



# Introduction to Artificial Intelligence

*Laboratory activity*

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# Chapter 1

## Rules and policies

### Lab organisation.

1. Laboratory work is 20% from the final grade.
2. There are 3 deliverables in total.
3. Before each deadline, you have to send your work (latex documentation/code) at [moodle.cs.utcluj.ro](https://moodle.cs.utcluj.ro)

Class: Introducere in Inteligenta Artificiala  
Enrollment key: lia2017-2018

4. *Laptop policy*: you can use your own laptop as long you have Linux. One goal of the laboratory is to increase your competency in Linux. It is **your** task to set static IPs:

IP: 192.168.1.51<sup>1</sup>  
MASK: 255.255.255.0  
GATEWAY: 192.168.1.2  
DNS: 192.168.1.2  
PROXY 192.168.1.2:3128

Wifi: Network: isg  
Password: inteligentaartificiala

5. *Group change policy*. Maximum number of students in a class is 14.
6. *For students repeating the class*: A discussion for validating the previous grade is mandatory in the first week. I usually have no problem to validate your previous grades, as long you request this in the first week. Failing to do so, leads to the grade 1 for the laboratory work in the current semester.

**Grading.** Assessment aims to measure your knowledge and skills needed to function in realistic AI-related tasks. Assessment is based on your written report explaining the nature of the project, findings, and recommendations. Meeting the deadlines is also important. Your report is comparable to ones you would write if you were a consultant reporting to a client.

Grade inflation makes difficult to distinguish between students. It also discourages the best students to do their best. In my quest for “optimal ranking of the students”, I do not use the following heuristics:

Table 1.1: Lab scheduling.

Activity	Deadline
<i>Searching agents, linux, latex, python</i>	$W_1$
<i>Uninformed search</i>	$W_2$
<i>Informed Search</i>	$W_3$
<i>Adversarial search</i>	$W_4$
<i>Propositional logic</i>	$W_5$
<i>First order logic</i>	$W_6$
<i>Inference in first order logic</i>	$W_7$
<i>Knowledge representation in first order logic</i>	$W_8$
<i>Classical planning</i>	$W_9$
<i>Contingent, conformant and probabilistic planning</i>	$W_{10}$
<i>Multi-agent planing</i>	$W_{11}$
<i>Modelling planning domains</i>	$W_{12}$
<i>Individual feedback</i> to clarify the good/bad issues related to student activity/results during the semester.	$W_{14}$

- "He worked hard at the project". Our society do not like anymore individuals that are *trying*, but individual that *do* stuff. Such heuristic is not admissible in education, except the primary school.
- "I knew he could do much better". Such a heuristic is not admissible because it does not encourage you to spread yourself.
- 7 means that you: i) constantly worked during classes, ii) you proved competent to use the tool and its expressivity for a realistic scenario, iii) you understood theoretical concepts on which the tool rely on.
- 8, 9 mean that your code is large enough and the results proved by your experiments are significant.
- 10 means that you did very impressive work or more efficient that I expected or handled a lot of special cases for realistic scenarios.
- 5 means that you managed to develop something of your own, functional, with your own piece of code substantially different from the examples available.
- You obtain less than 5 in one of the following situations:
  1. few code written by yourself.
  2. too much similarity with the provided examples.
  3. non-seriosity (i.e. re-current late at classes, playing games, worked for other disciplines, poor/unprofessional documentation of your work, etc.)<sup>2</sup>.
- You get 2 if you present the project but fail to submit the documentation or code. You get 1 if you do not present your project before the deadline. You get 0 for any line of code

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<sup>2</sup>Consider non-seriosity as a immutable boolean value that is unconsciously activated in my brain when one of the above conditions occurs for the first time.

taken from other parts that appear in section *My own code*. For information on TUCN's regulations on plagiarism do consult the active norms.

If your grade is 0, 1, or 2, you do not satisfy the preconditions for participating to the written exam. The only possibility to increase your laboratory grade is to take another project in the next year, at the same class, and to make all the steps again.

However, don't forget that focus is on learning, not on grading.

*Using Latex in your documentation.* You have to show some competency on writing documentation in Latex. For instance, you have to employ various latex elements: lists, citations, footnotes, verbatim, maths, code, etc.

**Plagiarism.** Most of you consider plagiarism only a minor form of cheating. This is far from accurate. Plagiarism is passing off the work of others as your own to gain unfair advantage.

During your project presentation and documentation, I must not be left with doubts on which parts of your project are your work or not. Always identify both: 1) who you worked with and 2) where you got your part of the code or solution. You should sign the declaration of originality.

Describe clearly the starting point of your solution. List explicitly any code re-used in your project. List explicitly any help (including debugging help, design discussions) provided by others (including colleagues or teaching assistant). Keep in mind that it is your own project and not the teaching assistant's project. Learning by collaborating does remain an effective method. You can use it, but don't forget to mention any kind of support. Learning by exploiting various knowledge-bases developed by your elder colleagues remain also an effective method for "learning by example". When comparing samples of good and poor assignments submitted by your colleagues in earlier years try to identify which is better and why. You can use this repository of previous assignments, but don't forget to mention any kind of inspiration source.

The assignment is designed to be individual and to pose you some difficulties (both technological and scientific) for which you should identify a working solution by the end of the semester. Each semester, a distinct AI tool is assigned to two students. You are encouraged to collaborate, especially during the the installation and example understanding phases ( $W_1$ - $W_4$ ). The quicker you get throughout these preparatory stages, the more time you have for your own project.

