

EASTERN MEDITERRANEAN UNIVERSITY
COMPUTER ENGINEERING DEPARTMENT
CMPE538 Multi-Objective Optimization
Sample Questions

Q.1. (Bin Packing) Consider a finite set U of N items, with a size vector S such that $S(i) \in \mathbb{Z}^+$ denotes the size of item i , $i=1, \dots, N$. Also, there are bins of uniform capacity B and our objective is to pack items in U using minimum number of bins, without exceeding the bin capacity B in every used bin.

- A. Describe a solution procedure for the solution of this problem using Genetic Algorithms.
- B. Describe a solution procedure for the solution of this problem using Simulated Annealing algorithm.

Q.2. Consider the PSO algorithm:

- C. A. Assume that we use the personal experience only in velocity computations, what type of behavior do you guess for PSO?
- D. B. Assume that we use the global experience only in velocity computations, what type of behavior do you guess for PSO?
- E. C. Hence, based on A and B, what are the advantages of using personal and global experiences together?

Q.3. Describe a way of forming a PSO+SA hybrid algorithm. That is, how can you combine the powers of PSO and SA into a new optimization approach that will be more powerful than both PSO and SA. Explain your ideas clearly and in detail.

Q.4. Generalized TSP problem. The generalized traveling salesman problem (GTSP) is a generalization of the well-known traveling salesman problem. Given an undirected complete graph $G = (V, E)$, where V represents the set of cities, in the GTSP, the set of nodes V is partitioned into m groups W_1, W_2, \dots, W_m where $0 < m \leq n$ and $W_1 \cup W_2 \cup \dots \cup W_m = V$. Each city $v_i \in V$ belongs to one and only one group. The groups are disjoint, that is, $\forall i \neq j, W_i \cap W_j = \emptyset$. The objective is to find a minimum-length tour containing exactly one node from each group W_i .

Describe a solution procedure for the solution of this problem using the simulated annealing (SA) method. Describe, solution representation, SA algorithm parameters and data structures, and the fitness function clearly.