

**P1077**

**[3734]-43**

**M.C.A. (Under Science Faculty)**

**COMPUTER SCIENCE**

**CS - 403 : Advance Database Management System  
(2005 Pattern) (Old Course) (Semester - IV)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

**Q1)** Attempt the following :

**[1 × 20 = 20]**

Consider the following BCNF schema for a portion of a simple corporate database.

Emp (eid, ename, addr, sal, age, yrs, deptid)

Dept (did, dname, floor budget)

Suppose you know that the following queries are the six most common queries in the workload for this corporation and that all six are roughly equivalent in frequency and importance.

1. List the id, name, and address of employees in a user-specified age range.
2. List the id, name and address of employees who work in the department with a user specified department name.
3. List the id and address of employees with a user specified employee name.
4. List the overall average salary for employees.
5. List the average salary for employees of each age; that is, for each age in the database list the age and the corresponding average salary.
6. List all the department information, ordered by department floor numbers.

- a) Given this information and assuming that these queries are more important than any updates, design a physical schema for the corporate database that will give good performance for the expected workload.
- b) Redesign the physical schema assuming that the set of important queries is changed to be the following.
  - i) List the id and address of employees with a user specified employee name.
  - ii) List the overall maximum salary for employees.
  - iii) List the average salary for employees by department; that is, for each deptid value, list the deptid value and the average salary of employees in that department.
  - iv) List the sum of the budgets of all departments by floor; that is, for each floor, list the floor and the sum.

**Q2)** State and justify the following (Any Five) **[5 × 2 = 10]**

- a) Attributes mentioned in a WHERE clause are candidates for indexing.
- b) A schedule is a list of actions from a set of transaction.
- c) Most system use a no-steal, force approach.
- d) In shared-disk system, each CPU has a private memory.
- e) Using an oid to refer to an object is same as a using a foreign key to refer to a tuple in another relation.
- f) In data warehouse, data is extracted from operational databases and external sources.
- g) An algorithm is scalable if the running time grows in proportion to the dataset size, holding the available system resources constant.

**Q3)** Attempt the following (Any Five): **[5 × 2 = 10]**

- a) While tuning the queries, which situations are not efficiently handled by many optimizers?
- b) With the help of example, explain the concept of serializability.
- c) List the actions written in a log.
- d) What is data-partitioned parallel evaluation?
- e) Describe the storage and access methods in ORDBMS.

- f) Draw a diagram of Typical Data Warehouse Architecture.
- g) What are the steps of KDD process?

**Q4)** Attempt the following (Any Four) : **[4 × 5 = 20]**

- a) For each of the following queries, identify one possible reason why an optimizer might not find a good plan. Rewrite the query so that a good plan is likely to be found.
  - i) An index is available on the age attribute.  

```
SELECT E.dno
FROM Employee E
WHERE E.age = 20 OR E.age = 10
```
  - ii) A B+ tree index is available on the age attribute  

```
SELECT E.dno
FROM Employee E
WHERE E.age <20 And E.age >10
```
- b) Consider the following actions taken by transaction  $T_1$  on database objects X and Y.  

```
R(X), W(X), R(Y), W(Y)
```

  - i) Give an example of another transaction  $T_2$  that, if run concurrently to transaction T without some form of concurrency control, could interfere with  $T_1$ .
  - ii) Explain how the use of strict 2PL would prevent interference between the two transactions.
  - iii) Strict 2PL is used in many database systems. Give two reason for its popularity.
- c) Consider the following classes of schedules : serializable, conflict-serializable, view-serializable, recoverable, avoids-cascading-aborts and stricts. For each of the following schedules, state which of the preceding classes it belongs to. If you cannot decide whether a schedule belongs in a certain class based on the listed actions, explain briefly.
  - i)  $T_1 : R(X), T_2 : R(X), T_1 : W(X), T_2 : W(X)$
  - ii)  $T_1 : W(X), T_2 : R(Y), T_1 : R(Y), T_2 : R(X)$

d) Consider the execution show in following figure.

LSN	LOG
00	Begin-checkpoint
10	End-checkpoint
20	Update : $T_1$ writes $P_5$
30	Update : $T_2$ writes $P_3$
40	$T_2$ commit
50	end
60	Update : $T_3$ writes $P_3$
70	$T_1$ abort
	Crash, Restart

- What is done during Analysis?
- What is done during Redo?
- What is done during Undo?

e) Consider the following sequences of actions, listed in the order they are submitted to the DBMS.

Sequence  $S_1$  :  $T_1 : R(X), T_2 : W(X), T_2 : W(Y), T_3 : W(Y),$   
 $T_1 : W(Y), T_1 : \text{Commit}, T_2 : \text{Commit}, T_3 : \text{Commit}$

Sequence  $S_2$  :  $T_1 : R(X), T_2 : W(Y), T_2 : W(X), T_3 : W(Y),$   
 $T_1 : W(Y), T_1 : \text{Commit}, T_2 : \text{Commit}, T_3 : \text{Commit}$

For each sequence and for each of the following concurrency control mechanisms, describe how the concurrency control mechanism handles the sequence. Assume that the timestamp of transaction  $T_1$  is  $i$ .

- Strict 2PL with timestamps used for deadlock prevention.
- Strict 2PL with deadlock detection.

**Q5)** Attempt the following (Any Four) : **[4 × 5= 20]**

- Write a short note on online transaction processing benchmarks.
- In detail, explain strict Two-Phase locking.
- How checkpointing reduce the amount of work to be done during restart?
- What are the alternative approaches for Distributed DBMS Architecture?
- Describe the functionality issues and efficiency issues in ORDBMS query processing.



Total No. of Questions : 5]

[Total No. of Pages : 2

**P1079**

**[3734]-51**

**MCA III (Seience Faculty)**

**Computer Science**

**CS - 501 MOBILE COMPUTING**

**(Sem. - V)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be shown whenever necessary.*

**Q1)** Attempt the following (Any four)

**[16]**

- a) Explain the terms user mobility & device portability with example.
- b) Explain path loss of radio signals with free space loss.
- c) What is fading? Explain long term & short term fading
- d) Explain following terms
  - i) blocking.
  - ii) scattering
- e) What is multicarrier modulation ? Explain with example.

**Q2)** Attempt the following (Any four)

**[16]**

- a) What reservation TDMA? Explain its advantages and disadvantages.
- b) What are the drawbacks of DAMA? How to overcome it.
- c) Write a short note on:
  - i) Rolling.
  - ii) ISMA.
- d) Explain the architecture of GSM.
- e) What is hand over? what role is played by HLR & VLR?

**P.T.O.**

**Q3)** Attempt the following (Any four) **[16]**

- a) Write a short note on GPRS.
- b) Explain IEEE 802.11 MAC frame.
- c) What is adhoc network? Explain its advantages & disadvantages.
- d) Explain prioritization phase in Hiper LAN.
- e) Explain the concept of tunnelling & reverse tunnelling.

**Q4)** Attempt the following (Any four) **[16]**

- a) What is triangular routing? Explain problem associated with it.
- b) What is COA? what are the two possibilities of occurrences of COA?
- c) Explain ITCP with its advantages & disadvantages.
- d) How the mobile TCP can be used to solve dis connection problems.
- e) What are the characteristics of 2.5G & 3G wireless network?

**Q5)** Attempt the following (Any four) **[16]**

- a) Explain the security issues in WAP.
- b) What is WSP? what features offered by WSP for content exchange between client and server?
- c) What is noise? Explain thermal & induced noise.
- d) Explain Rayleigh fading. what are the problems occur due to the Rayleigh fading?
- e) What is doppler effects? Explain.



Total No. of Questions : 5]

[Total No. of Pages : 2

**P1080**

**[3734]-52**

**M.C.A. (Science Faculty)**

**COMPUTER SCIENCE**

**CS - 502 :Expert System (Sem. - V)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn whenever necessary.*

**Q1)** Attempt any four of the following :

**[ 4 × 4 =16 ]**

- a) Write a short note on forward & backward chaining.
- b) State different examples of Expert system with example.
- c) Define the following terms with example
  - i) Memorization.
  - ii) Direct instruction.
- d) What are the advantages of decision tree architecture over production base architecture?
- e) What do you mean by knowledge acquisition and validation.

**Q2)** Attempt any four of the following :

**[ 4 × 4 =16 ]**

- a) List the different knowledge system building tools. Explain any one in detail.
- b) What is learning? Explain Analogy in detail.
- c) Write a short note on knowledge acquisition.
- d) What are different performance measures?
- e) Write a short note on inductive bias.

**Q3)** Attempt any four of the following :

**[4 × 4 = 16]**

- a) Write a short note on Genetic Algorithm.
- b) Explain Features of Hopfield network.

**P.T.O.**

- c) Explain pattern classification problem.
- d) Explain General learning model in brief.
- e) Define the following terms
  - i) Selective induction.
  - ii) Expedient induction.

**Q4)** Attempt any four of the following **[4 × 4 = 16]**

- a) Write difference between distributed representation & localist representation of connectionist network.
- b) Write difference between supervised and unsupervised learning.
- c) Define the following terms -
  - i) Hypothesis.
  - ii) Object.
- d) What is learning automatic. How it is being used to learn the best temperature control setting.
- e) Write difference between connectionist AI & symbolic AI.

**Q5)** Attempt any two **[ 2 × 8 = 16 ]**

- a) Use the following example build up the concept description, to learn the concept  
 “green flower or skinny object”  
 (green tall fat flower +)  
 (skinny green short flower +)  
 (tall skinny green flower +)  
 (red skinny short weed +)  
 (green short fat weed -)  
 (tall green flower skinny +)
- b) Explain backpropagation network.
- c) Define Expert system with example & explain components of expert system.





Total No. of Questions : 5]

[Total No. of Pages : 2

**P1081**

**[3734]-53**

**M.C.A. - III (Under Sceience Faculty)**

**CS - 503 : Software Project Management**

**(Sem. - V)**

***Time : 3 Hours]***

***[Max. Marks : 80***

***Instructions to the candidates:***

- 1) All questions are compulsory.***
- 2) Figures to the right indicate full marks.***
- 3) All questions carry equal marks.***

***Q1)*** Attempt the following (any four) : **[16]**

- a) Explain the principles of s/w engineering and what is it's role in project development?
- b) Discuss the programming standards . what is effect of good coding style?
- c) Explain project life cycle with neat diagram.
- d) What is mean by verification and validation. How it is differ from each other?
- e) Explain the term 'Risk'. What are different categories of risks?

***Q2)*** Attempt the following (any four) : **[16]**

- a) What is mean by 'prototype'? Explain prototyping model.
- b) How you can maintain the security of your s/w?
- c) Explain Acceptance testing strategies.
- d) What is configuration management? why it is essential for s/w project.
- e) Explain work Breakdown structure.

***Q3)*** Write a short note on following (any four) : **[16]**

- a) s/w capability Maturity Model.
- b) Modularity.
- c) s/w Architecture.
- d) Quality Assurance.
- e) User Manual.

***P.T.O.***

**Q4)** Justify the following (any four) :

**[16]**

- a) “s/w measurement is necessary for improving project work”.
- b) “Quality is directly propotional to cost”.
- c) “Structured walkthrough are arranged to assure s/w quality”.
- d) “Design specification follow consistency of design notations”.
- e) “Well documented system are easy to maintain and manage”.

**Q5)** Attempt the following (any four) :

**[16]**

- a) What is object oriented analysis? How it is differ from traditional structural analysis.
- b) Explain the size oriented metrics and function oriented metrics function oriented metrics.
- c) Discuss various factors affecting quality and productivity of s/w.
- d) What do you mean by project plan? What are the contents of project plan?
- e) Explain the concept of version control.



Total No. of Questions : 5]

[Total No. of Pages : 2

**P1082**

**[3734]-54**

**M.C.A. (III Year) (Science Faculty)**

**COMPUTER SCIENCE**

**CS - 504 : Advanced Modeling Techniques**

**(Sem. - V)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1)** Case study

**[4 × 4 = 16]**

“Super market” is well known supermarket in pune. It has chain of sereral supermarkets in the state. It’s head office is in Mumbai

The supermarket accepts payments in cash, “Super market card” or credit cards from various agencies such as ICICI, City Bank etc.

