

Artificial Intelligence – Lecture 1

Administrative Matters

Admin

What is AI?

LISP

Webpage: www.aass.oru.se/~ali/AI2008

Teacher: Amy Loutfi Hours: Fridays 10-12

Lab Assistant: Marcello Cirillo



- **Course book:**

Alison Cawsey, *The essence of Artificial Intelligence*
(Akademibokhandeln).

- **Recommended reading:**

(Lisp)

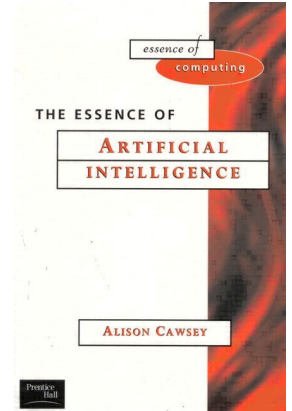
1. Haraldsson, *Programmering i Lisp*.

2. Steele, *Common Lisp The Language*, 1990

(AI)

1. Russel, Norvig, *Artificial Intelligence – a modern approach*.

2. Rich, Knight, *Artificial Intelligence*, 2:nd ed.



What is Artificial Intelligence?

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What is AI?

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Artificial: Not natural or real, made by the art of man

Intelligence: 1) The power of perceiving, learning, understanding and knowing;
mental ability. 2) News, information.

(Oxford Advanced Learners Dictionary of Current English)

Artificial Intelligence is the design and study of computer programs that behave intelligently.
(Dean, Allen.)

The branch of computer science that is concerned with the automation of intelligent behavior.
(Luger, Stubblefield)

Artificial Intelligence is the art of making computers work the way they do in the movies.
(Unknown)

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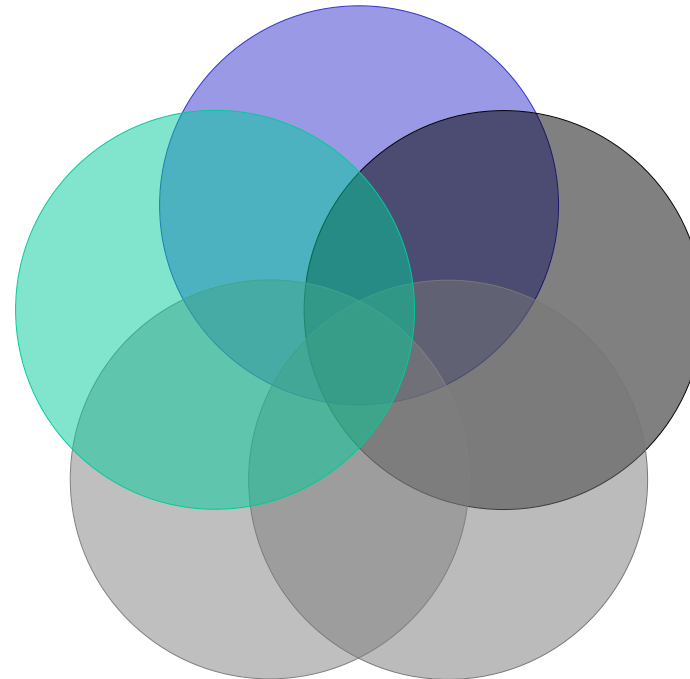
LISP

AI as a broad field involving research in numerous other areas

Computer Science

Psychology

Neuroscience



Linguistics

Philosophy

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- Weak AI:

Machines can be made to act as if they were intelligent.

Ex: Eliza, A.L.I.C.E, expertsystems etc.



- Strong AI:

Machines that act intelligently have real, conscious minds.

Ex: human-like AI, the movie A.I. etc. non-human-like HAL in the movie 2001



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Even if we make the great AI Machine, how do we test if it can think?

- **The Turing test:**

First described by Alan Turing, 1950.

If an impartial judge communicating with a human and/or with a computer both attempting to pass as a human and he cannot see the difference between them, then the machine passes the turing test.

- **The Chinese room:**

Thought experiment by John Searly (1980) debunking strong AI and the Turing test.

