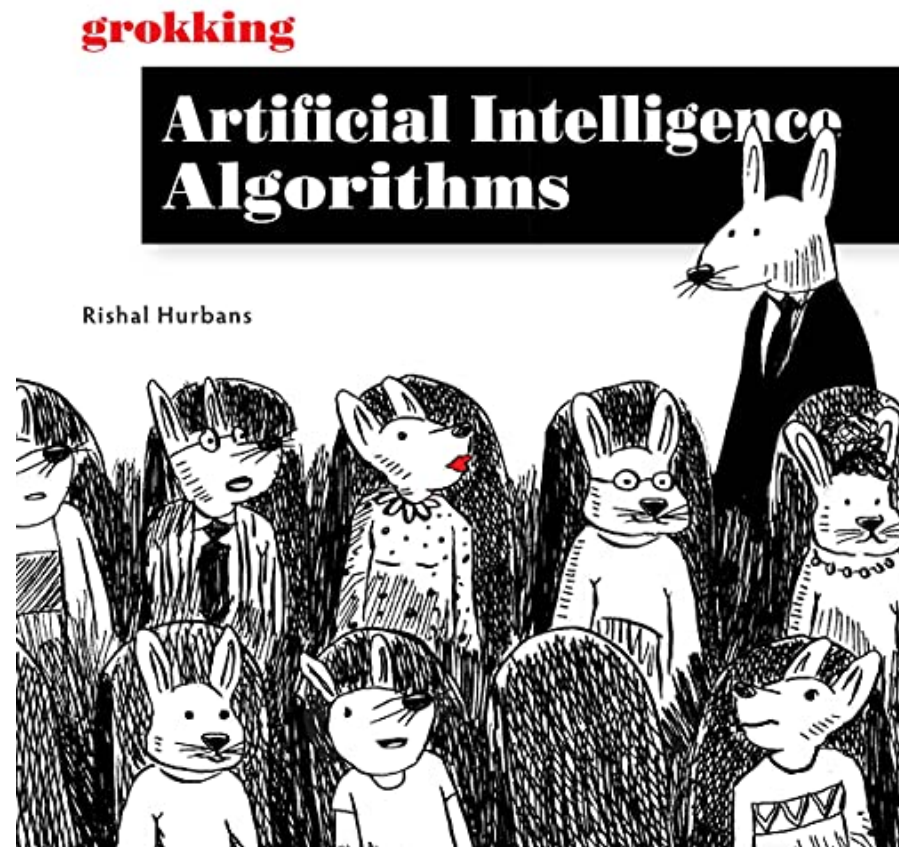


# AI Programming

*Referentievragen leerstof*



**VIVES University of Applied Sciences**  
**Bachelor in electronics-ICT**



# Referentievragen AI Programming

## *Chapter 1 – Intuition of artificial intelligence*

- Why is there no unanimous **definition** for artificial intelligence?
- What is the difference between **quantitative data** and **qualitative data**? Give some concrete examples of both types of data.
- What is the difference between **data**, **information** and **knowledge**?
- What is an **algorithm**? What is an **AI algorithm**? What are the **components** of an algorithm?
- Give a few **categories of problems** that people are trying to solve via (AI) algorithms.
- What is the difference between a **local best solution** and a **global best solution**?
- What is the difference between **super intelligence**, **general intelligence** and **narrow intelligence**?
- What is the relationship between **biology-inspired algorithms**, **machine learning**, **deep learning** and **search algorithms**?
- Which three types of '**learning**' fall under **machine learning** and concisely explain each type of '**learning**'?

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## *Chapter 2 – Search fundamentals*

- What is a **data structure** and give some concrete examples of data structures?
- Explain the following terms: **graph**, **vertex**, **node** and **edge**.
- Given: a **graph**
  - Assignment: determine the 'array of edges', the 'incidence matrix' and the 'adjacency matrix'
- Explain: a tree is a **connected acyclic graph**
- Explain the following 'tree' terms: **root node**, **parent node**, **sibling node**, **descendent**, **ancestor**, **leaf node**, **goal node**, **path**, **cost**, **degree** and **depth**.
- Explain the **Breadth-First Search** (BFS) algorithm and which data structure is used?
- Given: a search tree
  - Assignment: apply the Breadth-First Search (BFS) algorithm to find any solution
- Explain the **Depth-First Search** (DFS) algorithm and which data structure is used?
- Given: a search tree
  - Assignment: apply the Depth-First Search (DFS) algorithm to find any solution

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## *Chapter 3 – Intelligent search*

- **Heuristics**
  - What is a heuristic?
  - Why can heuristics improve the efficiency of search problems?
  - Give a few concrete examples of heuristics.
- **A\* Search**
  - Explain how the A\* search algorithm works.
  - How is the cost function determined?
- **A\* Search**
  - given: a search tree with the cost per node.
  - question: determine the sequence of searching the search tree, using the A\* algorithm.

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## *Chapter 3 – Intelligent search*

- **Min-Max Adversarial Search**

- Explain how the min-max adversarial search algorithm works.

- **Min-Max Adversarial Search**

- given: a search tree with the cost for each leaf node.
- question: determine the value of each node in the min-max search tree.

- **Alpha-Beta Pruning**

- Explain how the alpha-beta pruning adversarial search algorithm works.
- What is alpha? What is beta?
- What makes alpha-beta pruning a much more efficient search algorithm?