Customers using credit cards give the card at the time of purchase and sign the receipt. once in a week, the billing clerk prepares a statement and forwards it along with signed slips to the respective agencies. The agencies makes payments on statement to statement basis, sometime rejecting some of slips listed for irregularities.

Customer having “supermarket card” have charge slips for certain amount of purchase. Each time purchase is done. The balance on the charge slip is updated and Authorized. some customer make purchases using either of the above mentioned facilities.

Model the above system using UML techniques and draw the following diagrams by giving supporting specification if required.

- a) Class diagram.
- b) Use case diagram.
- c) Sequence diagram.
- d) Activity diagram.

**P.T.O.**

**Q2)** Attempt any Two of the following **[2 × 4 = 8]**

- a) Explain characteristics of objects with example.
- b) Explain different types of relationships supported by the UML.
- c) Discuss the components of activity diagram.

**Q3)** State whether the given statements are True or False. Justify your answer  
(Any six) **[6 × 2 = 12]**

- a) Aggregation can be recursive.
- b) Annotational things are explanatory parts of UML models.
- c) Messages in sequence diagram are numbered.
- d) Qualification usually reduces multiplicity from many to one, but not always.
- e) Generalization is often called “is-a” relationship.
- f) UML is mainly used for software systems.
- g) Source code files can be acts as a component.
- h) States may have substates and superstate.

**Q4)** Attempt any Three of the following **[3 × 4 = 12]**

- a) Explain with an example ‘include’ and ‘extend’s relationship between use cases.
- b) Explain breaking and organizing of system into subsystems in system design phase.
- c) Explain following terms
  - i) Component.
  - ii) Node.
  - iii) Reverse Engineering.
  - iv) Swimlanes.

**Q5)** Attempt any four of the following

**[4 × 8 = 32]**

- a) Prepare a data flow diagram for a system for processing results of students. The students fill in the examination form giving details about subject and centre etc. which is an input to the system. student pays examination fees and given fee receipt and the admit card Examination is conducted at various centres. centres provide the absentee report. The evaluation department provides the absentee report. The evaluation department provides marks of students in each subject. The mark sheet and the merit list are the output of the system.
- b) Prepare use case diagram for 'Bus reservation system'
- c) People use elevators to move from one floor to another. Discuss different scenarios and prepare a sequence diagram.
- d) Prepare a state transition diagram for the control of a telephone answering machine An incoming call is detected on the first ring and the machine answers the call with a prerecorded announcement. when the announcement is complete, the caller's message is recorded when the caller hangs up the machine becomes idle.
- e) Draw Activity diagram for considering different scenarios for ice-cream preparing machine where you can get different flavours.



**P1086****[3734]-104**

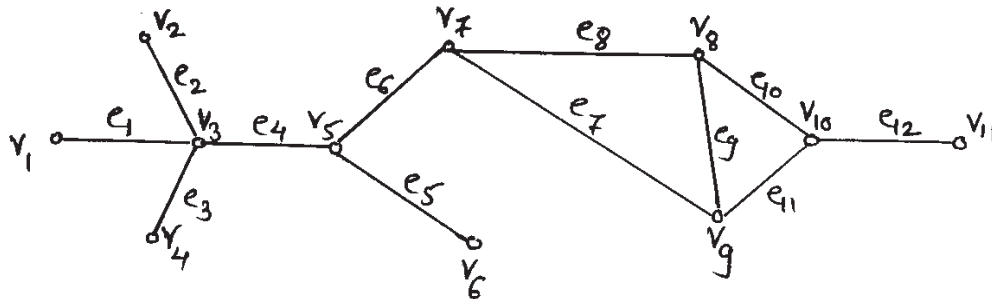
**M.C.A. - I (Under Science Faculty)**  
**CS - 105 : GRAPH THEORY**  
**(2008 Pattern) (New Course) (Sem. - I)**

*Time : 3 Hours]**[Max. Marks : 80**Instructions to the candidates:*

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.

**Q1)** Attempt any four of the following :**[4 × 4 = 16]**

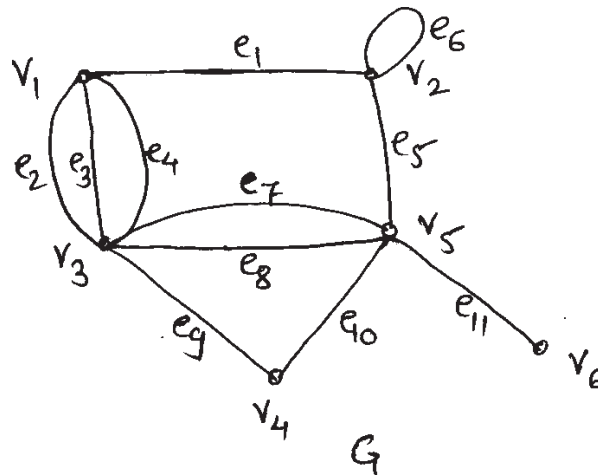
- a) Determine the number of edges in a graph with 6 vertices, 2 of degree 4 and 4 of degree 2. Draw two such graphs one simple and the other is not simple.
- b) Draw the following graphs :
  - i) Regular graph but not complete.
  - ii) Complete asymmetric digraph.
- c) Find all isthmus and cutvertices in following graph.



- d) Draw dodecahedron and show that it is Hamiltonian graph.
- e) Draw the graph of incidence matrix and its complement

$$I(G) = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix}$$

- f) For the graph  $G$  given below, find
- Underlying graph of  $G$ .
  - $G - U$ , where  $U = \{V_1, V_4, V_6\}$

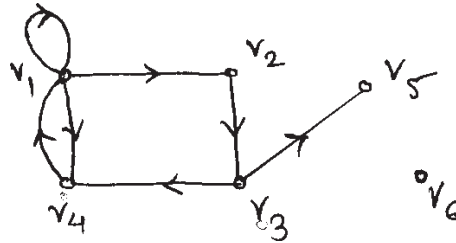


**Q2)** Attempt any Four of the following :

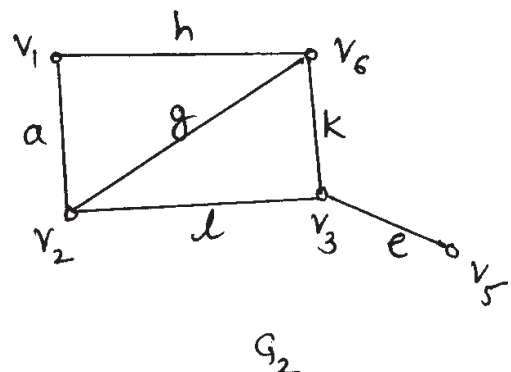
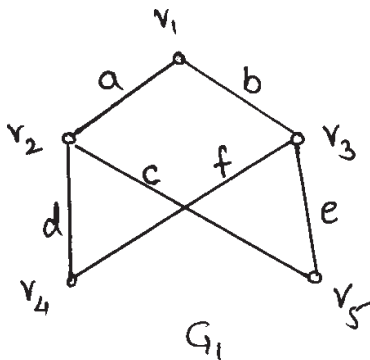
[4 × 4 = 16]

- Is it possible to draw a tree with eight vertices having degrees 1, 1, 1, 1, 2, 2, 3, 3. If so, draw it.
- A connected graph  $G$  is Euler if and only if the degree of every vertex is even.
- Find the indegree and outdegree of each vertex in the digraph show below. Verify that

$$\sum_{i=1}^n d^-(V_i) = \sum_{i=1}^n d^+(V_i)$$



- Find  $G_1 \cup G_2$ ,  $G_1 \cap G_2$  and  $G_1 \oplus G_2$  of the following graphs.



- Draw two spanning trees of Peterson's graph.
- Write Kruskal's algorithm for finding shortest spanning tree.

**Q3)** Attempt any four of the following :

**[4 × 4 = 16]**

- a) Draw arborescence for the following expression and express it in Polish notation.

$$\frac{(2a - 3b)^2}{c(e^3 + 3d)}$$

- b) Prove that a graph with  $n$  vertices and vertex connectivity  $K$  has atleast  $\frac{Kn}{2}$  edges.

- c) Give an examples of a graph.

- Which is Eulerian but not Hamiltonian.
- Which is Eulerian and Hamiltonian.
- Which is Hamiltonian but not Eulerian.
- Which is neither Eulerian nor Hamiltonian.

- d) There is one and only one path between any two vertices in a tree.

- e) Can there be a directed graph with six vertices where the outdegree of the vertices are 2, 3, 4, 1, 0 and 5 and the indegree are 2, 4, 1, 1, 5 and 2 if yes draw such digraph.

- f) Let  $G$  be a simple graph on  $n$  vertices and let  $\bar{G}$  be its complement. Show that for every vertex  $V$  in  $G$ .

$$d_G(V) + d_{\bar{G}}(V) = n - 1$$

where  $d_G(V)$  is the degree of the vertex  $V$  in the graph  $G$ .

**Q4)** Attempt any four of the following :

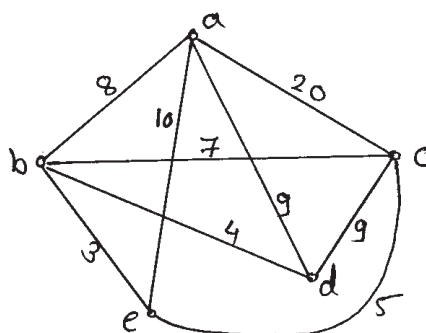
**[4 × 4 = 16]**

- a) Using generating function find the number of ways to collect 15 coins from 20 people if each of first 19 people can give a coin or nothing and the twentieth person can give either 1 coin or 5 coins or nothing.

- b) Solve the following recurrence relation.

$$2a_n = 7a_{n-1} - 3a_{n-2}; \quad a_0 = a_1 = 1$$

- c) Starting at 'a' solve the travelling salesman problem for the following graph.



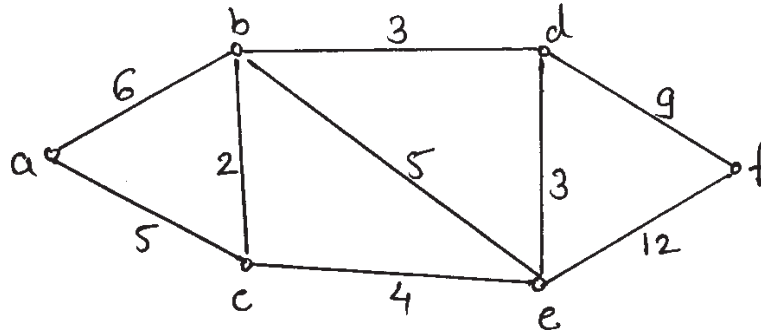


- d) Draw binary tree of 31 vertices with maximum height and minimum height.
- e) How many fundamental circuits and fundamental cutsets of a connected graph with 14 vertices and 25 edges with respect to a spanning tree.
- f) Find maximum edge connectivity of a graph with 8 vertices and 16 edges. Draw a graph showing that this can be achieved.

**Q5)** Attempt any two of the following :

**[2 × 8 = 16]**

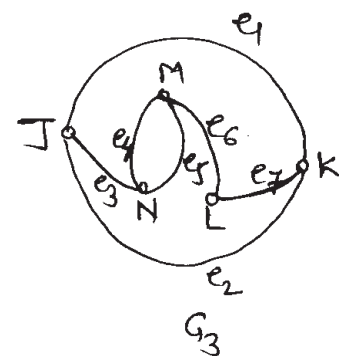
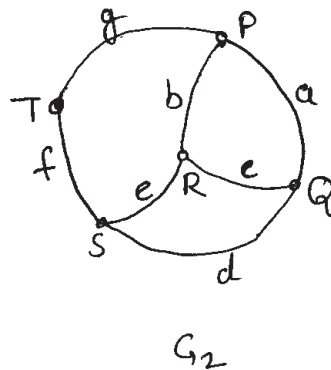
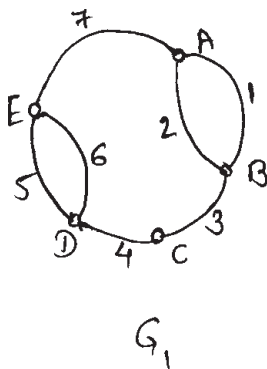
- a) Using Dijkstra's algorithm find the shortest path from vertex 'a' to all vertices of the graph below.



