ARTIFICIAL INTELLIGENCE

KNOWLEDGE REPRESENTATION

GOAL FOR TODAY

- Quality of the work to be submitted

- How will this online course look like?

- Knowledge representation

- Reasoning

- Propositional logic

COURSE DESCRIPTION

One-hour synchronous communication, readings, discussions, and evaluation

Lesson 1. Introduction

Lesson 2. Knowledge representation; Reasoning; Propositional Logic

Lesson 3. Predicate Logic

Lessons 4-5 Search Strategies; Prolog (I and II)

Lesson 6. Expert Systems

Lesson 7. Natural Language Processing

Lesson 8-9. Learning; Machine Learning; Python; Deep Learning (I and II)

Lesson 10. Catch-up; Presentations

Tentative ! Done by June 19nd

- Regular readings and discussions in Slack (10%)
  - Individual
- Homeworks (30%)
  - Course notes
  - Exercises – Propositional logic / Predicate logic / Prolog / Grammars
  - To be provided in a shareable file
  - Individual
- (Directed) Labs and project (Python) (40%)
  - Deep learning example
    - To be explained in a 2-minute video
    - Individual
  - Project
    - To be presented (5 minutes per team)
    - Team of 2-3 students
- Exam (20%)
  - Quiz (only)

LESSON 11 – KNOWLEDGE REPRESENTATION

WHAT IS KNOWLEDGE?

- Knowledge is crucial in intelligence – to make decision, to understand language, to recognize objects, to interpret situations etc.

- Humans store lots of knowledge and interconnection pieces in their brains

- Declarative knowledge – facts (e.g., I live in Thies)

- Procedural knowledge – how-to do things (e.g., how to go to Thies from where I am)

- Domain knowledge – (e.g., Transportation: I can take a Dem Dikk bus to go to Thies)

- Domain-independent knowledge – (e.g., A bus is a vehicle)

- General or common-sense knowledge – Acquired and considered known by humans (e.g., children are younger than their parents, people rarely reach 100 years)

- Systems consider domain knowledge as it is difficult they do not have the knowledge that we use daily
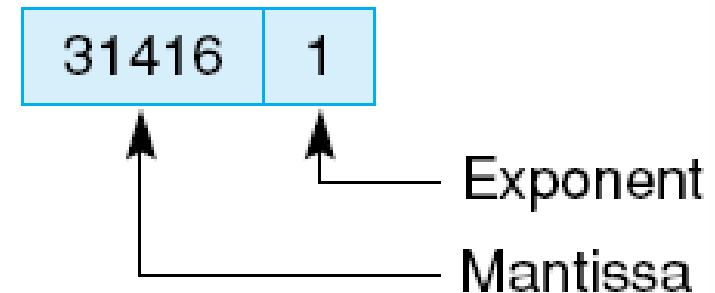
DIFFERENT REPRESENTATIONS OF A NUMBER

The real number: π

The decimal equivalent: 3.1415927 . . .

The floating point representation:

31416	1

              ↑   ↑ — Exponent

              — Mantissa

The representation in computer memory: 11100010

KNOWLEDGE REPRESENTATION

- We need to represent knowledge in a form accurate from the human source and understandable by computers

- The chosen representation is an important factor in influencing how the problem will be solved

- Knowledge representation schemes

  - Logical representation – Declarative; Expressions in formal logic represent knowledge (e.g., parent(john, paul))

  - Procedural representation – Set of instructions to solve a problem; Requires a set of facts, rules to apply, (if then) and method to apply the rules

  - Network representation – Knowledge is captured as a graph where nodes are objects or concepts, and edges are relationships or associations

  - Structured representation – Complex structures

    - Frames to represent information about an object (Minsky 1975)

    - Scripts to represent events (Schank, & Alberson 1977)

- Questions: Correctness, completeness, consistency, changes in knowledge

METRICS TO ASSESS KNOWLEDGE REPRESENTATION SCHEMES

- Expressiveness – Represent different types and granularities of knowledge

- Effectiveness – Provide a way to infer new knowledge from old one

- Efficiency – Efficiently gather knowledge and infer knowledge from old one

- Explanation – Provide an explanation of how knowledge is inferred and allow justifications of its reasoning