- **The Loebner price competition:**

The Loebner Prize is an annual competition that awards prizes to the Chatterbot considered the most humanlike for that year. The format of the competition is much like that of a standard Turing test. (*wikipedia*)

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artificial intelligence - Google-sökning - Windows Internet Explorer

http://www.google.se/search?hl=sv&q=artificial+intelligence&meta=

Google artificial intelligence Sök

Resultat 1 - 10 av ungefär 14 800 000 vid sökning efter **artificial intelligence**. (0,19 sekunder)

Artificial intelligence - Wikipedia, the free encyclopedia - [Översätt den här sidan]
Major AI textbooks define the field as "the study and design of intelligent agents," [1] where an intelligent agent is a system that perceives its ...
en.wikipedia.org/wiki/Artificial_intelligence - 277k - Cachad - Liknande sidor - Notera detta

Artificial Intelligence: AI (2001) - [Översätt den här sidan]
Directed by Steven Spielberg. With Haley Joel Osment, Frances O'Connor, Sam Robards. A highly advanced robotic boy longs to become.
www.imdb.com/title/tt0212720/ - 64k - Cachad - Liknande sidor - Notera detta

AI Research - Creating a new form of life - [Översätt den här sidan]
Artificial Intelligence Ltd. (Ai) develops conversational software - technology that enables machines to converse with humans in natural language.
www.a-i.com/ - 16k - Cachad - Liknande sidor - Notera detta

Artificial Intelligence Techniques in Shader Synthesis - KK-stiftelsen
KK-stiftelsens vill sprida resultat och erfarenheter från de projekt som stiftelsen stödjer. I vår projektdatabas kan du söka bland 1200 projekt.
www.kks.se/templates/ProjectPage.aspx?id=4503 - 71k - Cachad - Liknande sidor - Notera detta

Artificial intelligence 2
Filtyp: PDF/Adobe Acrobat - [Se som HTML-version](#)
Artificial intelligence 2. Information kommer att finnas tillgänglig fyra veckor före kursstart som är beräknad till vecka 45. ...
www.itufak.gu.se/digitalAssets/1152/1152903_Artificial_intelligence_2.pdf -
[Liknande sidor](#) - [Notera detta](#)

Artificial Intelligence: A Modern Approach, Second Edition | KogVet
14 maj 2008 ... Jag tänkte höra om någon har en, **Artificial Intelligence: A Modern Approach, Second Edition** att sälja? Kramar /Kenny ...
www.kogvet.se/forum/prylar_och_litteratur_kopes/artificial_intelligence_a_modern_approach_second_edition - 20k - Cachad - Liknande sidor - Notera detta

Artificial Intelligence - [Översätt den här sidan]
Artificial Intelligence (AI) is the area of computer science focusing on creating machines that can engage on behaviors that humans consider intelligent. ...
library.thinkquest.org/2705/ - 9k - Cachad - Liknande sidor - Notera detta

Artificial Intelligence & Mining - Högskolan i Borås
Artificial Intelligence & Mining, Artificial Intelligence & Mining. Medlemmar - AIMs Projekt - AIMs Nyheter. **Artificial Intelligence & Mining** ...
www.hb.se/.../04_SBBK8xLLM9MSSzPy8xBz9CP0os3hXX49QSyDRwN_NOMLAyNj2cPX2MPiwMDA_2Cb... - 14k - Cachad - Liknande sidor - Notera detta

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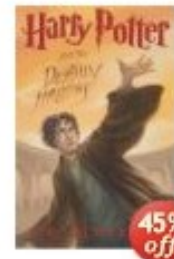
LISP

The screenshot shows the top navigation bar of the Amazon.com website. It includes the Amazon logo, a user profile for 'Geoffrey's Amazon.com', and links for 'See all 41 Product Categories', 'Your Account', 'Cart', 'Your Lists', and 'Help'. Below this is a secondary navigation bar with links for 'Gift Certificates', 'International', 'Hot New Releases', 'Bestsellers', 'Today's Deals', and 'Sell Your Stuff'. A search bar is present with 'Amazon.com' entered. A personalized greeting reads: 'Hello, Geoffrey J Gordon. We have [recommendations](#) for you. (If you're not Geoffrey J Gordon, [click here.](#))'

New For You[®]



[Girl Genius Volume 6: Agatha...](#) Paperback by Phil Foglio
([Why is this recommended for you?](#))



[Harry Potter and the Deathly Hallows](#) Hardcover by J. K. Rowling, Mary...
([Why is this recommended for you?](#))