- b) Solve the recurrence relation

$$a_n + 6a_{n-1} + 9a_{n-2} = 3; a_0 = 0, a_1 = 1$$

- c) Out of the three graphs, which two are isomorphic? Justify.



\*\*\*

Total No. of Questions : 5]

[Total No. of Pages : 2

**P1087**

**[3734]-201**

**M.C.A. - I (Under Science Faculty)**

**CS - 201 : DATA & FILE STRUCTURES USING C**

**(Sem. - II) (New) (2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *All questions carry equal marks.*

**Q1)** Answer the following (any four) :

**[4 × 4 = 16]**

- a) Write a short note on Time and Space complexity.
- b) Define following terms :
  - i) Complete binary tree.
  - ii) Abstract Data Type.
  - iii) Indegree of a graph.
  - iv) Spanning tree.
- c) What is recursion? Explain with suitable examples.
- d) Write a function to find sum of integers in a singly linked list.
- e) Explain in brief techniques to handle overflows.

**Q2)** Answer the following (any four) :

**[4 × 4 = 16]**

- a) What is collision in Hashing? Explain the technique to handle collision.
- b) Write an algorithm to check the balanceness of parenthesized expression using stack.
- c) Differentiate between stack and queue.
- d) What are the different ways of storing polynomials using array? List advantages of each method.
- e) Convert following infix expression into prefix, using stack. Show the content of stack.  
 $8 + (((7 - 5) * (9 - 4) + 6) / 4).$

**P.T.O.**

**Q3)** Answer the following (any four) : **[4 × 4 = 16]**

- a) Discuss advantages and disadvantages of direct access files.
- b) Define B – tree and B + tree. Discuss the various factors to be considered while deciding the value of m(m = order of the tree).
- c) Apply the quick sort technique to the following data set. Show each intermediate step.  
40   30   11   51   71   61   91   21   81   67
- d) Perform the height balancing for the following data set.  
red, blue, green, orange, pink, black, grey, white, violet.
- e) Write an algorithm to compute the shortest path from a source to all the destination.

**Q4)** Answer the following (any four) : **[4 × 4 = 16]**

- a) Write non-recursive postorder traversal algorithm.
- b) Write the function required to implement the queue as a linked list.
- c) Write a function to delete a node at position p in doubly linked list.
- d) Write a recursive routine to implement Breadth. First search.
- e) Write a recursive function to print the content of character string in reverse order.  
e.g. “Computer” will be printed as “retupmoc”.

**Q5)** Answer the following (any four) : **[4 × 4 = 16]**

- a) Define the following terms :
  - i) Orthogonal list.
  - ii) Adjacency list.
  - iii) Strictly binary tree.
  - iv) Expression tree.
- b) What is queue? Discuss applications of queue in computer.
- c) Differentiate between linear search and binary search method using suitable example.
- d) Write an algorithm for selection sort method.
- e) Write an algorithm to evaluate postfix expression.



Total No. of Questions : 5]

[Total No. of Pages : 4

**P1088**

**[3734]-202**

**M.C.A. - I (Under Science Faculty)**

**COMPUTER SCIENCE**

**CS - 202 : Theoretical Computer Science**

**(Sem. - II)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *All questions carry equal marks.*
- 4) *All questions are compulsory.*

**Q1)** Attempt all of the following:

**[8 × 2 = 16]**

- a) Find the transitive closure of the relation :  $R = \{(a, b), (b, c), (c, d), (e, d)\}$  over set  $S = \{a, b, c, d, e\}$ .
- b) Differentiate between DFA and NFA.
- c) Construct regular expression to denote a language  $L$  over  $\Sigma^*$  where  $\Sigma = \{0, 1\}$  such that every string in the language begin or end with either 00 or 11.
- d) Define :
  - i) CFG
  - ii) Nullable symbol.
- e) Construct a CFG for following :  
 $L = \{a^n b^m c^n \mid n \geq 1, m \geq 0\}$ .
- f) Write leftmost derivation for the string aababa using following grammar:  
 $S \rightarrow aS X \mid b$   
 $X \rightarrow X b \mid a$
- g) Define recursive and recursively enumerable language.
- h) Explain the one move of TM.

**Q2)** Attempt any four of the following:

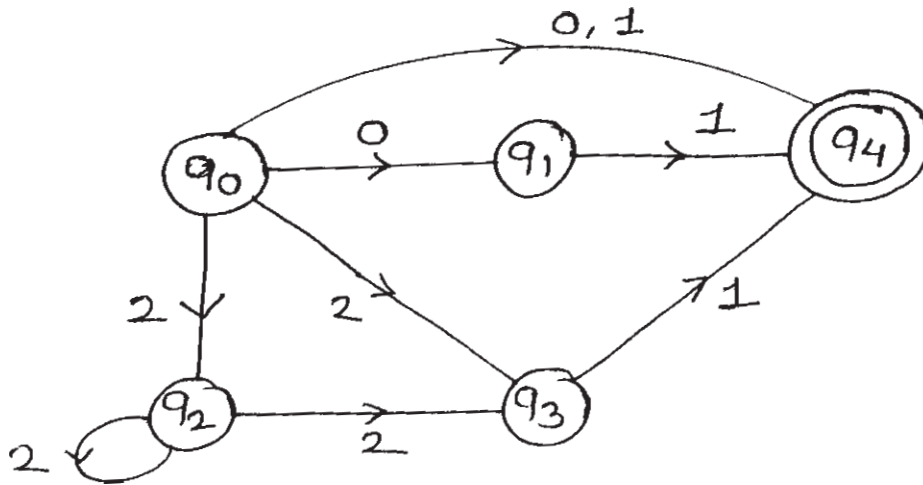
**[4 × 4 = 16]**

- a) Prove by induction on 'n' that

$$\sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6}$$

**P.T.O.**

- b) Design a DFA to accept all string over  $\Sigma = \{0, 1, 2\}$  such that all strings start with 01 and having substring 012.
- c) Construct DFA equivalent to the following NFA :



- d) Design a Moore machine which converts each occurrence of substring 101 by 100.
- e) Determine if following language is regular or not  
 $L = \{a^n \mid n \text{ is a perfect square}\}.$

**Q3)** Attempt any four of the following :

**[4 × 4 = 16]**

- a) Construct NFA with E-transition for the following regular expression:  
 $a^* b (a + b)^*.$
- b) Prove that the regular expressions P and Q as given below are equivalent:  
 $P = (1 + 011)^*$  and  
 $Q = \epsilon + 1^* (011)^* (1^* (011)^* )^*.$
- c) Consider the following CFG:  
 $S \rightarrow aB \mid aA$   
 $A \rightarrow aAB \mid a \mid b$   
 $B \rightarrow Abb \mid b$   
 Find out whether above grammar is ambiguous grammar or not?
- d) Find an equivalent CFG without useless symbol for following grammar:  
 $S \rightarrow AB \mid BC$   
 $A \rightarrow aAa \mid aAb$   
 $B \rightarrow bB \mid b$   
 $D \rightarrow dD \mid d$

e) Minimize the following DFA:

$M = (\{A, B, C, D, E, F, G, H\}, \{0, 1\}, \delta, A, \{D\})$  where  $\delta$  is given as:

	0	1
A	B	A
B	A	C
C	D	B
D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

**Q4)** Attempt any four of the following :

**[4 × 4 = 16]**

a) Convert the following CFG to CNF.

$S \rightarrow aAbB \mid Bbs$

$A \rightarrow aB \mid aBb \mid a$

$B \rightarrow aAbA \mid aAB \mid b$

b) Convert the following CFG to GNF

$S \rightarrow AB$

$A \rightarrow BS \mid b$

$B \rightarrow SA \mid a$

c) Construct PDA for language

$L = \{a^n b^{2n} c^k \mid n \geq 1, k \geq 0\}$

d) Construct PDA equivalent to following grammar:

$S \rightarrow AB$

$A \rightarrow aAb \mid ab$

$B \rightarrow cBd \mid cd$

e) Prove that CFL is closed under union and concatenation.

**Q5)** Attempt any four of the following :

**[4 × 4 = 16]**

a) Design TM to accept following language:

$L = \{a^m b^n \mid n \geq m, m > 0\}$

b) Design TM to accept following language:

$L = \{ww^R \mid w \in (0, 1)^*\}$

c) Convert following PDA to CFG:

$M = (\{q_0, q_1\}, \{a, b\}, \{z_0, z\}, \delta, q_0, z_0, \phi)$  where  $\delta$  is:

$$\delta(q_0, b, z_0) = \{(q_0, zz_0)\}$$

$$\delta(q_0, \epsilon, z_0) = \{(q_0, \epsilon)\}$$

$$\delta(q_0, b, z) = \{(q_0, zz)\}$$

$$\delta(q_0, a, z) = \{(q_1, z)\}$$

$$\delta(q_1, b, z) = \{(q_1, \epsilon)\}$$

$$\delta(q_1, a, z_0) = \{(q_0, z_0)\}$$

d) Explain Halting problem of TM.

e) Explain the following form of TM in brief:

i) Multitape TM.

ii) Restricted TM.



**P1089**

**[3734]-203**

**M.C.A. - I (Under Science Faculty)**

**CS - 203 : Object Oriented Programming (C++ Programming)**

**(Sem. - II) (2008 Pattern) (New)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*

**Q1)** Attempt all of the following :

**[8 × 2 = 16]**

- a) Explain Message Passing.
- b) What are member dereferencing operators?
- c) State true or false and justify : 'The following two sets of statements are same' :
  - i) Sample S1;  
S1 = S2;
  - ii) Sample S1 = S2;
- d) 'Before dereferencing a pointer, it is essential to assign a value to the pointer', comment.
- e) What is the difference between class template definition and ordinary class definition?
- f) State true or false and justify : 'If the base class and a derived class each include a member function with the same name, the member function of a derived class will be called by an object of derived class'.
- g) Why data members of the class or structure can not be initialized at the point of declaration?
- h) What is destructor?

**Q2)** Attempt any four of the following :

**[4 × 4 = 16]**

- a) What is object oriented programming? How is it different from the procedure oriented programming?
- b) Describe with examples, the uses of enumeration data types?
- c) Explain the use of new and delete operators.
- d) When you make function inline? Why?
- e) Explain how set w and endl manipulators work.

**Q3)** Attempt any four of the following :

**[4 × 4 = 16]**

- a) Write a C++ program, to find out division of two numbers. Also write a try block and throw the exception if the condition 'divide by zero' occurs.

**P.T.O.**



- b) Write a C++ program, to find maximum of two numbers using inline function.
- c) What will be output of following program? Explain.

```
#include <iostream.h>
class date
{
    private :
        int dd, mm, yy;
    public :
        date ( )
        {
            cout <<endl << "reached here";
        }
};
void main ( )
{
    date today ( );
    date * p = & today;
    cout <<endl << p;
}
```

- d) What will be output of following program? Explain.

```
#include <iostream.h>
class index
{
    protected :
        int count;
    public
        index ( )
        {
            count = 0;
        }
        void operator ++ ( )
        {
            count ++;
        }
        void display ( )
        {
            cout << endl<< count;
        }
};
void main ( )
```

```

{
    index C;
    C++;
    C.display ( );
    ++C;
    C.display ( );
}

```

- e) Write a C++ program that will create a manipulator with arguments. If row number and column number are passed as arguments to this manipulator, it should position the cursor at that row and column.

**Q4)** Attempt any four of the following : **[4 × 4 = 16]**

- What is a friend function? List out the characteristics of friend function.
- What is the difference between opening a file with a constructor function and opening a file with open ( ) function.
- Write a note on Hierarchical Inheritance.
- Write a C++ program to calculate area of rectangle and circle using function overloading.
- Write a function template which can have multiple argument types.

**Q5)** Attempt any four of the following : **[4 × 4 = 16]**

- a) Point out errors, if any, in the following program.

```

# include < iostream.h >

class list
{
    private :
        class node
        {
            int data;
            node * link;
        } * p;
    public :
        void create ( )
        {
            p = new node;
            p.data = 10;
            p → data = 10;
        }
};

```

```

void main ( )
{
    list l 1;
    l 1 . create ( );
}

```

- b) Write a C++ program that contains a class derived, derived from base. The base class should have a virtual function fun ( ) and it should be overridden in derived. Call fun ( ) from the constructor of the base class.
- c) What is name space? Explain with example.
- d) State true or false and justify :
  - i) Every thrown exception must be caught.
  - ii) For one try block there can be multiple catch blocks.
- e) Suppose there is a base class B and derived class D, derived from B. B has two public member functions  $b_1 ( )$  and  $b_2 ( )$ . Where as D has two public member functions  $d_1 ( )$  and  $d_2 ( )$ . Write these classes for following situations :
  - $b_1 ( )$  should be accessible in main,  $b_2$  should not be
  - both  $b_1$  and  $b_2$  should be accessible in main ( ).



