Reg. No. 2020UGCS039 R

Indian Institute of Information Technology Ranchi

Department of Computer Science & Engineering

B. Tech End Semester Examination – Spring Semester 2022-23

Semester: 6th | **Course Instructor: Dr. Tarun Biswas**

Course Code: CS 3010 (Hons.) | **Course Name: Evolutionary Computing**

QUESTION PAPER

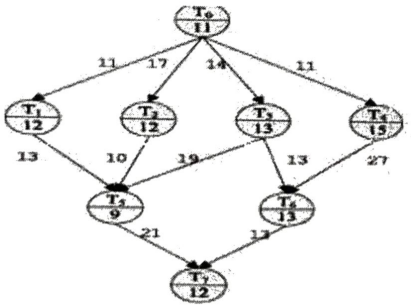
Duration: 3 Hrs. | **Max Marks: 100**

Instructions:

(1). Number in [ ] indicates marks.
(2). Any missing data can be assumed suitably.
(3). Symbols have their usual meaning.
(4). Non-programmable scientific calculator is allowed.

Answer any five (05) questions

1 Design a Genetic algorithm based task to processor assignment optimizing technique according to the below figure- **[4X5=20]**



T_i	Speed			Cost			Average cost
	P_0	P_1	P_2	P_0	P_1	P_2	
0	1.00	0.85	1.22	11	13	9	11.00
1	1.20	0.80	1.09	10	15	11	12.00
2	1.33	1.00	0.86	9	12	14	11.67
3	1.18	0.81	1.30	11	16	10	12.33
4	1.00	1.37	0.79	15	11	19	15.00
5	0.75	1.00	1.79	12	9	5	8.67
6	1.30	0.93	1.00	10	14	13	12.33
7	1.09	0.80	1.20	11	15	10	12.00

a) Design Chromosome representation of the problem?

b) Design a fitness function where load can be assigned in adequate manner.

c) How crossover and mutation is conducted

d) What is your termination criteria and why you have chosen that?

2 a) What is the goal when optimizing multiple conflicting objectives? What is the non-dominance rank of an individual? **[5+5]**

b) Define the Pareto dominance relation. What does it mean that solutions are incomparable? **[5+5]**

3 a) Draw a flowchart of Particle Swarm Optimization Algorithm? [6]

b) Explain the pseudo code of standard PSO algorithm. [6]

c) How does personal best solution impact on global best solution- logical insight according to the velocity and position update algorithm. [8]

4 a) Assume that a runtime analysis for a GA on bitstrings of length n on a specific optimization problem reveals that it takes the algorithm $O(n^3)$ steps (in expectation) to locate the optimum. How does this compare to random guessing (with the uniform distribution)? [10]

b) Why is it important on multi-modal problems to start the search with a sufficiently large step size? How does Elitism impact on GA performance [5+5]

5 a) Classify the crossover and mutation strategies in Genetic Algorithm? Explain one renowned crossover and mutation operating with example. [8]

b) Role of Selection pressure and its impact on evolutionary search [5]

c) Explain Tournament selection with an example [7]

6 a) Think of practical problems, e.g., in logistics or engineering (except scheduling problem). Make sure that you are able to translate such problems into optimization problems. Define the search space, the objective function, and the constraints (if present). [8]

b) Working principles of NSGA – II – derive the computational complexity of the algorithm [6+6]

All The Best