

Test-2 Examination, 2020-21
Ph.D., M.Tech – 1st Year CSE/ Integrated/ DA
Even Semester

Course Name: Nature Inspired Computing and Applications
Course Code: 19M12CS211

Maximum Marks: 20
Maximum Time: 1 Hr.

Note: Follow the instructions carefully

1. This is a paper and pen examination. Answers of all Objective and Subjective questions have to be written on papers only in your own handwriting. No Answers have to be given on Google Form.
2. Write following Information carefully and neatly on top of your Answer sheet, write your Name, Enrolment Number, Batch, Date and Time of Examination, Course Name, and Course Code.
3. Please Join the Google Meet Link and Keep your microphone mute. No student will leave the exam window and Google meet before One Hr.
4. Scanned answer sheets in a single pdf document with all the answers should be uploaded within 10 minutes.
5. Nomenclature of answer script is STUDENT ENROLLMENT_STUDENT NAME.pdf

Course Outcomes:

At the completion of the course, students will be able to,

CO	Description	Cognitive Level
CS211.1	Identify the need of computational complexity, evolutionary, and approximate algorithms.	Apply Level (Level 3)
CS211.2	Understand nature inspired algorithms, its strength, weakness, and suitability	Understand Level (Level 2)
CS211.3	Make use of nature-inspired algorithms to design, learn and optimize problem	Apply Level (Level 3)
CS211.4	Evaluate performance of Nature inspired algorithm in context of problem solving in optimized manner	Evaluate Level (Level 5)
CS211.5	Create a real environment effective artificial system with the use of properties exhibited from nature.	Create Level (Level 6)

Objective Questions:

1. [1 Mark] In the Artificial Bee Colony algorithm, the fitness value for a solution with an objective function value of 9 is _____.

Ans: 0.1

2. [1 Mark] In Evolutionary strategy, how survival is selected among parent and offspring.

Ans: $(\mu + \lambda)$ / Survival of fittest

3. [2 Marks] Consider an optimization problem with a single variable whose lower and upper bound is 5 and 20 respectively. If the decision variable is represented by a 4-bit string in binary coded genetic algorithm, which of the following represents the chromosome for a value of 10 for the decision variable?

Ans: 0101

Lb=5 ub=20

Av= 5 + ((20-5)/(2⁴-1))* DV => AV= 5+DV=> 10= 5+DV => DV= 5=>0101

4. [1.5 Mark] What is the use of Trial vector in Artificial Bee Colony Algorithm.
Ans: Trial vector is used to track the number of failures encountered by each solution.
5. [1.5 Mark] Mention the user defined parameters in Artificial Bee Colony algorithm.
Answer: objective function, lb, ub, Np, trial/ limit, T
6. [1 Mark] define the factor(s) in which only pheromone amplification will be important factor in ACO.
Answer: beta=0

Subjective Questions:

7. Let assume the following function $f(x) = x^3 - 60x^2 + 900x + 100$ where x is constraint to 0 to 31. We wish to maximize $f(x)$. Binary string is represented by 5 bits. For the above, answer following
- a. [2 Marks] Given the following four chromosomes give the values for x and $f(x)$.

Chromosome	Binary String
P ₁	11100
P ₂	01111
P ₃	10111
P ₄	00100

Select P3 and P2 are chosen as parents chromosome and apply one point crossover show the resulting offspring, C1 and C2. Use a crossover point as 1. Do the same using P4 and P2 with a crossover point of 2 and create C3 and C4. Write down all four designed offspring.

Answer:

Chromosome	Binary String	x	f(x)
P ₁	11100	28	212
P ₂	01111	15	3475
P ₃	10111	23	1227
P ₄	00100	4	2804

Chromosome	Binary String	x	f(x)
C ₁	11111	31	131
C ₂	00111	7	3803
C ₃	00111	7	3803
C ₄	01100	12	3998

- b. [2 Marks] Mention the generations of above example which will transfer to next iteration in Binary coded GA.
Ans: C4, C3, C2, P2
8. [2*3 =6 marks] Assume 4 cities {Delhi, Ghaziabad, Noida, Gurgaon}, which are represented by a fully connected graph. The following tables represent the pheromone levels on each edge of the graph and the distances between each city.

Pheromone trail				
	Delhi	Ghaziabad	Noida	Gurgaon
Delhi				
Ghaziabad	0.25			
Noida	0.11	0.98		
Gurgaon	0.34	0.34	0.67	

Distance				
	Delhi	Ghaziabad	Noida	Gurgaon
Delhi				
Ghaziabad	12			
Noida	10	6		
Gurgaon	8	15	3	

Assume an ant started its journey at city Delhi and destination is city Noida.

- Compute the probability that Ant will visit City Ghaziabad.
- Compute the probability that Ant will visit City Gurgaon.
- Compute the probability that Ant will visit City Delhi.

Ans:

A & B.

The probability is 0.422 (to 3dp). This is calculated as follows

$$\frac{0.98^1 * (1/6)^1}{0.98^1 * (1/6)^1 + 0.67^1 * (1/3)^1} = 0.422$$

The probability is 0.578 (to 3dp). This is calculated as follows.

$$\frac{0.67^1 * (1/3)^1}{0.67^1 * (1/3)^1 + 0.98^1 * (1/6)^1} = 0.578$$

OR $1 - 0.422$ (from above) = 0.578

C. The probability is zero as the ant has already visited city Delhi so is not allowed to return.

9. [2 marks]

In a four variable optimization problem, the solution [1 2 4 6] is undergoing the employed bee phase and the corresponding partner solution is [5 6 0 2]. Assume the random variable to be modified to be 1, and the parameter Φ to be 0.5. Write the newly generated solution?

Answers: [-1 2 4 6]