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Round Trip One Way Multi-Segment

from or any airport within

to or any airport within

outbound date

return date

travelers

adults (18 to 61)	seniors (62 plus)	youths (12 to 17)	children (2 to 11)	infants in seat (under 2)	infants on lap (under 2)
<input type="text" value="1"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

stops nonstops only up to 1 stop up to 2 stops no limit

sales city
(change only for trips originating outside the United States: [learn more](#))

[more options](#) (cabin, airport changes, seat availability, etc)

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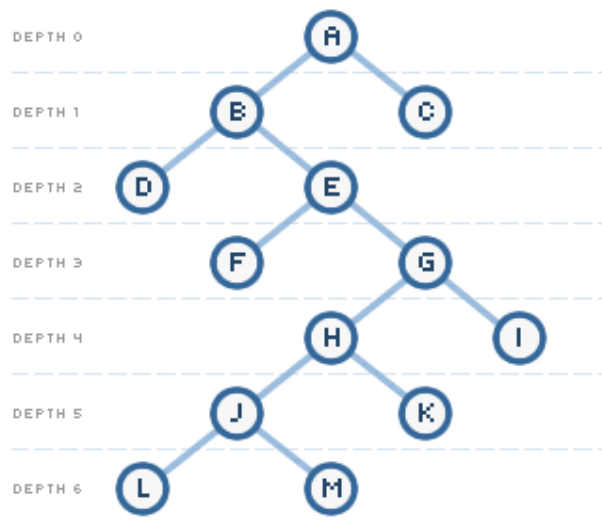
What is Artificial Intelligence

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- In this course AI looks a bit different.....



```
(defun inc(x) (+ 1 x))
```

- Search
- Expert Systems
- Natural Language Processing
- Machine Learning
- Knowledge Representation and Inference
- Agents and Robotics

- One laboratory exercise
- A final project (coded in LISP)

What is Artificial Intelligence?

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- But you can still do some cool things....

The water jug problem:

Suppose you are given 1 jug (3L) and 1 jug (4L). You also have a tap

With which you can fill the jugs.



4L



3L

Goal: Get exactly 2L in the 4L jug.

- From AI admirers to AI programmers.
 - Step 1: Represent the problem so that it is computer-friendly.
 - Step 2: Code the problem in programming language.
 - Step 3: Develop/code an algorithm to find a solution.
 - Step 4: Represent the solution so that it is human-friendly.

- Step 1: Representing the problem for a machine.

We represent the amount of water in the jugs with (X, Y)

1. $(X, Y) \rightarrow (4, Y)$ Fill the 4 liter jug.

2. $(X, Y) \rightarrow (X, 3)$ Fill the 3 liter jug.

