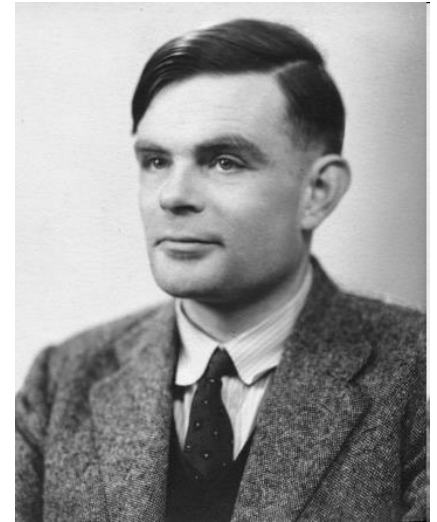
Background

- Historical Perspective

1930	• **Alan Turing studies Turing machines** • **Decidability** • **Halting problem**
1940 - 50s	• "Finite automata" machines • Chomsky Hierarchy for formal languages
1969	• NP-Hard

1970 -	• Modern computer science:
	    • Compilers,
	    • Computational Theory
	    • Complexity Theory

Background

- Automata Theory
  - Study of abstract computing devices, or "machines".

- Automaton
  - An abstract computing device.
  - Need not even be a physical hardware!

- Fundamental Question
  - Find out what different models of machines can do and cannot do.

Course Organization

- Sections:
  - Regular languages and their Descriptors
  - Context-free languages and their Descriptors
  - Turing Machines and TM variants
  - Decidability

- [Outlines](#)

Books

- Textbook:
    - Introduction to computer theory, Daniel I. A. Cohen.
- Reference Books:
    - Introduction to Automata Theory, Languages and Computation, J.E. Hopcroft, R. Motwani, J.D. Ullman, Addison Wesley/Pearson.
    - Automata, Computability and Complexity: Theory and Applications, by Elaine Rich.
    - An Introduction to Formal Languages and Automata, by Peter Linz, Jones & Bartlett Publishers.
    - Theory of Automata, Formal Languages and Computation, by S. P. Eugene, Kavier, New Age Publishers.

Marks Distribution

- 3 Quizzes, each of 5 marks (15%)
- 3 Assignment, each of 5 marks (15%)
- 1 Midterm (Theory: 25%, Viva: 5%)
- 1 Final (Theory: 30%, Viva: 10%)