Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/ME (CSE)/M.Tech (SE)/SEM-3/PGCSE-301F/PGSE-301F/2009-10

2010
ADVANCED SEARCH & OPTIMISATION TECHNIQUES

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* questions. 5 × 14 = 70

1. a) Write BFS algorithm. Why is it called a blind search technique ?

   b) Apply BFS in solving water jug problem. Assume the jugs having capacity of 4 gallons and 3 gallons respectively and also assume that start state = (0, 0) and goal state = (0, 1).

   c) What are the disadvantages of DFS ? 5 + 6 + 3

2. a) What is meant by heuristic search ?

   b) Write branch and bound algorithm. How can it be converted to A^* algorithm ?

c) Explain A^* algorithm with the help of a suitable example. 2 + 8 + 4

3. a) What is Constraint Satisfaction Problem (CSP) ?

b) Show that the Graph Colouring Problem can be viewed as a CSP.

c) Explain Forward Checking Algorithm using 5-queens problem as example.

d) What is Arc-consistency ? How can it be achieved ? Explain it using the above example. 2 + 3 + 4 + 5

4. a) What is the 8-puzzle problem ?

b) How can Hill Climbing be applied to solve this problem ?

c) What is the problem of local minima in Hill Climbing ?

d) Write the basic structure of Simulated Annealing Algorithm and show how it tries to overcome the problem of local minima. 3 + 3 + 2 + 6

5. a) Write the basic structure of Genetic Algorithm.

b) What is the role of *mutation* in Genetic Algorithm ?

c) Apply genetic algorithm to maximize the function $f(x) = x^3 - 10x^2 + 10$, where x is a 5-digit binary number. Take a population of size 4. Create the next generation using *selection*, *crossover* and *mutation.* 2 + 2 + 10

6. a) What is the Satisfiability problem ?

b) How can it be viewed as CSP ?

c) How can Tabu search be applied to solve this problem ? Write the relevant algorithm.

d) Given 3 colours to colour the following graph. Convert the Grap Colouring problem to a Satisifability problem.

2 + 2 + 5 + 5

7. a) What are the constraints in Job-Shop Scheduling Problem ?

   b) What is *makespan* ? Calculate the *makespan* in the following problem instance for the job sequence $J2$, $J3$, $J1$.

   Job $J1$ needs 2, 3, 1 hrs. in machine $M1$, $M3$, $M2$ respectively;

   Job $J2$ needs 1, 3, 2 hrs. in machine $M2$, $M3$, $M1$ respectively;

   Job $J3$ needs 4, 3, 2 hrs. in machine $M1$, $M3$, $M2$ respectively;

   c) How can simulated annealing be applied to minimize the *makespan* ? 2 + 7 + 5

8. a) How is the collective behaviour of particles used in the Particle Swarm Optimization (PSO) ?

   b) What is the Nurse Scheduling Problem ? Mention the costraints.

   c) How can you apply PSO algorithm to solve this problem ? 5 + 3 + 6

9. Write short notes on any *two* of the following : 2 × 7

   a) Conflict Directed Back-Jumping

   b) Ant Colony Optimization

   c) Travelling Salesman Problem.