3. $(X, Y) \rightarrow (0, Y)$ Empty the four liter jug

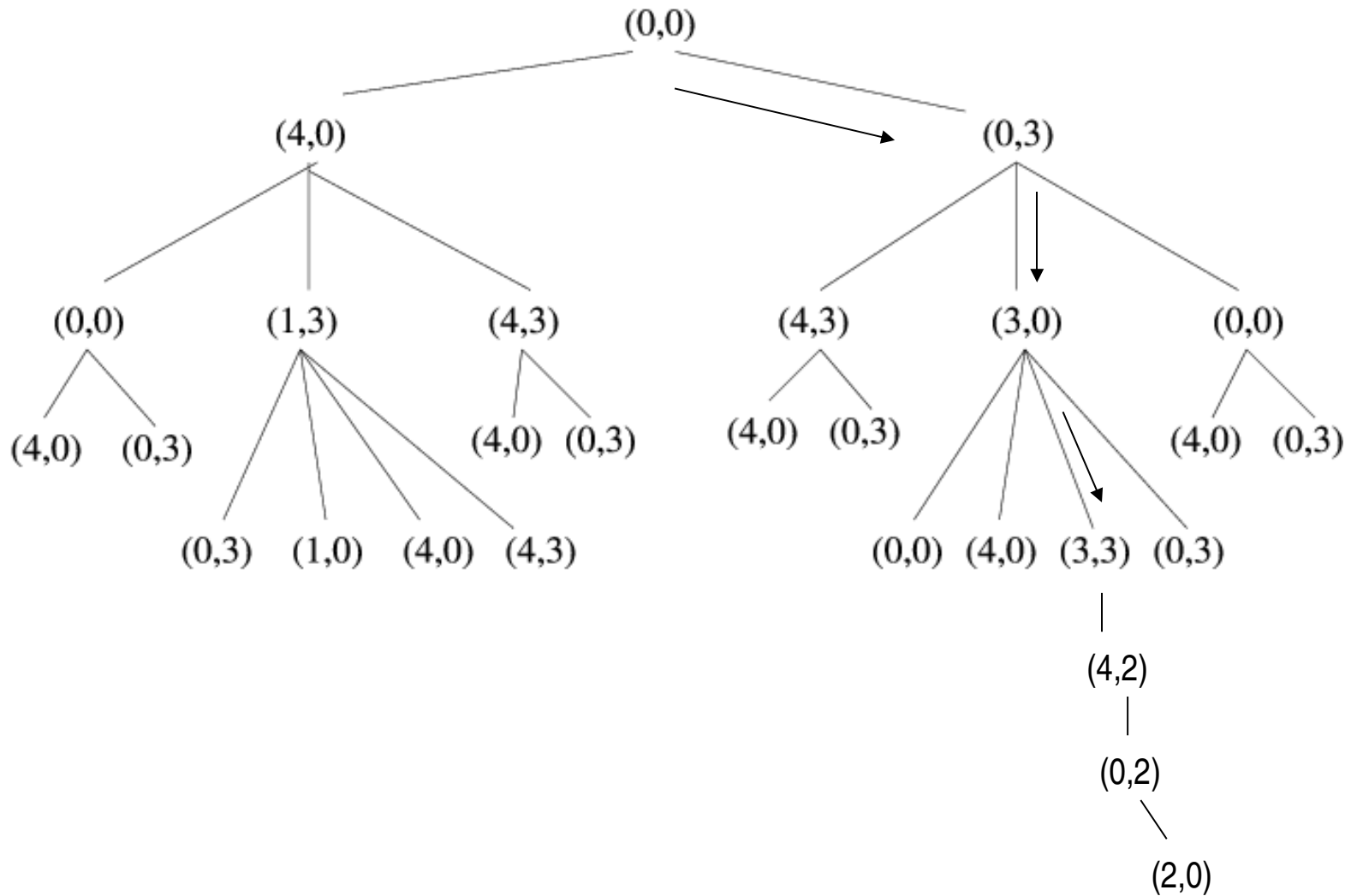
4. (X, Y) if $X+Y \geq 4$ and $Y > 0 \rightarrow (4, Y-(4-X))$

Fill the 4 liter jug with water from

the 3 liter jug.

Water Jug Problem

1. $(X,Y: X < 4) \rightarrow (4,Y)$ Fill the 4-liter jug
2. $(X,Y: Y < 3) \rightarrow (X,3)$ Fill the 3-liter jug
3. $(X,Y: X > 0) \rightarrow (0,Y)$ Empty the 4-liter jug on the ground
4. $(X,Y: Y > 0) \rightarrow (X,0)$ Empty the 3-liter jug on the ground
5. $(X,Y: X+Y \geq 4 \text{ and } Y > 0) \rightarrow (4, Y-(4-X))$
Fill the 4-liter jug from the 3-liter jug
6. $(X,Y: X+Y \geq 3 \text{ and } X > 0) \rightarrow (X-(3-Y), 3)$
Fill the 3-liter jug from the 4-liter jug
7. $(X,Y: X+Y \leq 4 \text{ and } Y > 0) \rightarrow (X+Y, 0)$
Pour all water from the 3-liter jug into the 4-liter jug
8. $(X,Y: X+Y \leq 3 \text{ and } X > 0) \rightarrow (0, X+Y)$
Pour all water from the 4-liter jug into the 3-liter jug
9. $(X,Y: X > 0) \rightarrow (X-D, Y)$
10. $(X,Y: Y > 0) \rightarrow (X, Y-D)$



LISP is:

- The second oldest highlevel (computer) language in widespread use today.
- The most popular language within the field of Artificial Intelligence.
- The most hated language by computer science students today.

Developed 1958 by John McCarthy at MIT lab as abstract notion for *recursive functions*.

Builds heavily on *linked lists* as the primitive datatype. Manipulating primarily *symbols*.

Trivial syntax: every program is a list of instructions.

Metaprogramming – programs that write or modify other programs.

Two major dialects today: Common Lisp and Scheme.

Many different implementations of Common Lisp exists. Eg:
CMU/CL – a free implementation from CMU.

