APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY
08 PALAKKAD CLUSTER

Q. P. Code : 2C181 **(Pages: 4)** **Name** ....

Reg. No: ....

SECOND SEMESTER M.TECH. DEGREE EXAMINATION April 2018

Branch: CSE **Specialization: COMPUTER SCIENCE & ENGINEERING**

08CS6032 EVOLUTIONARY COMPUTING

Time:3 hours **Max.marks: 60**

Answer all six questions.

Modules 1 to 6: Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

Q.no.	Module 1	Marks
1.a	Discuss the various steps in evolutionary cycle.	3

Answer b or c

b Given the following parents, P_1 and P_2, and the template T — 6

P_1	A	B	C	D	E	F	G	H	I	J
P_2	E	F	J	H	B	C	I	A	D	G
T	1	0	1	1	0	0	0	1	0	1

Show how the following crossover operators work

- uniform crossover
- order-based crossover

with regards to genetic algorithms. Use this problem description for parts b to e. Assume we have the following function

$$f(x) = x^3 - 60 * x^2 + 900 * x + 100$$

where x is constrained to 0…31. We wish to maximize f(x) (the optimal is x=10)
Using a binary representation we can represent x using five binary digits.

c Describe the connection between evolutionary algorithms and biology. Discuss the idea of using events that occur in nature as an inspiration for various computing strategies with the help of examples. — 6

Q.no.	Module 2	Marks
2.a	Define the acceptance function that is used by simulated annealing and describe the terms.	3

Answer b or c

b The following table shows six evaluations of a simulated annealing algorithm. For each evaluation give the probability of the next state being accepted. Assume the objective function is being maximised. **6**

No.	Current State (Evaluation)	Potential New State (Evaluation)	Temperature
1	120	50	20
2	120	50	500
3	120	100	20
4	120	100	500
5	120	150	20
6	120	150	500

c Discuss the four components in the simulated annealing cooling schedule. **6**

Q.no.	Module 3	Marks
3.a	Give an example of combinatorial problem. What is the most difficult part in solving these problems?	3

Answer b or c

b Use Genetic algorithm for obtaining the optimal solution of the following problem. **6**

Maximize $f(x) = 2x - (x^2) / 16$ in the given interval [0,31], and these points are coded by the corresponding binary numbers.

Assume m=4 and P (1) = {00010, 01001, 10011, 11000}

c A genetic algorithm is to be used to evolve a binary string of length n containing only 1s. The initial population is a randomly generated set of binary strings of length n. **6**

i. Give a suitable fitness function for this problem.

ii. Will the offspring of parents with a high fitness value generally also have a high fitness value, given your fitness function? Explain your answer.

Q.no.		Marks

Module 4

4.a Using the travelling salesman problem as an example, describe the following terms in relation to ant algorithms — **3**

i. Visibility

ii. Evaporation

iii. Transition Probability

Answer b or c

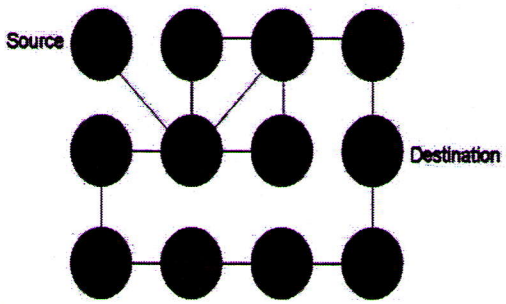
b Consider the graph given in Figure "Simulate" trail laying ants using a pen and paper and assume that — **6**

i) An ant always deploys one pheromone on each edge it passes,

ii) An ant always chooses the edge that holds the most pheromones, and

iii) In the case of no pheromones, the ant chooses a new edge randomly.

Let one ant walk at a time. What kind of deadlock might your colony eventually run into?



c The pheromones of the ants in Deneubourg's experiment evaporate very slowly, and thus ants cannot respond to changes in the environment at all. — **6**

i) Can you think of another benefit that evaporating pheromones might yield?

ii) What is the drawback if the evaporation rate is too high?

iii) When or for which kind of problems do you need a high evaporation rate?

Q.no.	Module 5	Marks
5.a	Describe the criteria to choose the parameters for particle swarm optimization.	4
	Answer b or c	
b	With the help of neat diagram, explain the swarming behaviour of birds and fishes. i. What is the motive behind such a behavior? ii. How can this become an inspiration for computational models?	8
c	What are the various problems that can be solved using particle swarm optimization?	8

Q.no.	Module 6	Marks
6.a	Compare the biological and artificial behaviour of bees in bee colony optimization.	4
	Answer b or c	
b	Discuss the application of the Artificial Bee Colony Algorithm for solving the Knapsack Problem by giving a suitable example.	8
c	How is ABC algorithms used to solve vehicle routing optimization problems?	8