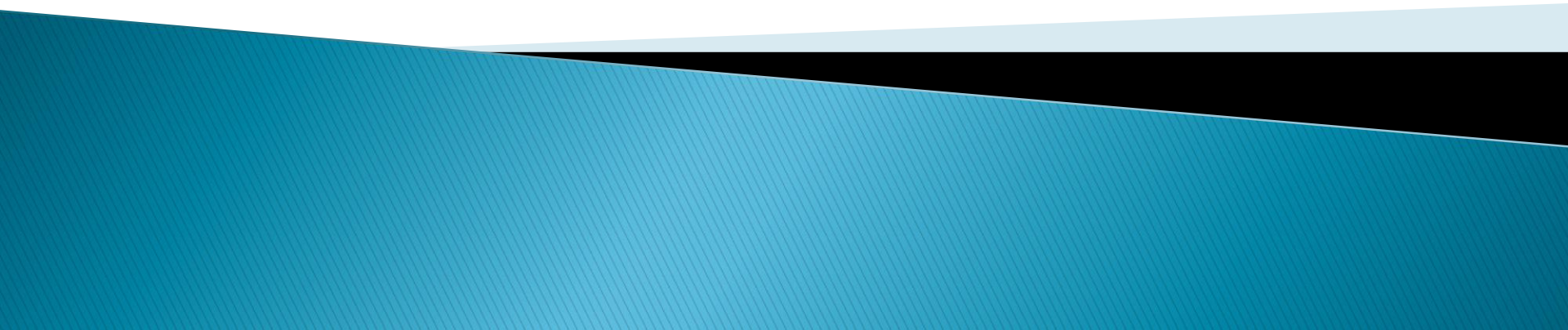


# CS5100 Foundations of Artificial Intelligence

Module 0



# Administrative details



Text: Artificial Intelligence: A Modern Approach (3rd edition), Stuart Russell and Peter Norvig



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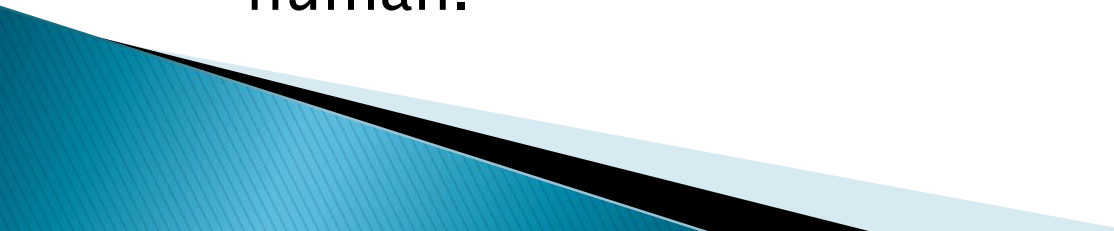
# Introduction

- ▶ What is artificial intelligence?
  - ' ... effort to make computers think ... ' (Haugeland, 1985)
  - '[The automation of] activities that we associate with human thinking ...' (Bellman, 1978)
  - 'The study of mental faculties through the use of computer models.' (Charniak and McDermott, 1985)

# Introduction

- 'The study of the computations that make it possible to perceive, reason, and act.' (Winston, 1992)
  - ' ... creating machines that perform functions that require intelligence when performed by people.' (Kurzweil, 1990)
  - ' ... how to make computers do things at which, at the moment, people are better.' (Rich and Knight, 1991)
  - ' ... the study of the design of intelligence agents.' (Poole et al., 1998)
  - ' ... intelligence behaviour in artifacts.' (Nilsson, 1998)
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# Goal of AI

- ▶ to understand and replicate human thought processes through computational modelling  
*(Cognitive Science: Inter-disciplinary field (AI, psychology, linguistics, philosophy, anthropology) that tries to form computational theories of human cognition).*
  - ▶ Alan Turing's famous 'Turing test' for intelligence
    - in which a program is judged intelligent if its behaviour cannot be differentiated from that of a human.
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# Turing's Test