Total No. of Questions : 5]

[Total No. of Pages : 3

**P1090**

**[3734]-204**

**M.C.A. - I (Science Faculty)**

**CS - 205 : Database Management System**

**(Sem - II) (2008 Pattern) (New)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*

**Q1)** Attempt all of the following :

**[8 × 2 = 16]**

- a) State two phases in 2-phase locking protocol.
- b) State any two Armstrong's axioms required to compute  $F^+$ .
- c) State all properties of transaction.
- d) Define instance and schema.
- e) What is query language? State its two categories.
- f) What do you mean by strong and weak entities?
- g) State the purpose and syntax of rename operation in SQL.
- h) State how to test conflict serializability?

**Q2)** Attempt any four of the following :

**[4 × 4 = 16]**

- a) Explain the components of query processor.
- b) What is Relational Algebra? Discuss its all fundamental operations.
- c) What do you mean by constraints? State all constraints used in DDL with their purposes.
- d) Explain lossy join decomposition with suitable example.

**P.T.O.**

- e) The following is the list representing the sequence of events in an interleaved execution of set of transactions  $T_1, T_2$ , &  $T_3$  with 2PL protocol.

Time	Transaction	Code
$t_1$	$T_1$	Lock (A,S)
$t_2$	$T_2$	Lock (B,X)
$t_3$	$T_3$	Lock (A, X)
$t_4$	$T_1$	Lock (C,S)
$t_5$	$T_2$	Lock (A,S)
$t_6$	$T_3$	Lock (D,X)
$t_7$	$T_1$	Display (A-C)
$t_8$	$T_2$	Lock (D,S)
$t_9$	$T_3$	Lock (C,X)
$t_{10}$	$T_1$	Commit
$t_{11}$	$T_2$	Lock (C,S)

Construct wait-for graph according to above requests. Is there a deadlock? Justify.

**Q3)** Attempt any four of the following : **[4 × 4 = 16]**

- Differentiate specialization and generalization.
- What do you mean by pattern matching? Discuss pattern matching operators in SQL.
- What is a transaction? Explain state diagram of a transaction.
- Explain Thomas' write Rule.
- For the given relation R (A,B,C,G,H,I) with  $F = \{A \rightarrow B, A \rightarrow C, CG \rightarrow H, CG \rightarrow I, B \rightarrow H\}$  find  $(AG)^+$ .

**Q4)** Attempt any four of the following : **[4 × 4 = 16]**

- What is mapping cardinality? Discuss types of mapping cardinality.
- Consider the following transactions :

$T_1$	$T_2$
read (x) ;	read (z) ;
$x := x + 1000$ ;	$z := z * 10$ ;
write (x);	write (z);
read (y);	read (x);
display (y);	$x := (x - 100)$ ;
	write (z)

Give any two non-serial schedules which are serializable to the serial schedule  $\langle T_1, T_2 \rangle$ .

- c) Consider the following relations  
patient (pno, pnm, paddr)  
donar (dno, dnm, daddr)  
patient and donar are related by many to many relationship with descriptive attribute date of donation. Normalize the database and solve the following queries.
- Count the number of patients to whom Mr.Saxena has donated blood during the year 2009.
  - Find the donars, who have donated blood to the patients in Pune City. In alphabetical order.
- d) Describe BCNF & 3NF.
- e) What is data abstraction? Explain it.

**Q5) a)** Attempt any two of the following : **[2 × 4 = 8]**

- State the basic design issues in the design of an E-R database schema.
- Describe 2-tier and 3-tier architecture of database.
- Consider the following relations :  
employee (eid, ename, desig)  
project (pno, ptitle, no-of-days)  
employee and project are related by many to one relationship. Normalise the database and solve the following queries.
  - Increase the no-of-days of projects by 15, for project numbers lie between 5 to 10.
  - Delete the employees working on projects with no-of-days less than 30.

**b)** Attempt the following : **[8]**

An I.T. industry is developing several projects on various domains (banking, education, inventory etc.) for many of its clients. Many I.T professionals are working on one project and an I.T. professional can work on many projects.

- Identify the entity sets their attributes and primary key for each entity set.
- Identify relationship sets and draw an E-R diagram.



**P1091****[3734]-301****M.C.A. - II (Under Science Faculty)****COMPUTER SCIENCE****CS-301 : Design and Analysis of Algorithms  
(New Course) (Semester - III)****Time : 3 Hours]****[Max. Marks : 80****Instructions to the candidates:**

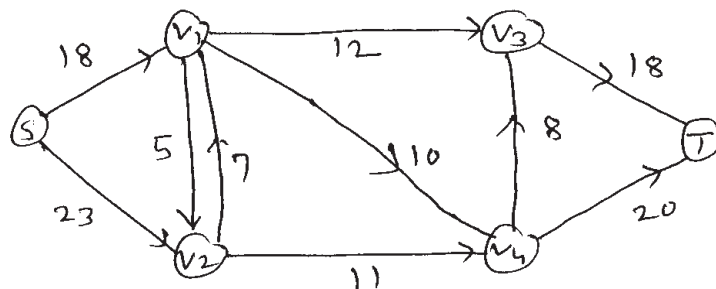
- 1) All questions are compulsory.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1)** Attempt all of the following :**[8 × 2 = 16]**

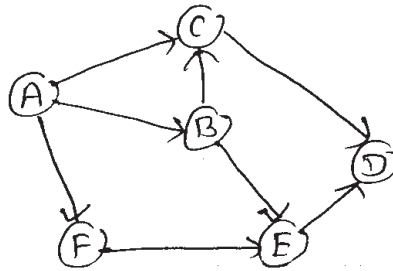
- a) What do you mean by stable sorting algorithm? Is merge sort a stable sorting algorithm?
- b) Partial solutions obtained during Kruskal's algorithm are also tree. Justify True or False.
- c) Explain state space tree.
- d) What do you mean by branch-and-bound? Give an example of an application where this technique might be useful.
- e) Define articulation point and biconnected component of a graph G.
- f) What is NP? What do you mean by polynomially equivalent problems?
- g) What do you mean by principle of optimality? State one difference between greedy method and dynamic programming.
- h) Define explicit and implicit constraints.

**Q2)** Attempt any Four of the following :**[4 × 5 = 20]**

- a) Explain Ford Fulkerson algorithm for finding maximum flow in a network. Illustrate it on the following graph with source S and sink T.

**P.T.O.**

- b) Write an insertion sort algorithm. Obtain its best case and worst case running time.
- c) Explain Topological sort algorithm. Illustrate it on the following graph.

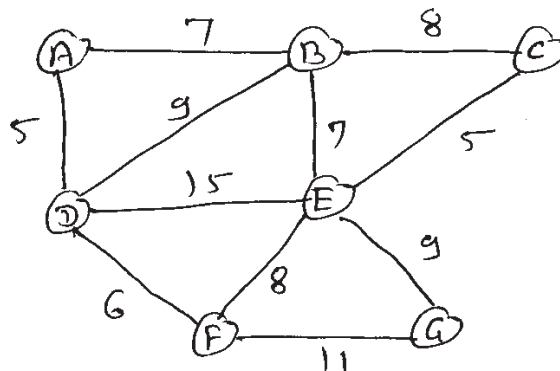


- d) Consider the following instance for job sequencing with deadlines problem where  $n = 6$ ,  $p = (13, 5, 12, 20, 18, 17)$  and  $d = (3, 2, 1, 4, 2, 1)$ . Give the solution obtaining using greedy strategy.
- e) Find out the solution for sum of subsets using fixed tuple size. State space tree  $n = 5$ ,  $m = 30$  and  $w = \{5, 7, 10, 13, 15\}$ .

**Q3)** Attempt any Four of the following :

**[4 × 8 = 32]**

- a) What is minimum spanning tree? Using Prim's and Kruskal's algorithm. Find minimum spanning tree of following graph.



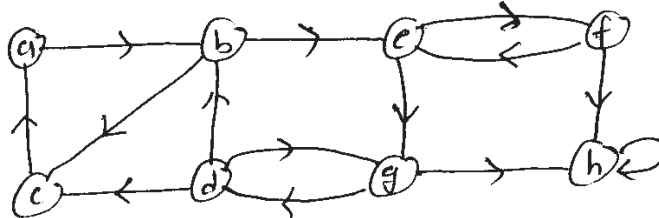
- b) Obtain the reduced cost matrix for the Travelling Salesperson instance given by the cost matrix.

$$\begin{bmatrix}
 \infty & 20 & 30 & 10 & 11 \\
 15 & \infty & 16 & 4 & 2 \\
 3 & 5 & \infty & 2 & 4 \\
 19 & 6 & 18 & \infty & 3 \\
 16 & 4 & 7 & 16 & \infty
 \end{bmatrix}$$

Find the next node that will be selected in LCBB formulation of the problem.



- c) Explain string editing problem. Give the recurrence for the value of optimal solution when the problem is to be solved using Dynamic programming. For  $X = (b, b, a, b, a)$  and  $Y = (a, b, a, a)$ . Give the matrix of the values computed in bottom up manner.
- d) Explain the algorithm based on DFS for finding strongly connected components of a directed graph  $G$ . Find the strongly connected components of the following group.

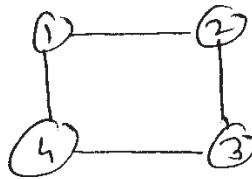


- e) Derive the time complexity required by strassen's matrix multiplication. How is the Strassen's approach different from the ordinary matrix multiplication algorithm.

**Q4)** Attempt any Three of the following :

**[3 × 4 = 12]**

- a) Apply backtracking method on the following instance of graph coloring problem of 4 nodes and 3 colors. How many solution vectors are possible.



- b) Apply Floyd Warshall algorithm to find lengths of shortest paths from vertex  $u$  to vertex  $v$ .  $\forall u, v \in v(G)$  where adjacency matrix of  $G$  is as follow.

$$W = \begin{bmatrix} 0 & 4 & 11 \\ 6 & 0 & 2 \\ 3 & \infty & 0 \end{bmatrix}$$

- c) Write a recursive algorithm to find  $n^{\text{th}}$  term of fibonacci series. Find its time complexity.
- d) Define  $S^i$  used in dynamic programming solution of 0/1 Knapsack problem. Compute the sets  $S_v^i$ ,  $0 \leq i \leq 4$  where  $m = 18$ ,  $w = (3, 8, 6, 4)$  &  $p = (9, 10, 12, 9)$ .
- e) Show that  $10n^2 + 3n + 5 = O(5n^2 + 10n + 7)$ .

\*\*\*

Total No. of Questions : 5]

[Total No. of Pages : 2

**P1092**

**[3734]-302**

**M.C.A. - II (Under Science Faculty)**

**COMPUTER SCIENCE**

**CS - 302 : Computer Networks**

**(Sem. - III) (New)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1)** Attempt all of the following :

**[8 × 2 = 16]**

- a) What is Token Management?
- b) Find out the class, Netid, Hostid, Subnetid for the IP address 129.90.30.32.
- c) Define the terms :
  - i) Boud Rate.
  - ii) Bandwidth.
- d) Define Asynchronous and synchronous transmission.
- e) Show the differential manchester and NRZ-I encoding pattern for the bit stream 101100110.
- f) What is unicasting and multicasting?
- g) What is supernetting? Why it is needed?
- h) Explain SAP and peer entities.

**Q2)** Attempt any four of the following :

**[4 × 4 = 16]**

- a) Explain Bridged and Switched ethernet?
- b) What are the service primitives? Explain each.
- c) Explain ARQ protocol.
- d) How Network layer impliments connectionless and connection oriented services?
- e) Explain Reservation, Polling and Token Passing.

**P.T.O.**

**Q3)** Attempt any four of the following : **[4 × 4 = 16]**

- a) Explain any four fields of IPv4 packet format.
- b) Explain TCP/IP model and compare it with OSI model.
- c) Construct a CRC message for the given bit stream 1000011101 and the generator polynomial is  $x^4 + x + 1$ .
- d) Explain pure and slotted ALOHA.
- e) Explain the desirable properties of Routing Algorithms.

