Artificial Intelligence

Date: _____ Name: ……
S. s. B Formation: .....

All subjects are mandatory, if you write outside the designated area the answer will not be considered.

1. Which one of the following representations is NOT proper for the N-Queen problem? (50p)
    a. Permutation of N size
    b. Vectors of N integers
    c. Vectors of N real numbers
    d. Binary

Justify the answer (50p):

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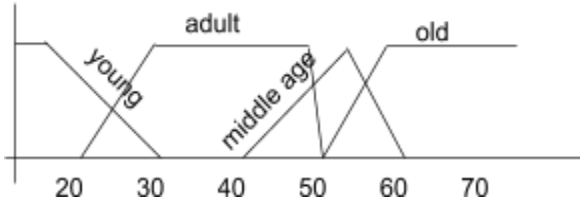
2. What is the fitness function for the previous problem? (50p)
    a. The number of queens placed on the same line
    b. The number of queens that attack each other
    c. The number of queens placed on the same column
    d. The difference in absolute value between the number of queens that attack each other on lines and the number of queens that attack each other on columns
3. Fuzzify the raw input data for a person of 25 years old. (250p)



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4. Consider the following rule for a RBS in 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? (50p)
    a. AND
    b. OR
    c. AND and OR
    d. none
5. Enumerate the elements that determine the probability for a new possible element to be added to the solution in an ant colony system. (100p)

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6. On what is based the ant colony system? (50p)
    a. An evolutionary schema
    b. The pheromone trace left by ants
    c. Identical with PSO
    d. Inertia and speed

7. What are the main specific features of a particle in PSO optimisation? (50p)
    a. Velocity and trace
    b. Current position and velocity
    c. Fitness function
    d. There is no specific feature

8. What is a proper encoding for an individual in Genetic Programming? (50p)
    a. depends on the problem
    b. a string of bits
    c. a computer program that solve the given problem
    d. a binary expression

9. Which one(s) of the following problems **can't** be solved by a perceptron? (50p)
    a. AND logic
    b. OR logic
    c. XOR
    d. any problem that implies a linear separation of a plane

10. How is propagated the error into an artificial neural network who uses as learning the backpropagation algorithm? (50p)
    a. In both directions
    b. You don't compute the error for this algorithm
    c. In the same direction with the input signal
    d. It propagates backwards

11. 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? (50p)

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12. How many weights will have the last neuron from the last layer (50p)?

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13. On what will depend the adjusting value of the weights if we use a backpropagation algorithm to train the network? (50p)

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14. Specify the correct statement(s) in a ruled based system in certain environments inference engine with Forward chaining (100p):
    a. Facts are represented in a working memory which is continually updated.
    b. The inference engine allows to draw new conclusions.
    c. The actions usually involve adding or deleting items from the working memory.
    d. The rules are of the form: left hand side (LHS) ==> right hand side (RHS).

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

$$offspring = parent_1 + \alpha(paren_2 - parent_1)$$

with α in $[0, 2]$.

Describe a possible pitfall if we use this crossover (50p):

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16. For a Genetic Programing algorithm identify the correct statement(s) (100p):
    a. Very hard to implement.
    b. Convergence (complete, optimal) through global optima is slowly.
    c. The solution's quality depends on the precision of variables involved in the algorithm.
    d. The main advantage is that it doesn't depend on parameters.

16. Enumerate 4 crossover operators (with a short description) for real representation used in Evolutionary Algorithms (400p):

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17. For the following problem describe (NOT CODE) a solving method using evolutionary computation (representation, operators, fitness, selection) (400p).

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

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WORKSHEET -- WILL NOT BE REVISED!!!!