

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.*

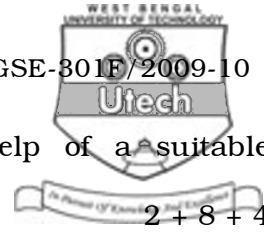
*Candidates are required to give their answers in their own words  
as far as practicable.*

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 ?
2. a) What is meant by heuristic search ?  
  
b) Write branch and bound algorithm. How can it be converted to  $A^*$  algorithm ?

5 + 6 + 3

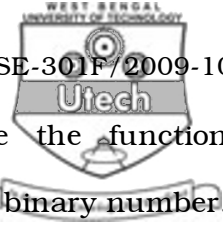


- c) Explain  $A^*$  algorithm with the help of a suitable example.  $2 + 8 + 4$

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 Graph Colouring problem to a Satisfiability 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  $J_2, J_3, J_1$ .
- Job  $J_1$  needs 2, 3, 1 hrs. in machine  $M_1, M_3, M_2$  respectively;  
Job  $J_2$  needs 1, 3, 2 hrs. in machine  $M_2, M_3, M_1$  respectively;  
Job  $J_3$  needs 4, 3, 2 hrs. in machine  $M_1, M_3, M_2$  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 constraints.
- c) How can you apply PSO algorithm to solve this problem ?  $5 + 3 + 6$
9. Write short notes on any *two* of the following :  $2 \times 7$
- a) Conflict Directed Back-Jumping
- b) Ant Colony Optimization
- c) Travelling Salesman Problem.