**Q4)** Attempt any four of the following : **[4 × 4 = 16]**

- a) What is pipelining? Explain
  - i) Go back n
  - ii) Selective Repeat.
- b) Explain VLAN.
- c) What are the deficiencies of IPv4? Explain the advantages of IPv6 over IPv4.
- d) What is congestion? Explain any two congestion prevention policies with their limitations.
- e) “Usually Computer Networks are packet switched, occasionally circuit switched but never message switched”. Comment.

**Q5)** Attempt any four of the following : **[4 × 4 = 16]**

- a) Explain Shannon’s capacity formula. If we have a channel with 20kHz bandwidth. The SNR for the channel is 40db. What is the data rate?
- b) Compare Twisted Pair with Fiber-Optic cable.
- c) Explain CSMA/CD.
- d) What is framing? Explain any two methods with their disadvantages.
- e) Describe classful addressing of IPv4. What are its limitations?



**P1093****[3734]-303****M.C.A. - II (Science Faculty)**

**CS - 303 : INTRODUCTION TO SYSTEM PROGRAMMING  
AND OPERATING SYSTEM CONCEPTS  
(Sem. - III) (New)**

*Time : 3 Hours]**[Max. Marks : 80**Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

**Q1)** Attempt all of the following :**[8 × 2 = 16]**

- a) Define loader and linker.
- b) What is multiprocessor system?
- c) What is device driver?
- d) Define fork system call.
- e) What is starvation?
- f) Define swapping.
- g) Explain the done ( ) system call.
- h) Write purpose of CPU scheduling algorithm.

**Q2)** Attempt any four of the following :**[4 × 4 = 16]**

- a) Explain any four components of system programs.
- b) Explain in brief different techniques of memory allocation.
- c) Consider the following set of processes, with the length of CPU burst time and arrival time in milliseconds.

<u>Process</u>	<u>Burst-time</u>	<u>Arrival time</u>
P <sub>1</sub>	5	1.5
P <sub>2</sub>	1	0
P <sub>3</sub>	2	2
P <sub>4</sub>	4	3

Illustrate the execution of these processes using non pre-emptive SJF CPU scheduling algorithm. Also calculate average waiting time and average turn around time. Also draw gant chart.

**P.T.O.**

- d) Write a note on semaphore.
- e) Explain the directory structure.

**Q3) Attempt any four of the following :** **[4 × 4 = 16]**

- Explain overlay technique with example.
- Consider the following reference string.  
1, 3, 3, 2, 5, 4, 5, 4, 1, 4, 2, 2, 5  
How many page fault will occur for the following algorithm.
  - LRU
  - Optimum.
- What is mean by thread? Explain single threaded & multithreaded process with neat diagram.
- What is deadlock? Explain its necessary four conditions.
- What is mean by I/o bound program and CPU bound program.

**Q4)** Attempt any four of the following : **[4 × 4 = 16]**

- a) Explain the following memory allocation algorithm with suitable example.
  - i) First-fit
  - ii) Best-fit.
- b) Explain all steps in DMA transfer.
- c) Explain the structure and importance of process control block.
- d) How the deadlock can be detected? Explain with example.
- e) Suppose the head of a moving head disk with 200 tracks numbered 0 to 199 is currently at track 53. If request in queue are 98,183,37,122,14,124,65,67. What is total head movement to satisfy these request using following scheduling algorithm.
  - i) SSTF
  - ii) SCAN

**Q5)** Attempt any four of the following : **[4 × 4 = 16]**

- State and explain safety algorithm.
- What is process? State & explain in brief process state.
- Explain functioning of multilevel queue.
- What is critical section problem.
- Explain difference between internal and external fragmentation in terms of memory.



Total No. of Questions : 5]

[Total No. of Pages : 2

**P1094**

**[3734]-304**

**M.C.A. (Science Faculty)**

**COMPUTER SCIENCE**

**CS - 305 : Event Driven Programming (Win 32 SDK)**

**(Sem - III) (New)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *All questions are compulsory.*

**Q1)** A cricket database stores information about cricket players and teams in a data source named 'CricInfo'. Write a SDK program which is menu driven having following facilities.

- Displays list of players.
- Displays list of teams, on selecting a particular team, displays all players from that team.
- Insert new player.

Make use of ODBC APIs. (WinMain not needed).

**[12]**

**Q2)** Write program statements using Win32 APIs for any four of the following :  
(WinMain not needed). **[20]**

- a) Display a "Welcome" message at the point in the client area whenever left mouse button is pressed and erased 'END' key is pressed.
- b) Display Horizontal scroll bar. Thumb position can be changed using HOME, END, Pg UP, and Pg Down keys.
- c) Define a push button of the size of client area. It should occupy the whole client area even when the Window size is changed.
- d) Client area is divided into two halves, left and right respectively. Left part is colored with black and right is colored with white. Color gets toggled between left and right parts whenever 'F1' function key is pressed.
- e) Display two edit boxes and show number of lines of text displayable within the client area in first edit box and approximate number of lowercase characters displayable horizontally within the client area in second edit box.

**P.T.O.**

**Q3)** Answer in brief, any eight : **[16]**

- a) What is the purpose of first parameter of LoadIcon and LoadCursor?
- b) What may happen if WndProc chooses to handle WM\_PAINT message like this?  
case WM\_PAINT : return 0;
- c) Draw neat labeled diagram showing the contents of lParam variable for keystroke messages.
- d) Write four 'not-so-obvious' uses of timer.
- e) How child window can be made visible and enable?
- f) What is the purpose of serialized message queue?
- g) What needs to be done to get confirmation before terminating a program?
- h) Why virtual keys are used?
- i) Which mouse message precedes all other mouse messages?
- j) Give a sequence of messages generated when user presses shift key followed by 'A' key?

**Q4)** Justify True/False any six : **[12]**

- a) VK\_MENU is a virtual key code for menu.
- b) WndProc is reentrant.
- c) Preemptive multitasking is also called as cooperative multitasking.
- d) A WM-PAINT message will eventually be followed by a WM\_SIZE message.
- e) System menu cannot be modified.
- f) Window scroll bars and scroll bar controls means one and the same.
- g) WM-TIMER is a Queued message.
- h) It is correct to write case WM\_PAINT : return 0; inside a WndProc.

**Q5)** Attempt any four : **[20]**

- a) How to convert DDB to DIB?
- b) Write short notes on mutex object and event object.
- c) Explain virtual memory management in Win 98/NT.
- d) Explain the concept of synchronization with regard to keyboard messages.
- e) Explain Window Subclassing in detail.



Total No. of Questions : 5]

[Total No. of Pages : 3

**P1095**

**[3734]-401**

**M.C.A. (Science Faculty)**

**CS - 401 : Introduction to UNIX and UNIX Internals**

**(Sem. - IV) (2008 Pattern) (New)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Figures to the right indicate full marks.*
- 3) All questions carry equal marks.*
- 4) Assume suitable data, if necessary.*
- 5) All questions are compulsory.*

**Q1)** Attempt all of the following :

**[8 × 2 = 16]**

- a) Explain any two Building Block primitives in unix.
- b) Explain any two metacharacters use for shell.
- c) Explain file system layout.
- d) Write all the contents of user stack and kernel stack.frame.
- e) Explain the structure of buffer pool.
- f) Give the syntax for creating directory file.
- g) Explain data structure for mount.
- h) Explain nice ( ) system call.

**Q2)** State true or false. Justify your answer (any four) :

**[4 × 4 = 16]**

- a) The kernel always spawn or schedule a special process to handle interrupts.
- b) “An Inode is locked across the system call”.
- c) An Inode may have a nonzero link-count, but its Inode number may not exist in any directories in the file system.
- d) Kernel can execute growreg ( ) to increases the size of any rigion.
- e) The process can never execute in user mode before handling outstanding signal.

**P.T.O.**



**Q3)** Attempt the following (any four) :

**[4 × 4 = 16]**

- a) Explain the race condition for locked Buffer.
- b) Calculate Block No and Byte offset into Block for inode number 539. Assume that Block 5 is beginning of the inode list, each disk inode is of 64 byte and one disk block is of 1KB.
- c) Explain four cases for reading and writing unname pipe.
- d) Describe what operations kernel does during execution of exit ( ) system call.
- e) Explain how kernel makes entry in callout table.

**Q4)** Attempt the following (any four) :

**[4 × 4 = 16]**

- a) Explain the behaviour of the following program :

```
main ( )
{
int Fd;
char c = 'n'
fd = create ("Pune", 0666);
for (i = 0; i ≤ 12; i ++ )
{
c = c + i
write (fd, & c, 1)
new = lseek (fd, 1023 L, 1.)
printf ("New seek value = "% d \ n", new)
}
}
```

- b) Write a shell program to count the no of words and line in given file.
- c) Explain how the following program will execute

```
# include <signal.h>
main ( )
{
if (for k ( ) == 0)
{
if (for k ( ) == 0)
{
pause ( );
pause ( );
}
setpgrp ( );
}
```

```

if (fork ( ) == 0)
{
if (fork ( ) == 0)
}
pause ( );
pause ( );
}
kill (0, SIGINT);
}

```

- d) Write a 'C' program which illustrate wait and Ignoring death of child signal.
- e) Explain the behaviour of the following program :

```

int global;
main ( )
{
int local;
local = 1
if (fork ( ) == 0)
{
global = 2;
local = 3;
- exit ( );
}
printf ("global % d local % d \n", global, local);
}

```

**Q5)** Attempt the following (any four) :

**[4 × 4 = 16]**

- Explain the layout of system memory.
- What is context switch? Write 4 steps for context switch.
- Explain how kernel handles signal in unix.
- Explain the data structure requires for demand paging.
- Explore the deadlock scenario for link system call.



Total No. of Questions : 5]

[Total No. of Pages : 2

**P1096**

**[3734]-402**

**M.C.A. - II (Science Faculty)**

**COMPUTER SCIENCE**

**CS - 402 : Advanced Networking and Mobile Computing**

**(Sem - IV) (2008 Pattern) (New)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *All questions carry equal marks.*
- 4) *All questions are compulsory.*

**Q1)** Attempt all :

**[8 × 2 = 16]**

- a) What is the purpose of POST and PUT method in HTTP?
- b) What is the purpose of the inverse domain?
- c) Define : piconet, scatternet.
- d) Specify layers in the reference model at which following functionalities are implemented :
  - i) frequency selection, encryption.
  - ii) device location, handover.
- e) Why handover is required in GSM?
- f) What is pseudoheader? Why it is used in UDP/TCP?
- g) What is multihoming in SCTP?
- h) What is anonymous FTP?

**Q2)** Attempt any four of the following :

**[4 × 4 = 16]**

- a) What is the fundamental difference of WML compared to HTML? Why has a scripting language been added to WML?
- b) What is the transparent bridge? What do we mean when we say that a bridge can filter traffic? Why is filtering important?
- c) Explain architecture of Electronic Mail using MTA and MAA.
- d) What are the advantages and disadvantages of snooping TCP?
- e) Name the requirements of mobile IP and justify them.

**P.T.O.**

**Q3)** Attempt any four of the following : **[4 × 4 = 16]**

- a) Explain architecture of IEEE 802.11.
- b) Explain architecture of WAP.
- c) What is triangular routing? How this problem can be resolved in mobile IP?
- d) What is the purpose of flags present in the control field of TCP?
- e) Compare FDMA and TDMA.

**Q4)** Attempt any four of the following : **[4 × 4 = 16]**

- a) What are the main reasons for the failure of CSMA/CD in wireless network?
- b) Compare DSSS and FHSS.
- c) Describe the functions of the MS and SIM. How and where is user related data represented/stored in GSM system?
- d) What are the advantages of mobile ad-hoc networks?
- e) How remote log-in is implemented using TELNET?

**Q5)** Attempt any four of the following : **[4 × 4 = 16]**

- a) What are the three types of Web Documents? What are the ways of creating such documents.
- b) Which types of different services does GSM offer?
- c) How TCP controls congestion?
- d) What are the location dependent services possible in mobile wireless network.
- e) Explain GPRS architecture with all components.