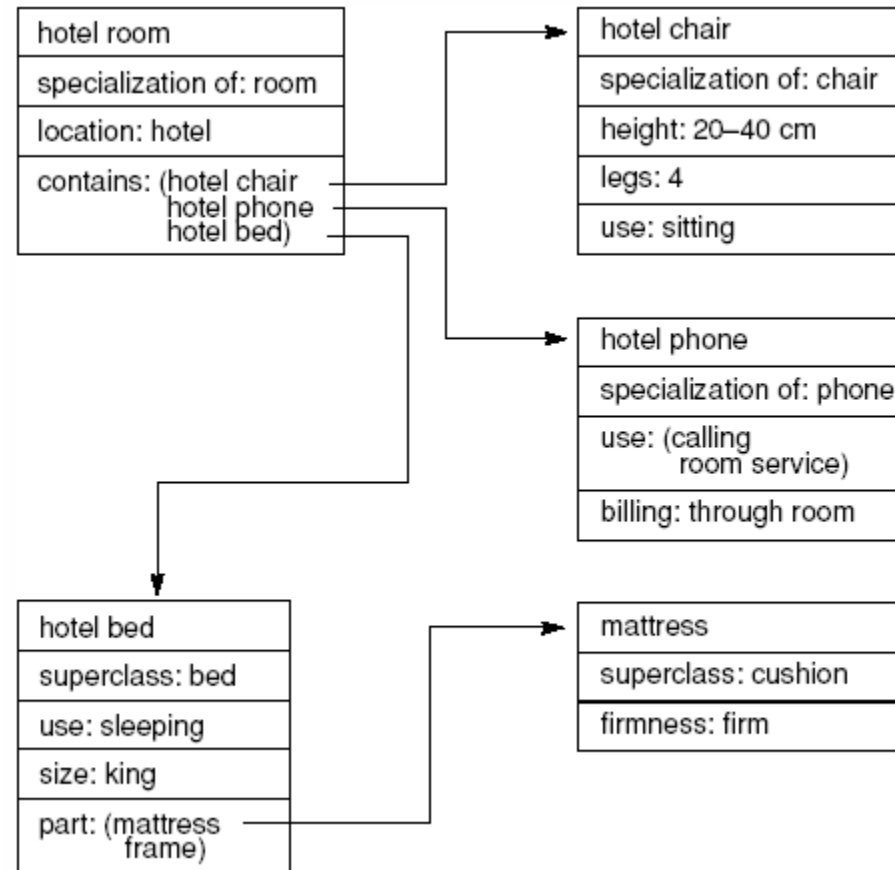# REPRESENTATION WITH CLAUSES
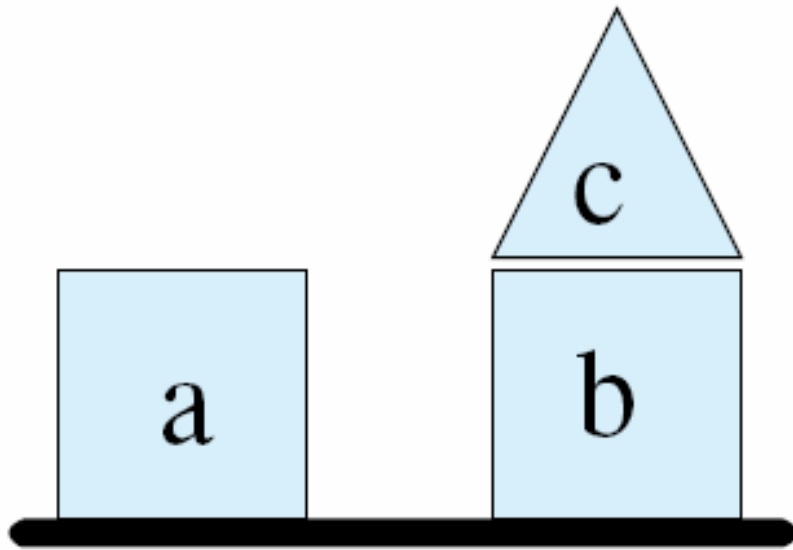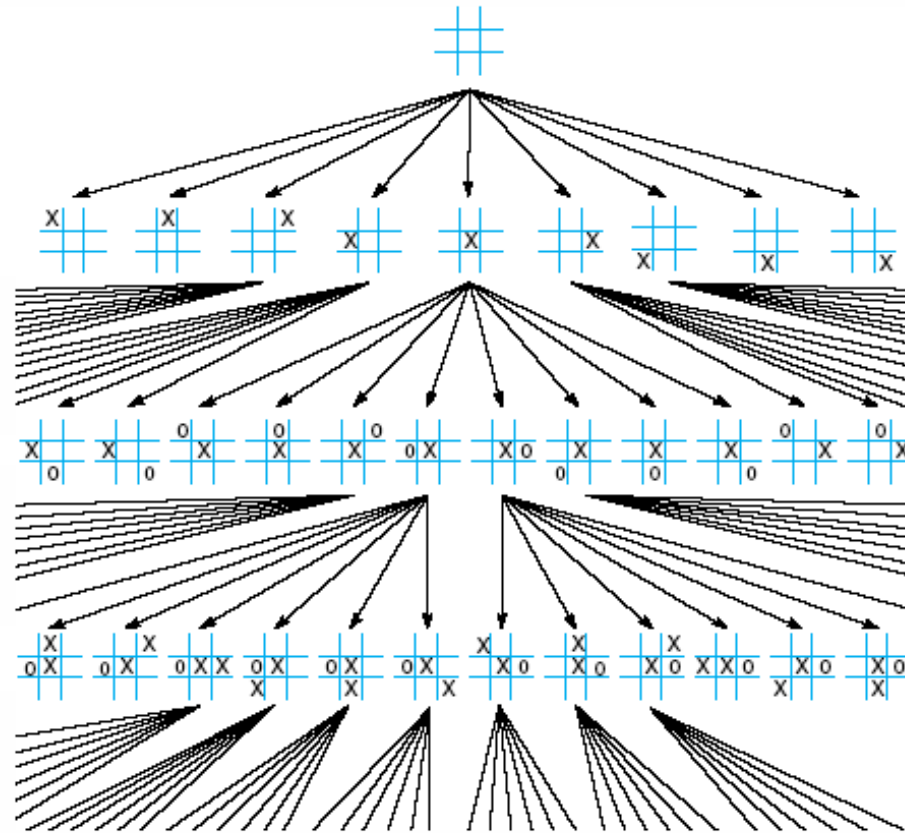

