School of Information Technology
Indian Institute of Technology Kharagpur

Soft Computing Applications :: IT60108

Class Test – II
(*Spring Semester, Session 2013-2014*)

Full Marks: 30 **Time: 30 minutes**

Multiple choice type questions

1. **Following are the set of multiple choice type questions. One or more choice(s) may be correct. Draw a CIRCLE against the each correct alternative.**

   i. Solving a **multi-objective optimization problem** with Genetic Algorithm (GA), always yields
      a. a unique single solution
      b. multiple solutions where all are optimal
      c. a number of Pareto-optima solutions
      d. a single Pareto-optimal solution

   ii. The **Back Propagation Learning** algorithm is used to train
      a. a single layer feed forward neural network only
      b. a multiple layer feed forward neural network only
      c. a recurrent neural network only
      d. any artificial neural network

   iii. Vector Evaluated Genetic Algorithm (VEGA) is a
      a. priori approach
      b. posteriori approach
      c. non-aggregating approach
      d. Pareto-based approach

   iv. Following is a Pareto-based approach, which follows **Crowding tournament selection**
      a. SOEA
      b. MOGA
      c. NPGA
      d. NSGA-II

   v. Following which approach suffers from "**Speciation problem**".
      a. NSGA
      b. NSGA-II
      c. NPGA
      d. VEGA

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vi. The ***support*** of Fuzzy set A is the set of all points *x* in *X* (is the universe of discourse) such that

a. $\mu_A(x) > 0$
b. $\mu_A(x) = 1$
c. $\mu_A(x) = 0.5$
d. $\mu_A(x) \neq 1$

vii. Following is an example of ***Sigmoid Membership*** function

a. $\mu(x: c, \sigma) = e^{-\frac{1}{2}\left(\frac{x-c}{\sigma}\right)^2}$
b. $\mu(x: a, c) = \frac{1}{1+e^{-\left[\frac{a}{x-c}\right]}}$
c. $\mu(x: a, b, c) = \frac{1}{1+\left\|\frac{x-c}{a}\right\|^{2b}}$
d. $\mu(x: a, b, c) = \begin{cases} 0 & x \leq a \\ \frac{x-a}{b-a} & a \leq x \leq b \\ \frac{c-x}{c-b} & b \leq x \leq c \\ 0 & c \leq x \end{cases}$

viii. A transfer function $fI)$ with transfer coefficient α follows its partial derivative with respect to input *I* as $\frac{\partial f}{\partial I} = \alpha f(I)(1 - f(I))$. The transfer function is most likely the

a. Linear transfer function
b. Log-sigmoid transfer function
c. Tan-sigmoid transfer function
d. Hard-limit transfer function

ix. Given that

R1: IF x is A THEN z is C
R2: IF y is B THEN z is c

Then, the fuzzy rule "IF x is A OR y is B THEN z is C" can be expressed as (with all symbols bearing usual meaning)

a. (A X B) + (B X C)
b. A X B →C
c. A X C → B X C
d. (AXC) U (BXC)

x. Given that "x is Sweet" with T(x) = 0.8 and "y is Sweet" with T(y) = 0.6.
The fuzzy truth value of "IF x is Sweet THEN y is Sweet" is

a. 0.4
b. 0.2
c. 0.8
d. 0.6

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True and False

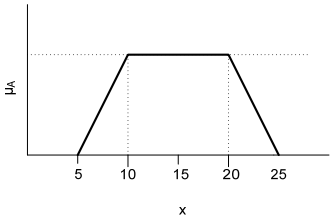
2. In the following, some statements are true and some are false. Write TRUE against each correct statement and FALSE against each wrong statement.

i. All fuzzy sets are crisp sets but all crisp sets are not fuzzy sets

ii. If A_α and A'_α denote α-cut and strong α-cut of a fuzzy set *A*, then ***support***(A) = A'_o and ***Core*** (A) = A_1 .

iii. If A(x, μ_A) denotes a fuzzy linguistic YOUNG over x ϵ X, is the set of ages, then the fuzzy linguistic VERY YOUNG can be defined as A^k with k>1.

iv. A fuzzy set *A* where membership function is represented in the following.