**P1097**

**[3734]-403**

**M.C.A. - II (Under Science Faculty)**  
**CS - 403 : Distributed Database Systems**  
**(2008 Pattern) (New) (Semester - IV)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*

**Q1)** Answer the following :

**[8 × 2 = 16]**

- a) State the complicating factors which are to be faced in a distributed environment.
- b) State the 3 dimensions based on which the architectural models for a DDB, are defined.
- c) Define the following terms :
  - i) Minterm selectivity.
  - ii) Access frequency.
- d) State the steps of query decomposition.
- e) State the names of the distributed query optimisation algorithms.
- f) Define degree 3 level of consistency for a transaction.
- g) What is intraquery concurrency?
- h) What are the different types of transactions?

**Q2)** Attempt any four :

**[4 × 4 = 16]**

- a) Explain client-server reference architecture.
- b) Write a short note on the components of a Distributed DBMS.
- c) Compare and contrast C2PL and D2PL.
- d) Explain optimistic concurrency control.
- e) Explain the different types of information requirements.

**Q3)** Attempt any four : **[4 × 4 = 16]**

- a) What are the different types of failures in Distributed DBMS.
- b) Explain in-place update recovery.
- c) What is prefix of a complete schedule? Explain with example.
- d) Explain 2PC protocol.
- e) For the following query draw the operator tree and the reduced cost (rewritten) operator tree.

Query : Find the names of employees other than Mohan who worked on the CAD/CAM project for either one or two years.

The relational schema is as follows :

EMP (ENO, ENAME, TITLE)

PROJ (PNO, PNAME, BUDGET)

ASG (ENO, PNO, RESP, DUR)

**Q4)** Solve any four of the following : **[4 × 4 = 16]**

Consider the following relational schema for solving subquestions a, b, c

EMP (ENO, ENAME, TITLE)

PROJ (PNO, PNAME, BUDGET)

ASG (ENO, PNO, RESP, DUR)

- a) Given a one-to-many relationship from EMP to ASG. Relation ASG can be indirectly fragmented according to the following rules :

$$ASG_1 = ASG \bowtie_{ENO} EMP_1$$

$$ASG_2 = ASG \bowtie_{ENO} EMP_2$$

The predicate on EMP gives

$$EMP_1 = \sigma_{TITLE = \text{"Programmer"}}(EMP)$$

$$EMP_2 = \sigma_{TITLE \neq \text{"Programmer"}}(EMP)$$

Query : Retrieve all attributes of tuples from EMP and ASG that have same value of ENO and the title "Mech. Eng."

Draw the generic query tree and reduced trees.

- b) Assume that the relation PROJ is horizontally fragmented in

$$PROJ_1 = \sigma_{PNO \leq P_2}(PROJ)$$

$$PROJ_2 = \sigma_{PNO > P_2}(PROJ)$$

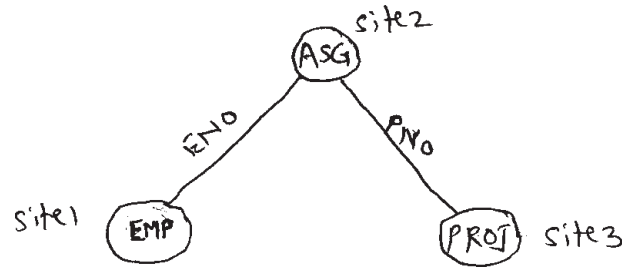
Transform the following query into a reduced query on fragments :

```

SELECT BUDGET
FROM PROJ, ASG
WHERE PROJ.PNO = ASG.PNO
AND ASG.PNO = "P4".

```

- c) Consider the join graph given below for the relational algebra query  
 $\text{PROJ} \bowtie_{\text{PNO}} \text{EMP} \bowtie_{\text{ENO}} \text{ASG}$



Using the information given below. describe a join program which will need minimum data transfer.

Size (EMP) = 100

Size (ASG) = 200

Size (PROJ) = 300

Size (EMP  $\bowtie$  ASG) = 300

Size (ASG  $\bowtie$  PROJ) = 200

- d) Let  $Q = \{q_1, q_2, q_3\}$  be a set of queries,  $A = \{A_1, A_2, A_3\}$  be a set of attributes and  $S = \{S_1, S_2\}$  be a set of sites. The matrix X describes the attribute usage values and the matrix Y gives application access frequencies. Assume that  $\text{ref } i(qk) = 1$  for all  $qk$  and  $S_i$  and that  $A_1$  is the key attribute. Use bond energy and partitioning algorithms to obtain a vertical fragmentation of attributes in the set A.

	$A_1$	$A_2$	$A_3$		$S_1$	$S_2$
$q_1$	1	1	0	$q_1$	2	30
$q_2$	1	0	1	$q_2$	28	0
$q_3$	1	0	0	$q_3$	33	35
X				Y		

- e) Consider the following schedules and explain whether they are serializable, recoverable and conflict serializable.

$S_1 = T_1 : R(X), T_2 : R(X), T_1 : W(X), T_2 : W(X),$

$S_2 = T_1 : W(X), T_2 : R(Y), T_1 : R(Y), T_2 : R(X),$

**Q5)** Attempt any four :

**[4 × 4= 16]**

- a) What is deadlock? How deadlocks can be managed in Distributed DBMS?
- b) What are LRM commands? Explain.
- c) Explain state transitions in 3 PC protocol w.r.t. termination protocol, co-ordinator time outs & participant time outs.
- d) Define and explain with the help of example :
  - i) Dirty read
  - ii) Phantom phenomenon.
- e) Consider a data item X. Let  $RTM(X) = 25$  and  $WTM(X) = 20$ . Let the pair  $(\langle R_i(X), TS \rangle, \langle W_j(X), TS \rangle)$  denote a read/write request of transaction  $T_i$  on the item X with timestamp TS. Indicate the behaviour of the basic Timestamp method with the following sequence of requests.  
 $\langle R_1(X), 19 \rangle, \langle R_2(X), 22 \rangle, \langle W_3(X), 21 \rangle,$   
 $\langle W_4(X), 23 \rangle, \langle R_5(X), 28 \rangle, \langle W_6(X), 27 \rangle$





Total No. of Questions : 4]

[Total No. of Pages : 2

**P1098**

**[3734]-404**

**M.C.A. (Science Faculty)**

**CS - 405 : Object Oriented Software Engineering**

**(Sem. - IV) (2008 Pattern) (New)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Figures to the right indicate full marks.*
- 3) Assume suitable data, if necessary.*
- 4) All questions are compulsory.*

**Q1)** Attempt all of the following :

**[8 × 2 = 16]**

- a) Explain structural things of UML.
- b) What are packages.
- c) UML is a language for software development - Comment.
- d) List the syntactic and semantic rules for UML.
- e) What is Forward Engineering?
- f) Instance and objects are largely synonymous - Comment.
- g) Which are the different types of testing?
- h) State the use of polymorphism.

**Q2)** Attempt any four of the following :

**[4 × 4 = 16]**

- a) Which are the different types of relationships supported in UML?
- b) Discuss the components of sequence diagram.
- c) Explain the steps to Reverse Engineer a class diagram.
- d) Discuss the aspects of ownership of other elements in a package.
- e) Explain elements of an object model.

**Q3)** Attempt any four of the following :

**[4 × 8 = 32]**

- a) Prepare object diagram showing all possible relationship among the following object classes. Include associations, aggregation and generalization, show multiplicity. Additional attributes can be added as per requirements.

Company, Department, Manager, Supervisor, Worker, Product, Machine.

**P.T.O.**

- b) A system is to be designed for Banking Application. A bank can have many customers. There are two types of accounts - savings and current. In each case the account holder may request to withdraw or deposit the amount. The account details are verified before transaction. If the account holder wants to withdraw money the balance is checked to verify if it is within limit. Consider different aspects and draw use case diagram, sequence diagram using UML techniques.
- c) A DVD player has ON/OFF, STOP/EJECT, PLAY, REWIND and FAST FORWARD buttons, first two buttons allow toggling between the two states. Draw the state chart diagram.
- d) Draw an activity diagram to represent the placement activity conducted by college for post graduate students.
- e) Draw a class diagram for an online email system.

**Q4)** Attempt any four of the following :

**[4 × 4 = 16]**

- a) Discuss the data management component.
- b) Explain inter class test case design.
- c) Write a note on artifacts in inspection.
- d) Explain the Phases - Construction and Transition in Object Oriented Analysis.
- e) Write a note on Rational Unified Process.



Total No. of Questions : 5]

[Total No. of Pages : 3

**P1067**

**[3734]-21**

**M.C.A. - I (Under Science Faculty)**

**CS-201 : Data and File Structures**

**(Sem. - II) (Old) (2005 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) All questions carry equal marks.*
- 3) Figures to the right indicate full marks.*

**Q1) Attempt any four of the following. [4×4=16]**

- a) Explain graph traversal methods with algorithm.
- b) Evaluate the following expression using stack.  $A + B * C - D$  with  $A = 4$ ,  $B = 3$ ,  $C = 5$  and  $D = 1$ .
- c) Write a function to count leaf nodes in a tree.
- d) Which are the methods for overflow handling.
- e) Write a short note on doubly ended queue.

**Q2) Attempt any four of the following. [4×4=16]**

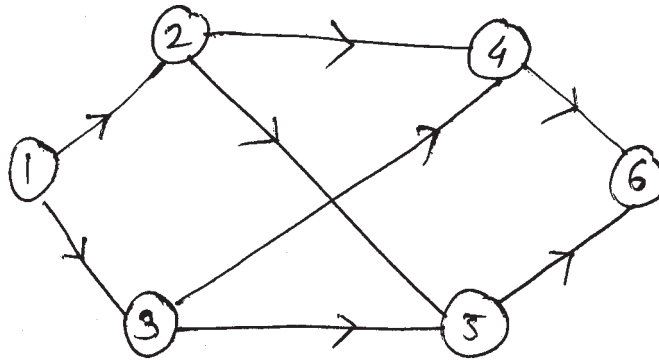
- a) Write a function for implementing binary search algorithm.
- b) Write a menu driven program to create, insert delete and display elements from doubly linked list.
- c) Create AVL tree for the following.  
Mon, Sun, Thu, Fri, Sat, Wed, Tue.
- d) Differentiate between direct access file and hashing function.
- e) Write a program to implement the shortest path algorithm.

**Q3) Attempt any four of the following. [4×4=16]**

- a) Sort the following sequence of numbers using heap sort method.  
28, 7, 75, 2, 63, 13, 57, 19
- b) Write a function to mirror which returns 1 if tree  $t_2$  is a mirror image of tree  $t_1$ , else returns 0.

**P.T.O.**

- c) Represent the following graph using adjacency matrix and adjacency list for indegree and out degree.

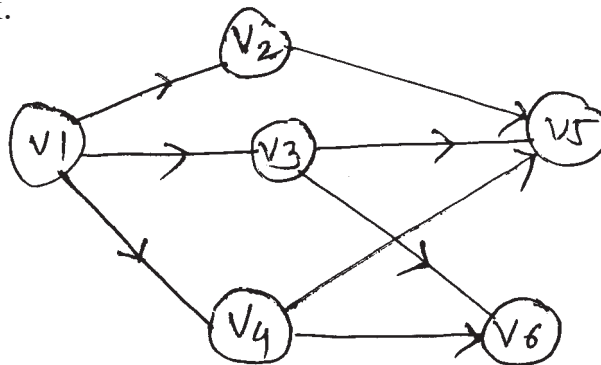


- d) What are the applications of stack? Explain matching parentheses in an expression.
- e) Find the union and intersection of two lists of numbers.

**Q4)** Attempt any four of the following.

**[4×4=16]**

- a) Explain insertion sort method and state its efficiency.
- b) Write an algorithm to convert an infix expression to post fix.
- c) Write a program to reverse a stack using queue.
- d) What is an AOV network? Find the topological order for the following network.



- e) Compare the data structures : stack and queue.

**Q5)** Attempt any four of the following.

**[4×4=16]**

- a) Define the terms.
- Spanning tree.
  - Complete graph.
  - ADT
  - The Big O notation.

- b) What are the primitive operations performed on Indexed sequential file?
- c) Write non-recursive function for Breadth First search of a graph.
- d) Write a procedure to erase a circular linked list pointed at by t.
- e) Define a binary tree and explain its type.