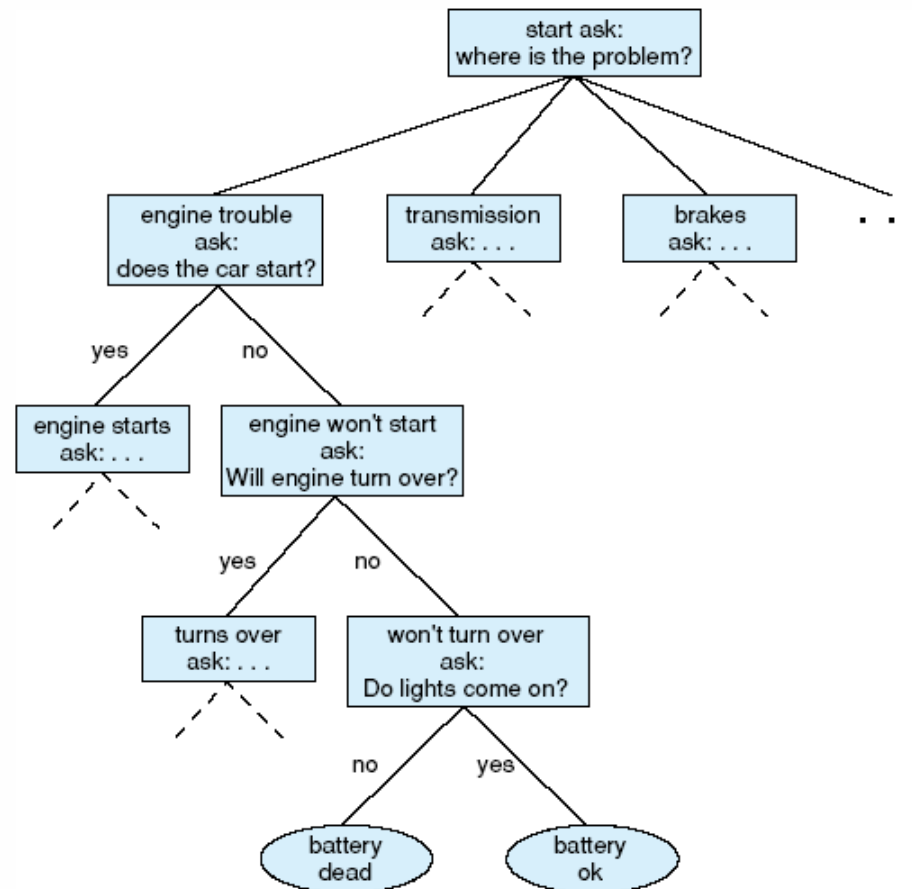ontable(a)

ontable(b)

on(c,b)

triangle(c)

square(a)

square(b)

DATABASE DESIGN : DESCRIPTION OF AN HOTEL ROOM

STATE SPACE FOR TIC-TAC-TOE

Luger: Artificial Intelligence, 6th edition. © Pearson Education Limited, 2009

DECISION TREE FOR AUTOMOTIVE DIAGNOSIS

Luger: Artificial Intelligence, 6th edition. © Pearson Education Limited, 2009

PICTURE

(0,0)

