1. Which one of the following representations is proper for the knapsack problem?

R: Binary

Justification:

* We need 2 values in order to decide if an object is taken into account or not (is put in the knapsack) 0 - NO, 1 – YES, so we will illustrate decisions by using the binary representation

1. Which one of the following representations is NOT proper for the N-QUEEN problem?

R: Binary

Justification:

* The position of the queens must be unique, so we need to illustrate them by using different values in a vector with integers, that either contains only the information from rows, or from columns only (0 and 1 would not be enough, suggestive)

1. What is the fitness function for the KNAPSACK PROBLEM?

R: The number of objects placed inside.

1. What is the fitness function for the N-QUEEN PROBLEM?

R: The number of queens that attack each other.

1. Consider the following rule for a RBS in an uncertain environment: *If the father is old and the mother is young the child has a chance to live longer.*

What is the proper logic operator used between the fuzzy variables when we apply this rule?

R: AND

1. Enumerate the elements that determine the probability for a new possible element to be added to the solution in an ant colony system

R: - Pheromone trail + higher pheromone value => intensity

- Higher visibility of further nodes

- Trail importance coefficient

- Visibility importance coefficient

1. On what is based the ant colony system?

R: The pheromone trace left by ants

1. What are the main specific features of a particle in PSO optimisation?

R: Current position and velocity

Fitness

1. What is a proper encoding for an individual in Genetic Programming?

R: A computer program that solve the given problem

1. Which of the following problems **can’t** be solved by a perceptron?

R: XOR

1. How is propagated the error into an artificial neuronal network who uses it as learning the backpropagation algorithm?

R: It propagates backwards

1. Using an ANN we want to determine if a shape from a black and white image is a circle or not. The image has 10x10 pixels and the ANN has the structure of 101:15:10:2 with a sigmoid activation function. What is the problem’s type?

R: This is a classification problem.

++ How many weights will have the last neuron from the last layer?

R: 10 weigths for one neuron from the output layer +

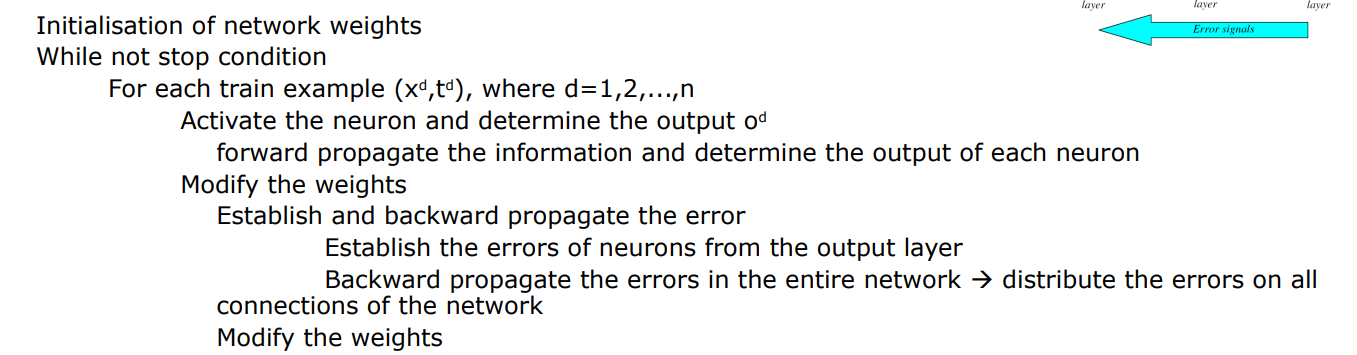
The value of the error function and the learning rate

1. Specify the correct statement(s) in a rule based system in a certain environments inference engine with Forward chaining

R:

* The inference engine allows to draw new conclusions
* Facts are represented in a working memory which is continually updated
* The actions usually involve adding or deleting items from the working memory.
* The rules are of the form: left hand side (LHS) ⇒ right hand side (RHS)
* Rules represent possible actions to take when specified conditions hold on items in the working memory.
* The conditions are usually patterns that must match items in the working memory

1. What will depend on the adjusting value of the weights if we use a backpropagation algorithm to train the network?



1. Consider an evolutionary algorithm that is used for searching the minimum of a real function that has a crossover operator

*offspring = parent1 + a(parent2 - parent1),* with a in [0, 2].

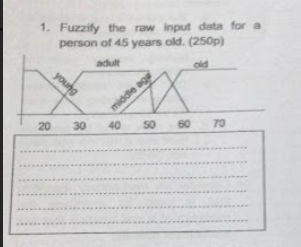
Describe a possible pitfall if we use this crossover:

R: If alpha is 0 offspring = parent1 + 0 or alpha is 1 offsrping = ~~parent1~~ + parent2- ~~parent1, i~~t means that the population is not changed, so we don’t have evolution.