Total No. of Questions : 5]

[Total No. of Pages : 3

P1068

[3734]-22

M.C.A. - I (Under Science Faculty)

COMPUTER SCIENCE

CS-202 : Theoretical Computer Science

(Sem. - II) (Old)

Time : 3 Hours]

[Max. Marks : 80

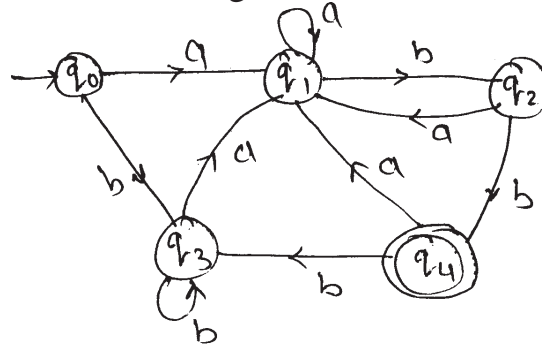
Instructions to candidates:

- 1) All questions are compulsory.
- 2) All questions carry equal marks.
- 3) Figures to the right indicate full marks.
- 4) Neat diagrams must be drawn whenever necessary
- 5) Assume suitable data, if necessary.

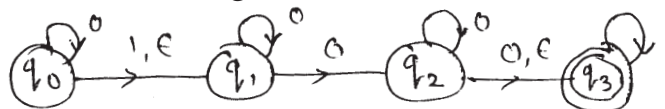
Q1) Attempt any four of the following.

[4×4=16]

- a) Find the transitive, the reflexive and transitive closure of the relation  $R = \{(1, 2), (2, 3), (1, 4), (4, 2), (3, 4)\}$  over set  $S = \{1, 2, 3, 4\}$ .
- b) Design a DFA which accepts strings in which 'a' always appear trippled whenever is present over  $\{a, b\}$ .
- c) Design Moore machine accepts binary number divisible by 4.
- d) Minimize the following DFA.



- e) Convert following NFA into DFA.



Q2) Attempt any four of the following.

[4×4=16]

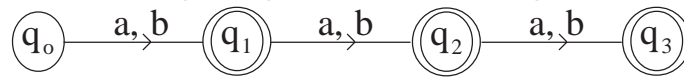
- a) Construct regular expression for the following
  - (i) All words over  $\{a, b\}$  that do not have either 'aa' or 'bb' as substring.
  - (ii) Set of all string that begins or ends with either '00' or '11' over  $\{0, 1\}$ .

P.T.O.

- b) Prove that the regular sets are closed under intersection.
- c) Construct NFA- $\epsilon$  for the following  
 $01^* + (0 + 1)^* 11$
- d) Determine if following language is regular or not.

$$L = \{a^n b^n \mid n \geq 1\}$$

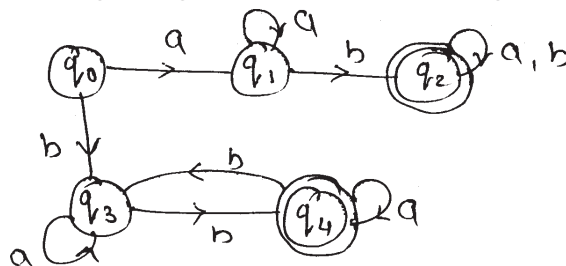
- e) Determine Regular grammar for DFA given below.



**Q3)** Attempt any four of the following.

**[4×4=16]**

- a) Construct CFG for following
- $L = \{a^n b^m \mid n \geq m, m > 0\}$
  - $L = \{a b^*\}$
- b) What is useless symbol? States rules to eliminate useless symbol in CFL. Explain with example.
- c) Convert following grammar to CNF
- $$S \rightarrow aAab \mid Aba$$
- $$A \rightarrow aS \mid bB$$
- $$B \rightarrow ASb \mid a$$
- d) Convert the following grammar to GNF
- $$S \rightarrow AA \mid a$$
- $$A \rightarrow SS \mid b$$
- e) Define regular grammar for following FA



**Q4)** Attempt any four of the following.

**[4×4=16]**

- a) Construct PDA for following language  
 $L = \{0^n 1^n \mid n \geq 1\}$
- b) Design PDA for following language  
 $L = \{WCW^R \mid W \in (0 + 1)^*\}$

- c) Construct PDA for following CFG  
 $S \rightarrow AB$   
 $A \rightarrow BB \mid a$   
 $B \rightarrow AB \mid a \mid b$
- d) Convert following PDA to CFG.  
 $A = (\{q_0, q_1\}, \{a, b\}, \{z_0, z\}, \delta, q_0, z_0, \phi)$   
 $\delta$ :  
 $\delta(q_0, b, z_0) = \{(q_0, zz_0)\}$   
 $\delta(q_0, \epsilon, z_0) = \{(q_0, \epsilon)\}$   
 $\delta(q_0, b, z) = \{(q_0, zz)\}$   
 $\delta(q_0, a, z) = \{(q_1, z)\}$   
 $\delta(q_1, b, z) = \{(q_1, \epsilon)\}$   
 $\delta(q_1, a, z_0) = \{(q_0, z_0)\}$
- e) Write a short note on Chomsky hierarchy of language.

**Q5)** Attempt any four of the following.

**[4×4=16]**

- a) Design TM to accept following language  
 $L = \{a^m b^n \mid n \geq m, m \geq 1\}$
- b) Design TM to accept following language  
 $L = \{0^a 1^b 2^{a+b} \mid a, b \geq 1\}$
- c) Design TM to accept following language  
 $L = \{W \# W \mid W \in \{a, b\}^*\}$
- d) Write a short note on NP-Hard and NP-complete.
- e) Explain the following terms in brief.
- i) Multitape TM
  - ii) Iterated TM.

□□□□



Total No. of Questions : 6]

[Total No. of Pages : 3

**P1069**

**[3734]-23**

**M.C.A. - I (Under Science Faculty)**

**COMPUTER SCIENCE**

**CS-203 : SDK and MFC Event Driven Programming**

**(Sem. - II) (Old)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Assume suitable data, if necessary.*
- 4) Neat diagrams must be drawn wherever necessary.*

**SECTION - I**

**Q1)** Case study.

**[1×8=8]**

Develop an automated system to help a supermarket maintain inventory of items. Your system must have the following options.

- a) Add a new item.
- b) List the stock of items.
- c) Create a Bill of 'n' items.
- d) Display total sales in a day.

Note : Use ODBC API, state your assumptions clearly, if any. (WinMain not required)

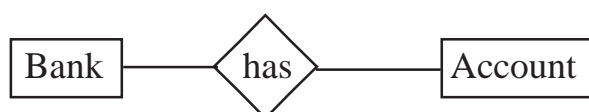
**Q2)** Write down the windows procedure for the following any four. **[4×4=16]**

- a) Move a circle horizontally and vertically in the client area depending on the movement of the mouse.
- b) Accept text in an edit box control and display the same text with change of case in a static control, on the press of 'OK' Button.

eg. Text in Edit box : Welcome to SDK

Text in Static box : wELCOME TO sdk.

- c) Draw the following diagram in a window.



**P.T.O.**

- d) Display first 'n' perfect numbers.
- e) Create 2 threads, one that generates random numbers and displays them and the other generates random points (x, y) and displays them.

**Q3)** Attempt any eight of the following. **[8×2=16]**

- a) What are the three ways to subclass a window class?
- b) What is a Device Context?
- c) Explain the BitBlt( ) function.
- d) Justify True / False.  
A window application must ensure that it calls PostQuitMessage( ) atleast once to terminate the message loop.
- e) State any two functions to create a Modal dialog box.
- f) Explain any four window styles.
- g) Define thread synchronization.
- h) What are the contents of PAINTSTRUCT?
- i) State any two commonly used mouse messages.
- j) State the functions that set a mapping mode and retrieve the current mapping mode of a device.

## **SECTION - II**

**Q4)** Attempt any two of the following. **[2×5=10]**

- a) Write an MFC application that displays current time.
- b) Write an MFC application that defines an integer array of 10 elements. Allow the user to enter 'n' numbers and store them in the array. If 'n' is greater than 10 then allow the array to grow. Display the array elements.
- c) Display three concentric circles filled with 3 different colors using MFC classes.

**Q5)** Attempt any four of the following. **[4×4=16]**

- a) State the important features that Cobject provides to classes that inherit from it.
- b) Explain the two types of document/view applications that MFC supports.
- c) Describe the general procedure for creating a model property sheet.
- d) Explain any four CDC drawing functions that use regions.
- e) What are virtual key codes? Explain dead-key messages?

**Q6)** Attempt any seven of the following.

**[7×2=14]**

- a) List any four windows common controls.
- b) Implement the MFC message map to handle WM\_PAINT message.
- c) Active X control is a COM object. Comment.
- d) Explain owner-draw menus in brief.
- e) How can class Wizard be used to derive dialog classes?
- f) State any two key C Document operations.
- g) Describe any two special Indicator ID's MFC defines for status bar panes.
- h) Justify True / False.

An ActiveX control can obtain information about the environment in which it is run by reading the container's control states.



Total No. of Questions : 5]

[Total No. of Pages : 3

**P1070**

**[3734]-24**

**M.C.A. - I (Under Science Faculty)**  
**CS-205 : Operating System Concepts**  
**(Sem. - II) (Old)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) All questions carry equal marks.*
- 3) Figures to the right indicate full marks.*

**Q1)** Answer any four of the following: **[4×4=16]**

- a) Explain the advantages of swapping in an operating system. Can Swapping be used in multiprogramming system. Justify.
- b) What is a system call? How is it processed by an operating system?
- c) How the protection is provided by O.S. to the file system. Explain in brief.
- d) Explain the techniques used for free space management.
- e) Discuss the methods for preventing deadlock situation.

**Q2)** Attempt any four of the following: **[4×4=16]**

- a) What is scheduler? What are the different types of scheduler? Explain in brief.
- b) Write a note on contiguous memory allocation.
- c) Explain following UNIX commands with syntax.  
i) cat, ii) mv, iii) rm, iv) mkdir.
- d) Explain logical and physical addresses. How logical address is converted into physical address in paging?
- e) Explain the structure of process control block.

**Q3)** Attempt any four of the following: **[4×4=16]**

- a) Discuss the advantages and disadvantages of Remote file system.
- b) What are page faults? When do they occur? Describe the action taken by O.S. when a page fault occur.

**P.T.O.**

- c) If one block is to be added at the end of an existing file, which one of the continuous, linked and indexed strategies will be most efficient? Why?
- d) In multiprogramming and time sharing environment several user share the system simultaneously. This situation can result in various security problems. What are the two such problems?
- e) Explain all steps in DMA transfer.

**Q4)** Attempt any four of the following:

**[4×4=16]**

- a) Consider the following snapshot of a system.

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P <sub>0</sub>	0	1	1	3	2	1	1	0	2
P <sub>1</sub>	3	3	2	4	3	2			
P <sub>2</sub>	1	3	4	2	3	4			
P <sub>3</sub>	3	2	1	3	3	3			
P <sub>4</sub>	1	1	1	1	2	3			

Answer using Banker's Algorithm. Is the system in a safe state?

- b) Consider the following segment table :

<u>Segment</u>	<u>Base</u>	<u>Length</u>
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses?

i) 0430, ii) 10, iii) 2500.

- c) Given memory partitions of 100 kB, 500 kB, 200 kB, 300 kB and 600 kB (in order), how would each of the first-fit and best-fit algorithms place processes of 212 kB, 417 kB, 112 kB and 426 kB (in order)? Which algorithm makes the most efficient use of memory?

d) Consider the following reference string

4, 3, 2, 1, 4, 3, 5, 4, 3, 2, 1, 5.

How many page fault occurs for the following algorithms with 3 page frames.

i) LRU

ii) Optimal.

e) Consider the following snapshot of a system.

<u>Job</u>	<u>Arrival time</u>	<u>CPU burst time</u>	<u>Priority</u>
J <sub>1</sub>	0	4	3
J <sub>2</sub>	2	3	1 (lowest)
J <sub>3</sub>	1	7	4 (highest)
J <sub>4</sub>	3	15	2

Compute average turn around time using SJF.

**Q5)** Write short notes on any four:

**[4×4=16]**

a) Interrupt Handler.

b) Device Driver.

c) Multilevel feed back queue.

d) Distributed operating system.

e) Process synchronization.