https://web.stanford.edu/class/cs101/image-diagram1.png
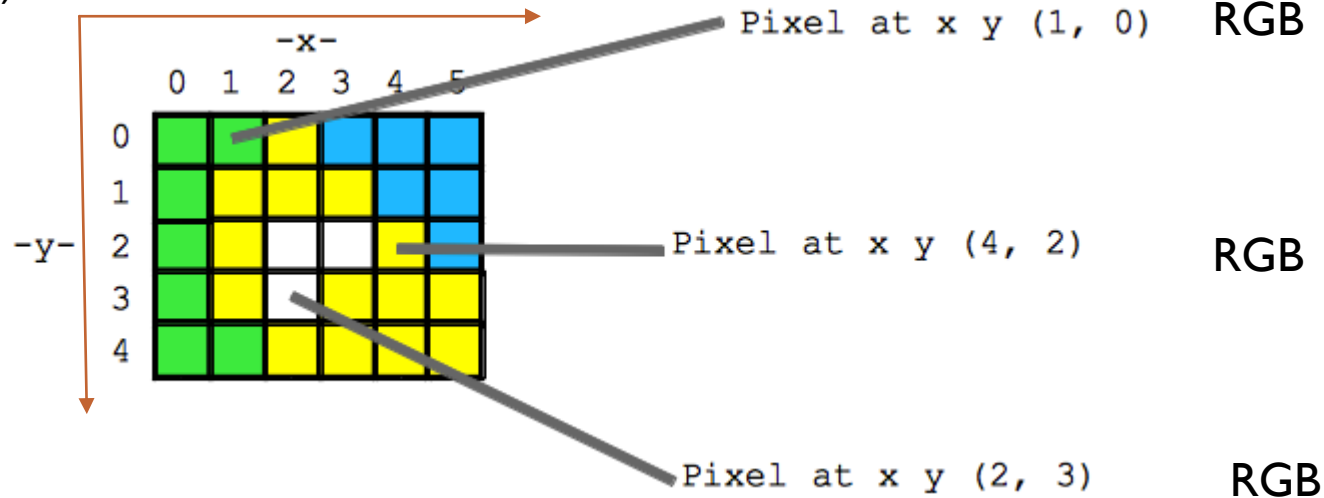
https://www.w3schools.com/colors/colors_rgb.asp

PICTURE

GREYSCALE IMAGE

COLOR IMAGE

https://i.imgur.com/s0qk6ga.jpg

https://necromuralist.github.io/neural_networks/posts/image-to-vector/

ONTOLOGIES TO REPRESENT A DOMAIN OF INTEREST
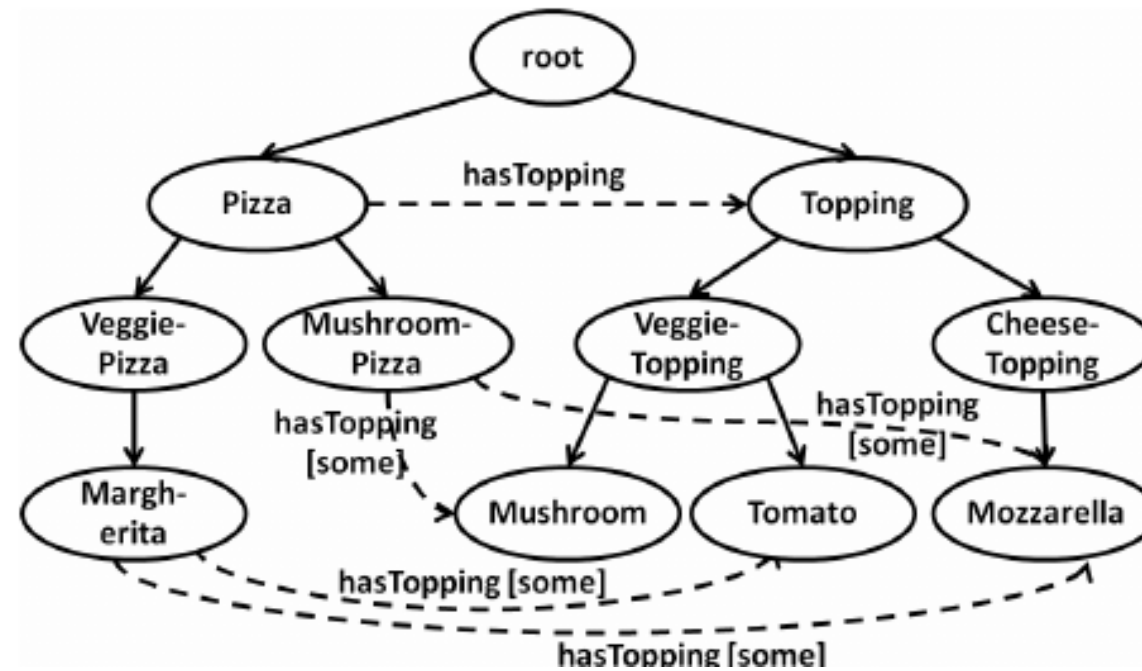
https://www.researchgate.net/publication/236842047_Efficient_Regression_Testing_of_Ontology-Driven_Systems/figures?lo=1

HOMEWORK

HOMEWORK

- READ : Slides

- EXERCICE : Why is the representation of π 1110001?