See <http://www.cons.org/cmuc/>

CLISP – Another (slightly simpler) free implementation.

See <http://clisp.cons.org/>

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Flow chart ("goto programming") Basic, Fortran

Structured programming C, Pascal

Object-oriented programming Smalltalk, C++, CLOS

Process programming Ada

Functional programming pure LISP, ML

Rulebased programming Prolog, Expertsystems

LISP is usually associated to *functional programming* although it can do most of these paradigms.

LISP Properties

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LISP

- Symbol manipulation, lists enclosed in parentheses.

```
(+ a b) (car (color red) (owner mathias)) ()
```

```
(1 2 (3 a b) (4 (5)))
```

- Interpreted (can also compile code)

LISP prints result:

Example:

```
> (+ 1 2)
```

```
=> 3
```

```
> (defun inc(x) (+ 1 x))
```

```
=> INC
```

```
> (inc 3)
```

```
=> 4
```

Forms

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A form is an *S-expression* that can be *evaluated* (computed). Let *S* be any *S-expression* that we want to evaluate:

If *S* is a number the the result of evaluating *S* is that number.

If *S* is a variable name (atomic symbol) than the result of evaluating *S* is the (current) content of that variable. If no such variable exists -> error.

If *S* is a *special form* – treat specially.

If *S* is a list then the first element of the list is considered a function name and the rest of the elements are evaluated to get the arguments. The result of evaluating *S* is the result of applying the function to the given arguments.

> 10

=> 10

> (+ 2 5)

=> 7

S-expressions in Lisp

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- Atoms:
 - a b c foo hi hello
- Numbers
 - 1 2 3 47 0.1 11.0

- Recursive definition:

since: 1 2 3 a b c are S-expressions

therefore: (1 2 3 a b) is an S-expression

therefore: (1 2 (a b) 3) is an S-expression

LISP Functions

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- To print atoms as they are or set strings use the quote
':

> a

=> will try find return the value of the variable called a

> 'a

=> will return the letter a

>'(a b c)

=> will return a list containing (a b c)

Special form: DEFUN

**(defun name (parameter1 ... parameterN)
functionbody)**

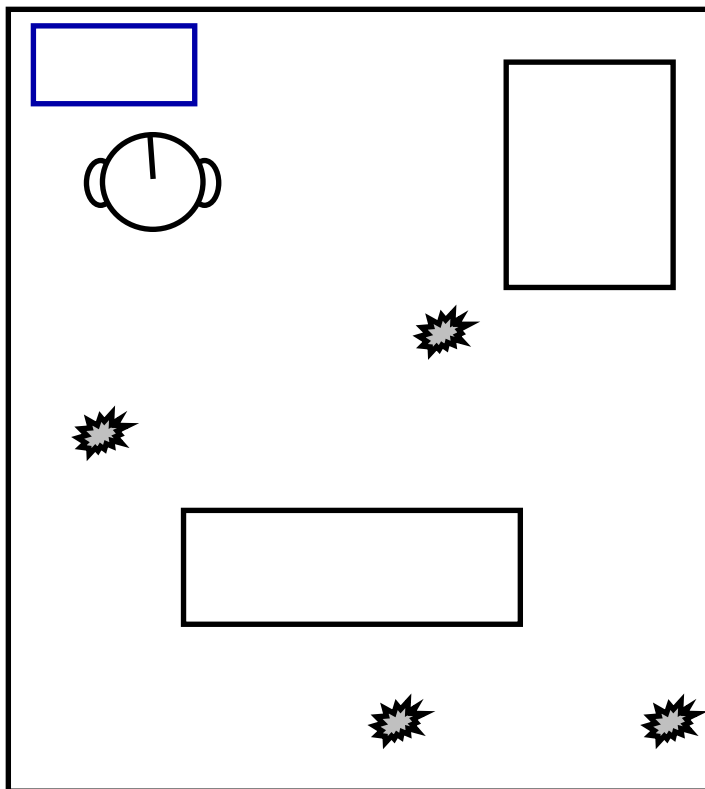
Creates a new function with given name and parameters. When called the variables. parameter1 ... parametersN are bound to the given arguments and the expression(s)

function-body are evaluated and returned.

Special form: SETQ

(setq name expression)

Sets the value of variable name to the result of executing expression.



Objectives:

2. Clean all the dirt
3. Go back to the starting position and switch off.