□□□□

Total No. of Questions : 3]

[Total No. of Pages : 3

P1071

[3734]-31

M.C.A. - II (Under Science Faculty)

COMPUTER SCIENCE

CS-301 : Design and Analysis of Algorithms

(Sem. - III) (Old Course)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.
- 4) Neat diagrams must be drawn wherever necessary.

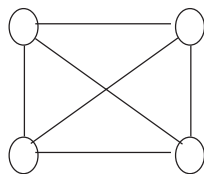
Q1) Attempt any four of the following.

[4×5=20]

- a) Solve the following recurrence relation

$$T(n) = \begin{cases} 2 & , \text{if } n = 1 \\ 2T\left(\frac{n}{2}\right) + cn & , \text{if } n > 1 \end{cases}$$

- b) Explain O,  $\theta$  and  $\Omega$  notation to define complexity of an algorithm.
- c) Write the control abstraction for the greedy method. What is the difference between subset and ordering paradigm.
- d) Find out all the spanning trees for the graph given below :



- e) Obtain an optimal merge pattern for merging 5 files whose sizes are  $F = (5, 10, 7, 28, 5)$  using greedy strategy. Draw the binary merge tree.

Q2) Attempt any six of the following.

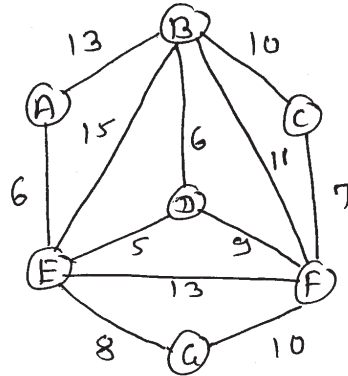
[6×8=48]

- a) Show how quicksort sorts the following sequence of keys. What is its time complexity. Is quicksort an inplace sorting algorithm?

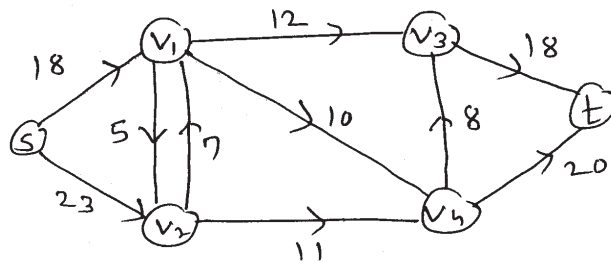
Keys : 5, 5, 8, 3, 4, 3, 2

P.T.O.

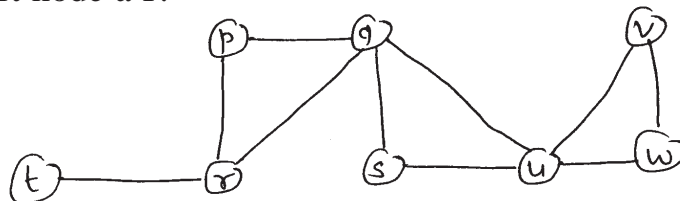
- b) Find an optimal solution to knapsack problem instance,  $n = 7$ ,  $m = 35$ ,  $w = (15, 13, 12, 7, 9, 5, 8)$  and  $p = (30, 28, 36, 7, 15, 10, 20)$
- c) Using Prim's and Kruskal's algorithm find the minimum spanning tree of following graph G.



- d) What is flow network? Explain Ford Fulkerson algorithm to find maximum flow and illustrate it on the following network where  $s$  is the source and  $t$  is the sink.



- e) Solve the following Knapsack problem by branch and bound method.  
 $m = 25$ ,  $p = (5, 4, 3, 2, 4)$  and  $w = (10, 8, 7, 6, 3)$
- f) Explain all stages in BFS and DFS for the following graph assuming start node a P.



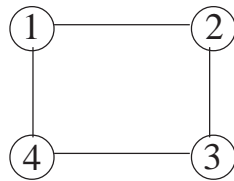
- g) Given set  $S$  of weights as  $(5, 10, 12, 13, 15, 18)$ ,  $n = 6$ ,  $m = 30$ . Apply backtracking to find all possible subsets of  $S$  that gives the sum of elements as 30.
- h) Develop the recurrence relation for travelling salesman problem using dynamic programming and show that the time complexity is  $O(n^2 2^n)$ .



**Q3)** Attempt any three of the following.

**[3×4=12]**

- a) Diagrammatically represent the solution space of 4 Queen's problem.
- b) Apply Backtracking method on the following instance of graph coloring problem of 4 nodes and 3 colors. Find an solutions.



- c)
  - (i) State Cook's theorem.
  - (ii) Strongly connected component.
- d) Show the relationship between P, NP, NP-Hard and NP-Complete problems.

□□□□

Total No. of Questions : 5]

[Total No. of Pages : 4

**P1072**

**[3734]-32**

**M.C.A. - II (Science Faculty)**

**CS-302 : DATABASE SYSTEM CONCEPTS**

**(Sem. - III) (Old)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1) a)** Kalpa Vriksha is an upgrowing construction company. It develops various sites in the Bombay suburbs. The sites can be as large as a township or as small as an apartment. Customers book flats which can be either 1 BHK or 2 BHK or 3 BHK. Payment can be done through bank by borrowing a loan or down payment of cash.

Construct an E-R diagram for the above database. **[10]**

- i) Identify the Entity Sets, Relationship sets and their attributes.
- ii) Identify the Primary key for each entity set.
- iii) Convert E-R diagram into Relational database.

**b)** Attempt any one of the following. **[6]**

- i) What is data model? Explain in detail the types of data model.
- ii) Draw the structure of DBMS. Explain the Query Processor Component.

**Q2)** Attempt any four of the following. **[16]**

- a) Short note on Data Abstraction.
- b) Explain the following :
  - i) Primary Key.
  - ii) Derived attribute.
  - iii) Weak Entity Set.
  - iv) Discriminating attribute.

**P.T.O.**

- c) Explain with the help of an example the ECA model of Triggers.
- d) Explain with the help of a suitable example as to why the fourth normal form was introduced.
- e) Define Lock. Discuss the different types of lock. Also explain its usage.

**Q3)** Attempt any four of the following. **[16]**

- a) Discuss the reasons for allowing concurrent execution of transactions.
- b) Explain the concept of View serializability of schedules based on View Equivalence.
- c) Define the following :  
i) 2NF   ii) 3NF   iii) BCNF   iv) 4NF
- d) Discuss Armstrong's Axioms.
- e) Explain the help of Audit trails for security purpose.

**Q4)** Attempt any four of the following. **[16]**

- a) Consider the following relational database.  
Supplier (Sno, Sname, Saddr, Sphone)  
Item (Icode, Iname)  
SI (Sno, Icode, Qty, Price)  
Write following queries in Relational Algebra.  
i) List the name, address and phone no. of suppliers supplying 'Table'.  
ii) Calculate the total quantity of Item whose item code = 'I108'.
- b) Short note on Timestamp Ordering Protocol.
- c) Explain the following :  
i) 2PL   ii) Strict 2PL   iii) Rigorous 2PL   iv) Conservative 2PL
- d) Short note on Shadow Paging.
- e) Consider the following Relational Database.  
Emp (Eno, Ename, addr, Job, Salary, age, deptno)  
Dept (dno, dname, mgrno)  
Write the following queries in SQL.  
i) List the youngest employee working for 'Accounts' department.  
ii) Display the departments managed by 'ShriRam Dixit'.

**Q5)** Attempt any four of the following.

**[16]**

- a) The following is a list of events in an interleaved execution of set of transactions  $T_1, T_2, T_3, T_4$  with 2PL Protocol.

Time	Transaction	Code
$t_1$	$T_1$	Lock (A, X)
$t_2$	$T_2$	Lock (B, S)
$t_3$	$T_1$	Lock (B, X)
$t_4$	$T_2$	Lock (A, S)
$t_5$	$T_3$	Lock (C, X)
$t_6$	$T_4$	Lock (C, S)
$t_7$	$T_3$	Lock (A, X)

Construct a wait-For-Graph according to the above request. Is there a deadlock? Give proper justifications.

- b) Consider following transactions.

$T_1$	$T_2$	$T_3$
Read (A)	Read (C)	Read (B)
$A = A + 25$	$C = C + 88$	$B = B + 70$
Write (A)	Write (C)	Write (B)
Read (B)	Read (A)	Read (K)
$B = B - 20$	$A = A + 60$	$K = K + 81$
Write (B)	Write (A)	Write (K)

Give atleast 2 non-serial schedules which are serializable for above 3 transactions.

- c) Following are the log entries at the time of system crash.

[ start - transaction  $T_1$ ]  
 [ write,  $T_1$ , A, 200]  
 [ commit  $T_1$ ]  
 [ checkpoint]  
 [ start - transaction  $T_5$ ]  
 [ write,  $T_5$ , K, 29]  
 [ write,  $T_5$ , R, 108]

[ start - transaction  $T_4$ ]

[ write,  $T_4$ , B, 1024]

[ commit  $T_5$ ]

[ start - transaction  $T_2$ ]

[ write,  $T_2$ , D, 1160]

← System Crash

What is the Recovery Procedure if

- i) Deffered update is used.
- ii) Immediate update is used.
- d) Consider relation  $R = (X, Y, Z, A, B, C)$  and set of FD,  $F = \{A \rightarrow B, X \rightarrow Y, XY \rightarrow ABC, A \rightarrow C\}$ . Compute the set of candidate keys.
- e) Explain with a suitable example 'Assertions'.

□□□□

Total No. of Questions : 5]

[Total No. of Pages : 2

**P1076**

**[3734]-42**

**M.C.A. - II (Under Science Faculty)**

**COMPUTER SCIENCE**

**CS-402 : Artificial Intelligence**

**(Sem. - IV) (Old)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) All question carry equal marks.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*
- 5) Neat diagrams must be drawn wherever necessary.*

**Q1)** Attempt any four of the following.

**[4×4=16]**

- a) What is the purpose of Turing Test? Explain in detail.
- b) Define the following terms and give one example for each.  
(i) Modus Ponens, (ii) Chain Rule.
- c) Explain knowledge aquisition in detail.
- d) Write a short note on object oriented systems.
- e) Describe the application of A.I.

**Q2)** Attempt any four of the following.

**[4×4=16]**

- a) Write a LISP function to add all elements of an array.
- b) Write a LISP function to find  $n$  raised to  $m$  using recursion.
- c) Write a LISP function to find area of triangle with proper messaging.
- d) Write a PROLOG program to find  $n^{\text{th}}$  element of the given list.
- e) Write a PROLOG program to find factorial of given number.

**Q3)** Attempt any four of the following.

**[4×4=16]**

- a) Explain any four predicates used in LISP.
- b) Explain the concept of dynamic database in PROLOG.
- c) Write a short note CG.

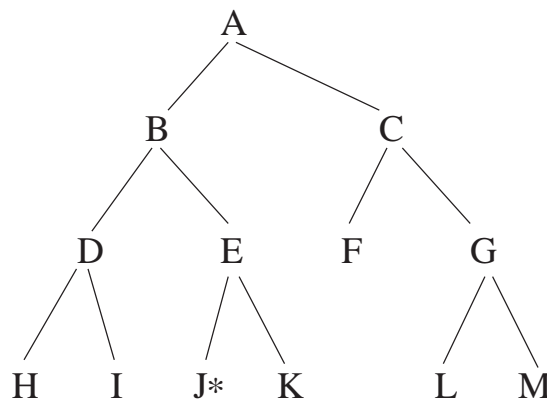
**P.T.O.**

- d) Write unification algorithm.
- e) Transform the following formula to prenex normal form.  

$$\forall x : [\exists y : Q(x, y) \wedge p(x)] \rightarrow [\exists z : R(x, z) \vee R(y, z)]$$

**Q4)** Attempt any two of the following. **[2×8=16]**

- a) Explain various primitives actions provided in CD theory.
- b) Write DFS algorithm and draw stepwise tree generation by expanding each next state until a goal node is reached.  
 [Goal states are designated with \*].



- c) Discuss problem characteristics in detail.

**Q5)** Attempt any two of the following. **[2×8=16]**

- a) Write shop script.
- b) Construct partitioned semantic Net representations for the following
  - (i) Every dog has bitten a mail carrier.
  - (ii) Every dog in town has bitten the constable.
- c) What do you mean by resolution? Discuss different types of resolution.

□□□□