**Class attendance.** I expect active participation at all activities. Keep in mind the exam can include any topic that was covered during class, explained on the board, or which emerged from discussions among participants. Missing lab assignments or midterm leads to minimum grade for that part. You are free to manage your laboratory classes - meaning that you can submit the project earlier - as long as you meet all the constraints and deadlines.

# Chapter 2

## A1: Search

Ce e Inteligenta Artificiala?

studiul agentior care (1) percep mediul si (2) realizeaza actiuni

Scopuri:

ingineresc: rezolvarea problemelor din lumea reala utilizand AI drept un set de idei despre reprezentarea cunostintelor, utilizarea cunostintelor si asamblarea sistemelor

stiintific: determinarea acelor idei despre reprezentarea cunostintelor, utiizarea acestora si asamblarea sistemelor care explica diverse feluri de inteligenta

Obiectiv joc

Pac-Man trebuie sa adune cat mai multe puncte in timp ce se fereste de fantome

Obiectivul pentru acest proiect este de a implementa funtiile de cautare DFS, BFS, Uniform si A\* cu ajutorul carora vom reusi implementarea funtiilor: foodHeuristic, findPathToClosestDot, isGoalState, mai exact funtiile ce il ajuta pe pac-man sa manance mancarea cat mai eficient.

De ce inteligenta artificiala?

Ne-am gandit sa facem un pas inainte si sa mai dezvoltam putin jocul, asa ca ne-a venit ideea sa facem un agent logic pentru Pac-Man.

Jocul este implementat in limbajul python.

Prin intelegerea algoritmilor de BFS si DFS pe care i-am implementat, am reusit sa vedem cum umbla pac-man prin labirint si astfel am putut sa trecem la urmatorul pas.

Cautarea in latime, BFS este un algoritm pentru parcurgerea sau cautarea intr-o structura de date de tip arbore sau graf. Aceasta incepe cu radacina arborelui si exploreaza nodurile mai intai cele vecine acestuia, inainte de a trece la vecinii de pe nivelul urmator.

Cautare sau parcurgere in adancime, DFS este un algoritm pentru parcurgerea sau cautarea intr-o structura de date de tip arbore sau graf. Se incepe de la radacina si se exploreaza cat mai mult posibil de-a lungul fiecarei ramuri inainte de a face pasi inapoi.

Cu ajutorul functiei BFS am reusit sa implementam functi A\* (combina costul pentru a aseza nodul din starea initiala cu costul estimat pentru obtinerea de la nod la obiectiv)  $f(n) = g(n) + h(n)$ .

Cu ajutorul functiei A\* am reusit sa il facem pe pac-man sa manance toata mancarea. Pentru a reusi sa manance cat mai eficient si cu cat mai putine stari am dezvoltat un algoritm pentru funtia foodHeuristic (7203 stari). Pentru aceasta functie am mai implementat o functie ce calculeaza distanta manhattan si o functie ce calculeaza distanta minima pana la mancare.

### Concluzie:

Datorita acestui proiect am reusit sa intelegm bazele unui nou limbaj de programare, mai exact python. Obiectivul proiectului a fost aproape atins, deoarece am fi vrut sa implemantam si niste fantome, dar obiectivul principal a fost atins si am reusit sa dezvoltam un agent ce stie sa manace singur toate mancare.

# Chapter 3

## A2: Logics



# Chapter 4

## A3: Planning

# Bibliography

<https://medium.com/@lennyboyatzis/ai-teaching-pacman-to-search-with-depth-first-search-ee57daf889ab>  
<https://ro.wikipedia.org/wiki/Pac-Man>

# Appendix A

## Your original code

This section should contain only code developed by you, without any line re-used from other sources. This section helps me to correctly evaluate your amount of work and results obtained. Including in this section any line of code taken from someone else leads to failure of IS class this year.

```
1.def manhattanDist( pos1, pos2): xy1 = pos1 xy2 = pos2 return abs(xy1[0] - xy2[0]) +  
abs(xy1[1] - xy2[1])
```

```
def distantaMin(lista): (punctMin, distMin)=lista[0] for (punct, dist) in lista: if dist<distMin:  
distMin=dist return punctMin,distMin
```

```
2.def foodHeuristic(state, problem):  
foodList = foodGrid.asList() distante = [] heuristic = 0 if len(foodList) == 0: return 0  
for food in foodList: dist = manhattanDist(food, position) distante.append((food, dist))  
(punctMin, distMin) = distantaMin(distante)  
heuristic = mazeDistance(punctMin, position, problem.startingGameState) foodRamasa =  
0  
for food in foodList: (foodL, foodC) = food (pozL, pozC) = position (foodMinL, foodMinC)  
= punctMin if (foodL != pozL and foodL != foodMinL) or (foodC != pozC and foodC !=  
foodMinC): foodRamasa += 1  
heuristic += foodRamasa  
return heuristic
```

```
3.def isGoalState(self, state):  
f = self.food.asList() distance, food = min([(util.manhattanDistance(state, food), food) for  
food in f]) isGoal = state == food return isGoal
```

```
4.def findPathToClosestDot(self, gameState): actions = search.bfs(problem) return actions
```

Intelligent Systems Group