1. For a Genetic Programming algorithm identify the correct statement(s):

R: The solution’s quality depends on the precision of variables involved in the algorithm.

1. Fuzzify the raw input data for a person of 45 years old.



A piece of paper with writing on it

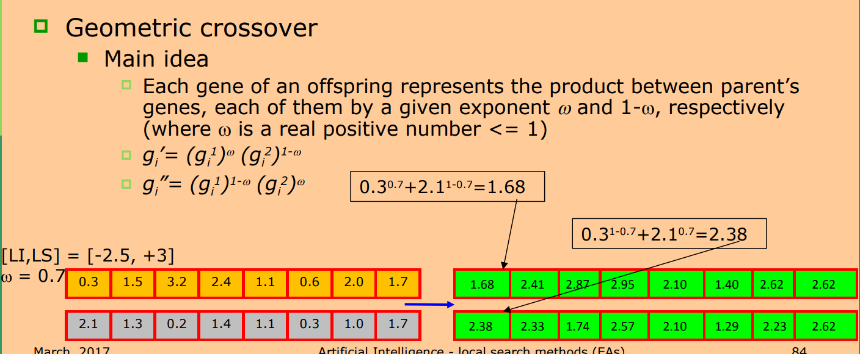
Description automatically generated

1. Enumerate 4 crossover operators (with a short description) for real representation used in Evolutionary Algorithm

R:

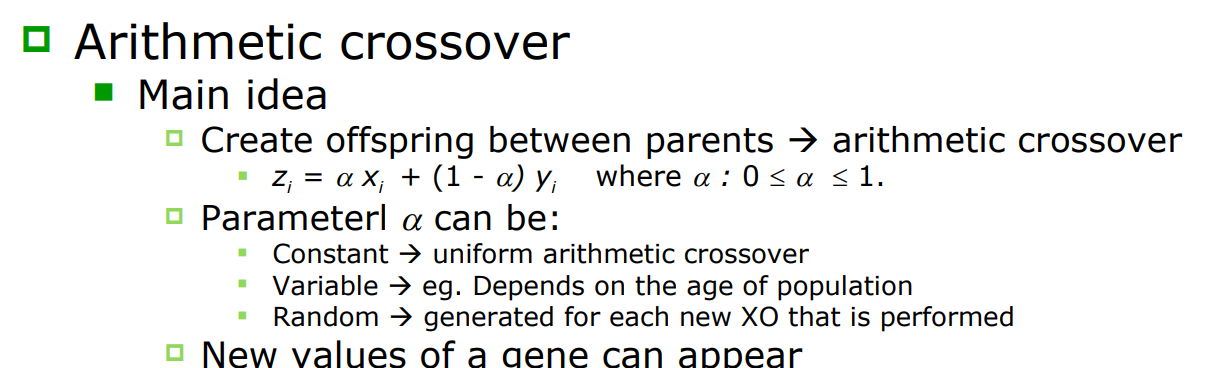
Graphical user interface, text, application

Description automatically generated



Graphical user interface, text

Description automatically generated



1. For the following problem describe (NOT CODE) a solving method using evolutionary computation (representation, computation, fitness, selection)

**There is a set of cards printed with integer numbers. Select a subset in such way that the sum of the numbers engraved on them should be M (or as close to M as possible).**

**REPRESENTATION**

Because it is given that we have a SET of cards, we will consider that each card is unique. So our problem will be similar to the Knapsack one.

In this case, the representation will be a binary one. We will have for the Genotype bit-strings, which will tell us (as a PHENOTYPE) if a card is selected for the subset or not (0 for NO and 1 for YES).

**COMPUTATION**

**Mutation & Crossover**

Graphical user interface, text, application

Description automatically generated

Diagram

Description automatically generated with medium confidence

**FITNESS**

I consider that a good a fitness function would be abs(M – sum of the selected cards), where M is the total sum of cards in the subset (MINIMIZATION)

**SELECTION**

* Recombination:

Ranking selection – sort population based on fitness – individuals have ranks

Best individual rank miu and the worst one rank 1

* Survival:

Elitism - Keep the best individuals from a generation to the next one (if the offspring are weaker than parents, then keep the parents)

1. Enumerate 4 selection methods (with a short description) used by Evolutionary Algorithm

Graphical user interface, text, application, email

Description automatically generated



Text

Description automatically generated



Text

Description automatically generated

Chart

Description automatically generated with low confidence Text

Description automatically generated