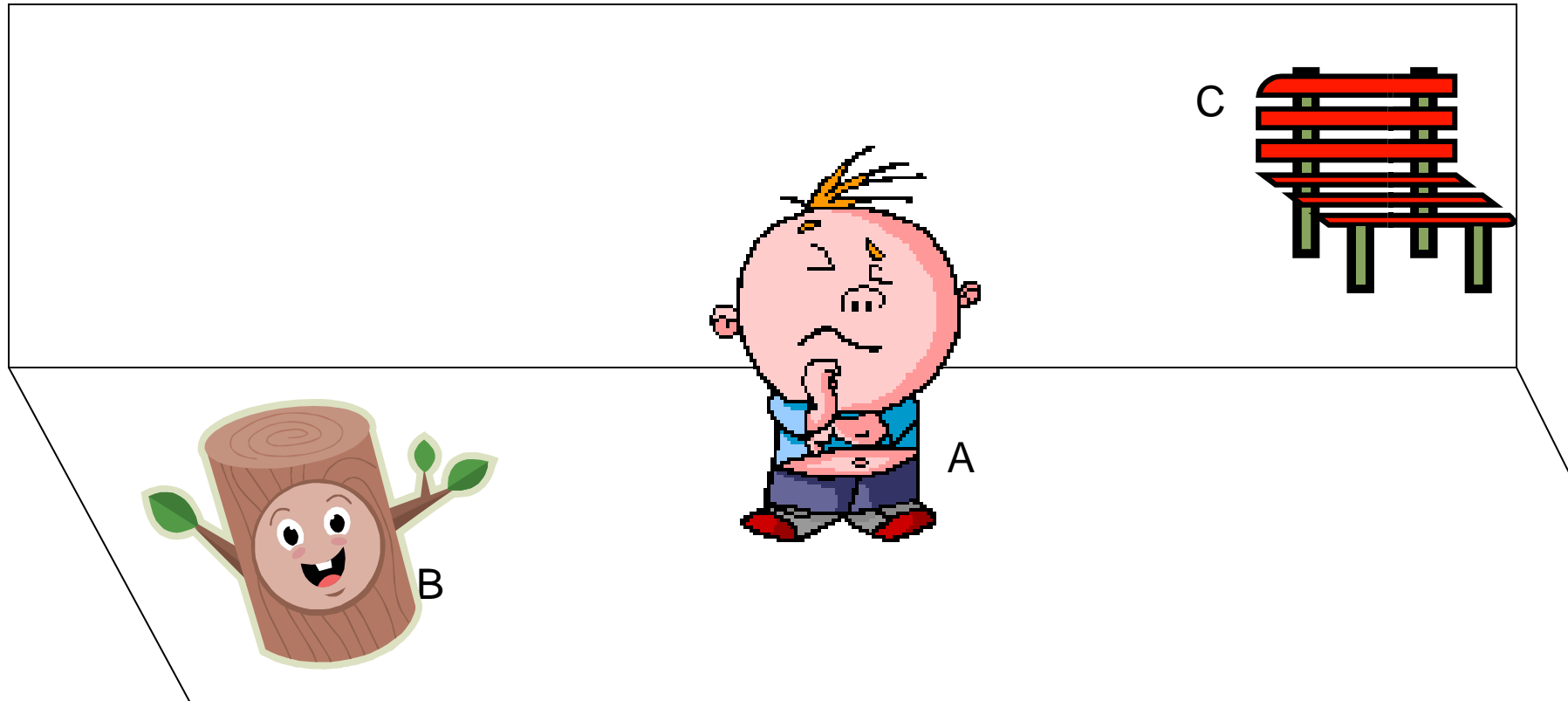
- ▶ If the human cannot tell whether the responses from the other side of a wall are coming from a human or computer, then the computer is intelligent.



# Subfields of Artificial Intelligence

- ▶ The major subfields of Artificial Intelligence are as follows:
- ▶ **Problem solving:**
  - an agent is given a problem setting and a goal and
  - must determine how to realize that goal.

# Problem Solving



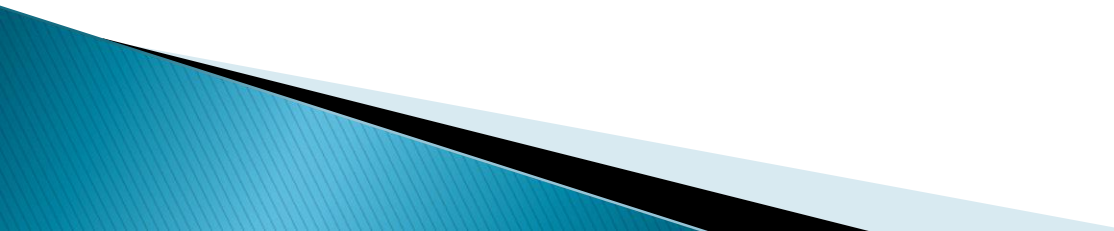
Find a sequence of operations to produce the expected output from the initial input.



