

COMP110: Principles of Computing

## **2: Basic Principles for Computation**

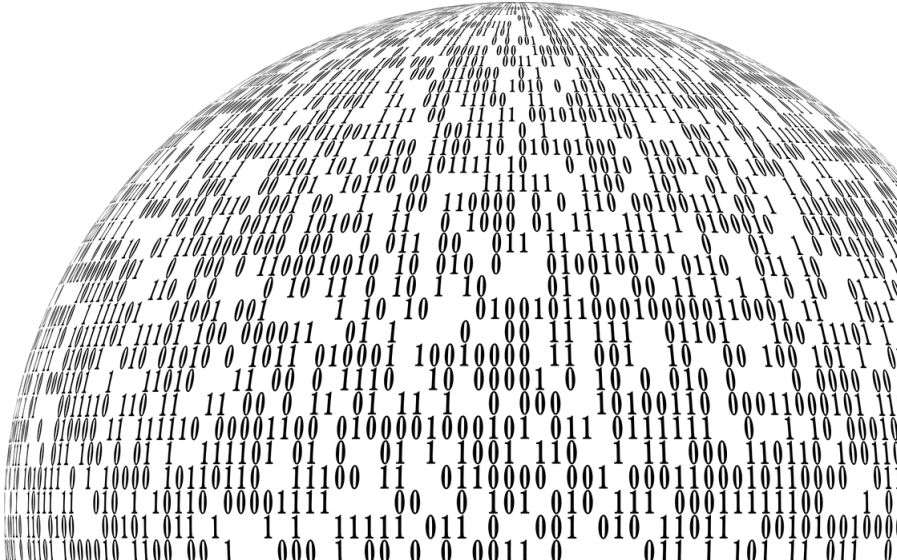
# Learning outcomes

By the end of today's session, you should be able to:

- ▶ Recall the historic significance of Alan Turing and his...
- ▶ Explain the basic concept of Turing Machines
- ▶ Define the term 'Turing Complete'

## Student Rep Nominations

# Activity - Groups of Five





Alan Turing - Celebrating the life of a genius

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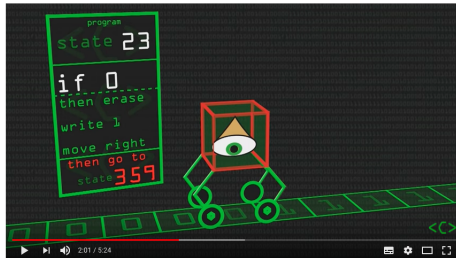


Cambridge University  
Published on 21 Jun 2012

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Saturday 23 June 2012 marks the centenary of the birth of Alan Turing - mathematical genius, hero of the WWII code breakers of Bletchley Park, and father of modern computing.

Figure: <https://www.youtube.com/watch?v=gtRLmL70TH0>



### Turing Machines Explained - Computerphile

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Computerphile  
Published on 29 Aug 2014

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Turing Machines are the basis of modern computing, but what actually is a Turing Machine?  
Assistant Professor Mark Jago explains.

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Figure: <https://www.youtube.com/watch?v=dNRDvLACg5Q>

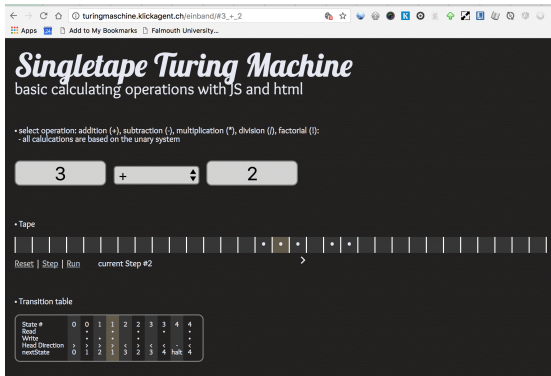


Figure: <http://turingmaschine.klickagent.ch/einband/>

# Turing Completeness

To show that something is Turing complete, it is enough to show that it can be used to simulate some Turing complete system.

For an imperative language to be classed as Turing Complete it must have:

- ▶ Conditional branching (e.g., “if” and “goto” statements, or a “branch if zero” instruction)
- ▶ Ability to change an arbitrary amount of memory (e.g., the ability to maintain an arbitrary number of variables).



!!! Since this is almost always the case, most if not all imperative languages are Turing complete if the limitations of finite memory are ignored.

imperative programming is a programming paradigm that uses statements that change a program's state