- **Alpha-Beta Pruning**

- given: a search tree with the cost for each leaf node.
- question: determine the value of each node in the search tree and explain why certain branches in the search tree may be pruned.

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## *Chapter 4 – Evolutionary algoritms*

- **Genetic Algorithm: Life cycle**
  - Briefly explain the **life cycle** of a genetic algorithm.
- **Enter diversity**
  - Genetic algorithms use **crossover** and **mutation** as principles to ensure the **diversity** of the next generations.
    - Explain this principle.
    - Give some examples of crossover and mutation.
- **Genetic Algorithm parameters**
  - Name 5 parameters to configure a genetic algorithm.
  - How does each parameter affect the generation of solutions?
- **Fitness function**
  - What is a **fitness function** within genetic algorithms?
  - Why is the correct choice of the right fitness function crucial for the performance of the algorithm?

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## *Chapter 5 – Advanced evolutionary approaches*

- **Selection mechanisms**

- Briefly discuss the principle of following selection mechanisms in the evolutionary algorithm and discuss the advantages and disadvantages of each selection mechanism:
  - roulette-wheel selection
  - rank selection
  - tournament selection
  - elitism selection

- **Mutation mechanisms**

- Briefly discuss the principle of following mutation mechanisms in the evolutionary algorithm:
  - boundary mutation
  - arithmetic mutation

- **Tree encoding and tree crossover**

- Briefly discuss the principle of:
  - tree encoding
  - tree crossover

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## *Chapter 6 – Swarm intelligence*

- **Swarm intelligence**
  - Explain what swarm intelligence is and on what principles is this form of intelligence based.
  - Why is the analogy to ants selected in the ant optimization algorithm?
- **Ant colony optimization algorithm**
  - Discuss the different steps in the ant colony optimization algorithm
  - Discuss the mathematical formula for destination selection based on pheromones and distance heuristics.
  - How is the best solution ultimately determined?
  - What criteria can be used to stop the algorithm?
- **Ant colony optimization algorithm – selection of the destination**
  - given: a figure showing the distances between different objects and the intensity of the pheromones on each of the paths.
  - question: discuss how the destination with the highest probability is determined. Use the mathematical formula for selecting the destination and choose your own value for **alpha** and **beta**.



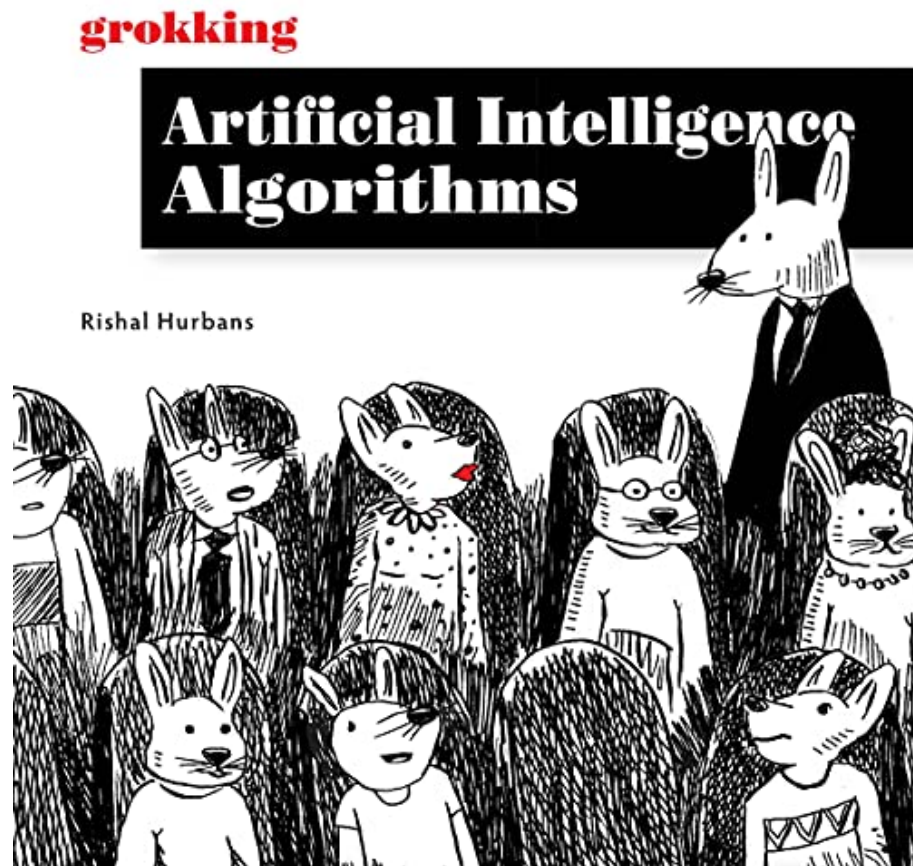
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## *Chapter 7 – Swarm intelligence: Particles*

- **Particle swarm intelligence: bird flocks**
  - What do the following terms mean for simulating the movement of individual birds in relation to bird flocks?
    - Alignment
    - Cohesion
    - Separation
- **Particle swarm optimization algorithm**
  - Discuss the different steps in the particle swarm optimization life cycle algorithm
  - Discuss how the position of the particles is updated
  - How is the best solution ultimately determined?
  - What criteria can be used to stop the algorithm?
- **Particle swarm optimization algorithm**
  - Explain the following relation:
    - $\text{new velocity} = \text{inertia component} + \text{cognitive component} + \text{social component}$
  - What is the function of?
    - The inertia component
    - The cognitive component
    - The social component

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