Then crisp value of the fuzzy set obtained by CoG, CoS or MoM, in this case will give the same value.

v. If A and B are two Fuzzy sets, such that
A = {(x_1, 0.5), (x_2, 0.1)} and B = {(x_2, 0.2), (x_3, 0.5)} then the C = A U B would be
C = {(x_1, 0.5), (x_2, 0.2), (x_3, 0.5)

vi. If $\bar{x}$* denotes a Pareto optimal solution, then there exist no feasible vector $\bar{x}$ that decreses some objective function without causing a simultaneous increase at least one other objective function. Assume that the problem is to minimize all objectives.

vii. Both SOEA (Single Objective Evolutionary Algorithm) and VEGA (Vector Evaluated Genetic Algorithm) can be implemented in SGA (Simple Genetic Algorithm) framework.

viii. An *l-m-n* type multiple layer feed forward neural network not necessarily meant for solving non-linear problems with error minimization.

ix. **Steepest descent gradient method** is the method to search an optimum values of an artificial neural network parameters.

x. Non-dominating sorting procedure can handle a) any number of objectives, b) both maximization and minimization without any need of transformation, and c) simple genetic algorithm framework with a modification of selection operation.

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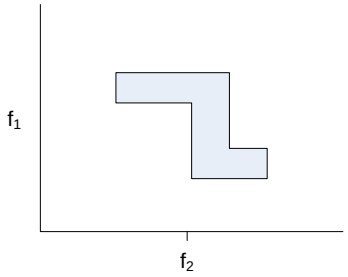
3. Give ONE line answer to each of the following questions.

i. Trace the Pareto optimal font in the following graph (assume that both f_1 and f_2 are to be maximized)

Ans:



ii. **IF temperature is Low THEN pressure is High** is represented by the fuzzy relation shown below.

Temperature \ Pressure	1	2	3	4	5
10	0.8	0.8	0.9	0.9	0.9
15	0.7	0.7	0.8	0.8	0.8
20	0.6	0.7	0.8	0.8	0.8
25	0.5	0.6	0.6	0.7	0.7
30	0.5	0.6	0.7	0.7	0.7

For temperature 20, what is the crisp value of pressure as High?

Ans:

iii. What will be the sizes of *V* and *W* matrices of an **l-m-n neural network**? Here, *V* and *W* are the weight matrices between input and hidden, and hidden and output layers, respectively.

Ans:

iv. State the "Generalized Modus Tollen" in terms of four fuzzy linguistic states A, A', B and B'.

Ans:

v. A decision vector *u* dominates *v* iff *u* is ***better*** than *v* with respect to (at least) one objective and not ***worst*** than *v* with respect to all other objectives. If *u* and *v* are the vectors with *x* and *y* as components, explain the above statement graphically.

Ans:

Name: …… Regn.No……

vi. Write down the **Zadeh max-min** rule to compute the fuzzy implication "IF x is A THEN y is B", where *A* and *B* are two fuzzy sets defined over *X* and *Y* as the universe of discourses, respectively, with μ_A and μ_B are the membership functions.

Ans:

vii. IF ***core***(A) and ***core***(B) are the core of the Fuzzy set A and B, respectively, then what is the ***core***(AUB)?

Ans:

viii. Give the definition of "Relative Deviation" for an i^{th} objective followed in ***Weighted Min-Max*** approach.

Ans:

ix. Under what circumstances CoG method of defuzzification gives better result than CoS method?

Ans:

x. Identify the following training algorithm as supervised and unsupervised learning algorithms to train ANNs:

Back propagation, Hebbian, Competitive and Stochastic

Ans:

Back propagation ---->
Hebbian ----->
Competitive ----->
Stochastic ----->