School of Information Technology
Indian Institute of Technology Kharagpur

Soft Computing Applications :: IT60108
Class Test – I
(*Spring Semester, Session 2013-2014*)

Full Marks: 40 **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. STRIKE THROUGH against the each correct alternative.

   i. Any soft-computing methodology is characterized with
      a. precise solutions
      b. control actions are unambiguous and accurate
      c. extensive mathematical model of the problem to be investigated
      d. algorithm which can easily adapt with the change of dynamic environment

   ii. Consider the optimization problem as stated below.
   Maximize $f(x,z) = -x^2 + 10x + xz - z^2 + 8z + 2$, where $x, z > 0$.
   The problem has
      a. no maxima
      b. one maxima
      c. two maxima
      d. cannot be determined

   iii. Following which technique is not a random search technique
      a. Branch-and-bound
      b. Tabu search
      c. Simulated annealing
      d. Genetic algorithm

   iv. Solving an optimization problem with Genetic algorithm fails, if
      a. Objective functions are discontinuous
      b. Design variables are with discrete (integer) values
      c. Domain of design variables are not known
      d. There are too many design variables
      e. None of the above

   v. Which of the following is not true for genetic algorithm (GA)
      a. GA is an iterative search process.
      b. GA is a population-based probabilistic search process.
      c. GA is an optimization technique where solution is not necessarily guaranteed to be optimal.
      d. GA always converges to an optimal solution after a finite number of cycles.

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vi. Fitness scaling is desirable to ensure
   a. Population diversity
   b. Selection pressure
   c. That better solutions in a population are selected only
   d. Relatively inferior solutions are not ignored

vii. The Roulette-Wheel selection usually with
   a. High population diversity and low selection pressure
   b. Low population diversity and high selection pressure
   c. High population diversity and moderate selection pressure
   d. Low population diversity and moderate selection pressure

viii. The crossover technique(s), which may suffer from end-point bias is
   a. Single-point crossover
   b. Two-point crossover
   c. Uniform crossover
   d. Half uniform crossover

ix. Which mutation operation can be considered in Order-GA
   a. Flipping
   b. Reversing
   c. Interchanging
   d. Random mutation

x. Which is/are not to be considered as GA parameter(s)?
   a. N, population size
   b. ϵ, obtainable accuracy
   c. μ_p , mutation probability
   d. $\overline{f}$, average fitness score

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. Suppose, $y = f(x)$ denotes a function of single variable *x*, and y^i denotes its *i*-th derivation. If y^i = *+ve* for some value say *x = a*, then *f(x)* has a local minima at *x = a* .

ii. If a minimization problem has a minimum at a point x = x^*, then its dual problem has the maximum value at the same point x = x^*

iii. All NP-Complete problems are solvable in polynomial time with Genetic algorithm.

iv. In steady-state Genetic Algorithm, the selection is always biased towards more highly fit individuals.

v. The tournament selection provides very low selection pressure with a moderate rate of convergence.

vi. If an optimization problem is in the class of parameter optimization, then it would prefer different encoding scheme than the solution optimization.

vii. In binary-coded GA, Hamming cliff problem will never occur if the Hamming distance between two chromosomes is large.

viii. The Real-coded GA is the most suitable GA technique for optimization in a continuous search space.

ix. Out of selection and reproduction, the task reproduction demands more computation than the task selection.

x. It is not possible to define the genotype of chromosome with different schema in it with different encoding scheme.

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

i. Given an optimization problem as minimize $\frac{x^2}{2} - \frac{2}{x^2}$ for all x > 0 write down its dual problem.

Ans:

ii. If f_1 and f_2 are the fitness scores such that $f_1<f_2$ in a minimization problem solving with GA, then the best fitness value according to any selection operation is

Ans:

iii. Once the initial population is created, which (optimal) operation needs to be applied only once?

Ans:

iv. In which GA, “partially mapped crossover (PMX) technique is followed?

Ans:

v. To solve an optimization problem both binary and value encoding can map phenotype onto genotype. In such a case, which GA would be preferred? Why?

Ans:

vi. Given an example of an optimization problem, which needs order encoding.
Ans:

vii. From the following two parent chromosomes we are two obtain a specific child chromosome as shown below. Which crossover technique (precisely name the strategy, say "Shuffle crossover") should be considered?

P1: 1 0 0 1 0 1 1 0 1 0 1 0
P2: 0 1 0 0 1 1 0 0 1 1 0 0
C1: 0 1 0 1 0 1 1 0 1 1 0 0

Ans:

viii. In a multi-objective optimization problem with n-objectives namely f_1, f_2, …, f_n, an individual should be represented with how many chromosomes?
Ans:

ix. The crossover mask is used in which crossover mechanism?
Ans:

x. Name the crossover technique, which is highly influenced by the probability distribution functions.
Ans:

4. In the following table, an item in the left is some way link to some part in the right item. Identify, which item in the left is connected to an item in the right.

i.	0-1 Knapsack problem	(a)	Mating pool
ii.	Tree encoding	(b)	Binary encoded-GA
iii.	Hamming cliff	(c)	Faster converge rate
iv.	Simulated binary crossover	(d)	Travelling salesman problem
v.	Order-GA	(e)	Computational geometry problem
vi.	Edge recombination	(f)	Precedence preservative crossover
vii.	Hard computing based solution	(g)	Binary crossover
viii.	Roulette-Wheel selection	(h)	Genetic Programming
ix.	Tournament selection	(i)	Real-coded GA
x.	Population diversity	(j)	Concept of exploration

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