# Subfields of Artificial Intelligence

- ▶ **Knowledge representation and reasoning studies :**
  - how an agent can represent knowledge it has about the environment
  - uses it to derive further knowledge,
  - either using a logic-based representation (when the knowledge is certain)
  - or a probabilistic

# Knowledge representation and reasoning

- ▶ AI agents deal with knowledge (data)
    - Facts (believe & observe knowledge)
    - Procedures (how to knowledge)
    - Meaning (relate & define knowledge)
  - ▶ Right representation is crucial
    - Wrong choice can lead to project failure
  - ▶ Examples
    - First order theorem proving... first order logic
    - Inductive logic programming... logic programs
    - Neural networks learning... neural networks
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# Subfields of Artificial Intelligence

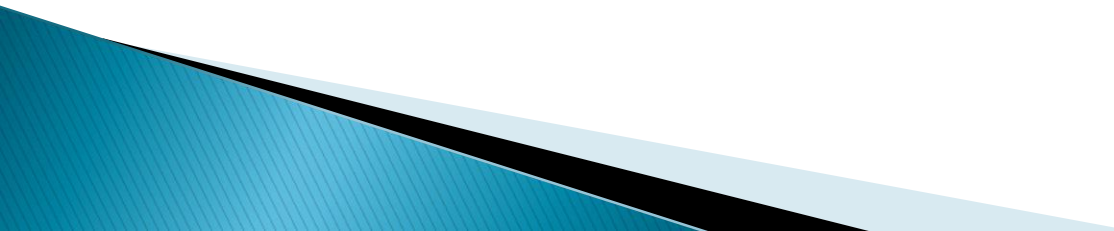
## ▶ Planning:

- an agent is given knowledge of an environment and
- formulates a plan for interacting with it to achieve its goals.

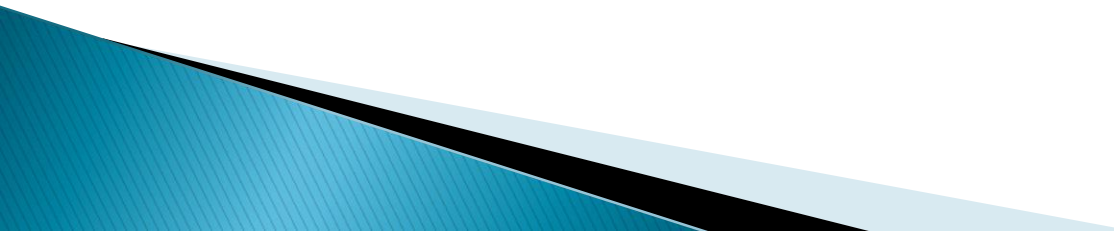
## ▶ What is planning?

- A plan is a collection of actions for performing some task. e.g. assembling your new IKEA cupboard.
- Many programs are available to help humans formulate plans.
- However it is difficult to generate plans automatically.

# Subfields of Artificial Intelligence

- ▶ **Machine Learning :**
  - ▶ An agent improves its performance through experience.
    - ability to distinguish between categories of objects(supervised learning),
    - learning structure from raw data (unsupervised learning),
    - learning to maximise reward (or minimise cost) in an environment
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# MachineLearning

- ▶ Learning denotes changes in a system that will enable the system to do the same task more efficiently next time.
  - ▶ For example, a machine learning system could be trained on email messages to learn to distinguish between spam and non-spam messages.
  - ▶ After learning, it can then be used to classify new email messages into spam and non-spam folders.
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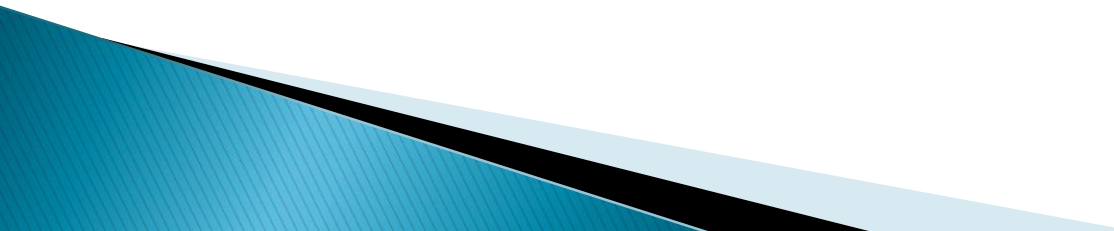
# Subfields of Artificial Intelligence

## ► Computer Vision

- an agent interprets or processes raw visual images
- Computer Vision is the science and technology of obtaining models, meaning and control information from visual data.
- The Robocup tournament and ASIMO are examples of Artificial Intelligence using Computer Vision to its greatest extent.



# Subfields of Artificial Intelligence

- ▶ **Natural language Processing:**
    - an agent must process input in a natural language (e.g. English), or generate it.
  - ▶ NLP is the branch of computer science focused on developing systems that allow computers to communicate with people using everyday language.
  - ▶ Many challenges in NLP involve natural language understanding that is, enabling computers to derive meaning from human or natural language input.
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# Reading advice and Resources

- ▶ Read all chapters as indicated in the essential reading

*Prescribed text : Artificial Intelligence: A Modern Approach (3rd edition), Stuart Russell and Peter Norvig*