



DEC - 2008

DATABASE MANAGEMENT SYSTEMS

Branch : T.E. (Comp./I.T.)

(2003 Course)

Time: 3 Hours

Max. Marks: 100

Instructions: 1) Answers to the two sections should be written in separate books.

2) Neat diagrams must be drawn wherever necessary.

3) Black figures to the right indicate full marks.

4) Assume suitable data, if necessary.

SECTION – I

1. a) Consider a university database for the scheduling of classrooms for final exams. This database could be modeled as the single entity set exam, with attributes course_name, section_no, room_no and time. Alternatively, one or more additional entity sets could be defined, along with relationship sets to replace some of the attributes of the exam entity set as. 10
- Course with attributes name, dept and course_no
 - Section with attributes s_no and enrollment, and dependent as a weak entity set on course.
 - Room with attributes r_no, capacity and building
- i) Show an E-R diagram illustrating the use of all three additional entity sets listed.
- ii) Explain what application characteristics would influence a decision to include or not to include each of the additional entity sets.
- b) Explain the distinction between condition defined and user defined design constraints, which of these constraints can the system check automatically ? Explain your answer. 6
- c) Explain the difference between physical and logical data independence. 2

OR

2. a) Explain the concept of Generalization – Specialization. Design a generalization-specialization hierarchy for a motor-vehicle sales company. The company sells motorcycles, passenger cars, vans and buses. Justify your placement of attributes at each level of the hierarchy. 6



- b) What is integrity constraint ? Explain referential integrity constraints using on delete cascade clause with suitable example. 6
- c) Specify CODDs norms to be specified by RDBMS. 6

3. a) Let the following relation schemas be given

$R = (A, B, C)$

$S = (D, E, F)$

Let relations $r(R)$ and $s(S)$ be given. Give an expression in the tuple relational calculus that is equivalent to each of the following :

- a) $\Pi_{A(r)}$
- b) $\sigma_{B=17}(r)$
- c) $r \times s$
- d) $\Pi_{A,F}(\sigma_{C=D}(r \times s))$ 8
- b) Describe the circumstances in which you would choose to use embedded SQL rather than using SQL alone or using only a general-purpose programming language. Compare dynamic and embedded SQL with suitable example ? 8

OR

4. a) Consider the relational database 6

employee(e_name,street,city)

works(e_name,company_name,salary)

company(company_name,city)

manages(e_name,mgr_name)

Write a relational algebra or SQL expression for each of the following queries

- i) Find the company with the most employees
- ii) Find the company with the smallest payroll
- iii) Find those companies whose employees earn a higher salary, on average, than the average salary at 'Bank of India'.



b) Suppose there are two relations r and s, such that the foreign key B of r references the primary key A of s. Describe how the trigger mechanism can be used to implement the on delete cascade option, when a tuple is deleted from s. 6

c) Explain the concept of trigger and assertion ? 4

5. a) Compute and explain the closure and canonical cover F_c of the following set F of functional dependencies for relation schema $R = (A, B, C, D, E)$

$A \rightarrow BC \quad CD \rightarrow E \quad B \rightarrow D \quad E \rightarrow A$ 8

b) Use Armstrong's axioms to prove the soundness of the decomposition rule. 8

OR

6. a) Show that, if a relation schema is in BCNF, then it is also in 3NF. 8

b) Define multivalued dependency. List all the nontrivial multivalued dependencies satisfied by the relation given below. 8

A	B	C
a1	b1	c1
a1	b1	c2
a2	b1	c1
a2	b1	c3

SECTION – II

7. a) Discuss the techniques for allowing a hash file to expand and shrink dynamically. What are the advantages and disadvantages of each. 8

b) Discuss the cost components for a cost function that is used to estimate query execution cost ? Are there cases in which it is desirable for users to be aware of the costs of computing query-processing strategies ? Explain your answer. 8

OR

8. a) What are the reasons for having variable length records ? Explain implementation of variable length record using fixed-length representation in detail. 8



- b) What are the advantages and disadvantages of hash indices relative to B+tree indices ? How might the type of index available influence the choice of a query processing strategy ? 8
9. a) Discuss how serializability is used to enforce concurrency control in a database system. Why is Serializability sometimes considered to restrictive as a measure of correctness for schedules. 8
- b) When do deadlocks happen, how to prevent them, and how to recover if deadlock takes place. 8
- OR
10. a) How does the granularity of data items affect the performance of concurrency control ? What factors affect selection of granularity size for data items ? 8
- b) Explain ACID properties. 4
- c) Explain shadow paging recovery scheme. 4
11. a) Discuss how persistence is specified in the ODMG object model in the C++ binding. 8
- b) What is fragment of a relation ? What are the main types of fragments ? Why is fragmentation a useful concept in distributed database design ? 8
- c) What is pointer swizzling. 2
- OR
12. a) What is the difference between persistent and transient objects ? How is persistence handled in the typical object oriented database systems ? 8
- b) What are the various issues that decide the time cost of communication between client and server. 6
- c) Specify the steps in accessing the data object in conventional DBMS and OODBMS. 4



OPERATING SYSTEMS

Branch : T.E. (Information Technology)
(2003 Course)

Time : 3 Hours

Max. Marks: 100

Instructions : 1) Answers to the two Sections should be written in separate books.

2) Neat diagrams must be drawn wherever necessary.

3) Black figures to the right indicate full marks.

4) Assume suitable data, if necessary.

5) Answer all questions from each Section.

SECTION – I

- 1. a) What are the design considerations for a multiprocessor O.S.? Illustrate the differences between a microkernel and a layered kernel with the help of neat diagrams. 8
- b) Explain with the help of neat diagram various Linux kernel components. 8

OR

- 1. a) Explain the concept of virtual machine with its implementation and benefits. Also explain in brief examples of virtual machine. 8
- b) Discuss the batch and real time operating system with respect to process scheduling, memory management, I/O management and file management. 8
- 2. a) Specify various requirements to meet Mutual Exclusion. Describe various hardware approaches to achieve mutual exclusion and state its advantages and disadvantages. 8
- b) What is busy waiting with respect to process synchronization ? Explain how semaphore reduces the severity of this problem.

Also define with examples :

- i) general semaphores ii) binary semaphores
- iii) strong semaphores iv) weak semaphores. 10

OR



2. a) Write a safety algorithm in the deadlock problem and state its time complexity. Consider following snapshot of system at time T_0 . 10

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P_0	0	1	0	7	5	3	2	3	0
P_1	3	0	2	3	2	2			
P_2	3	0	2	9	0	2			
P_3	2	1	1	2	2	2			
P_4	0	0	2	4	3	3			

Calculate the need matrix and state whether system is safe. If yes, justify with step wise calculations. Give safe sequence.

- b) What is a difference between process and thread ? What are the contents of thread control bock ? Give the differences between user level thread and kernel level thread. 8

3. a) Consider the following set of processes with the length of the CPU burst time given in milliseconds. 10

Process	Arrival time	Burst time	Priority
P_1	0	3	3
P_2	1	5	1
P_3	3	2	3
P_4	9	5	2
P_5	12	5	1

Draw a Gantt chart and find out average waiting time and average turn around time for (i) FCFS (ii) SJF (Preemptive) (iii) SJF (Non Preemptive) (iv) Priority (Preemptive – a smaller priority number implies a high priority) (v) Round Robin (Time Quantum = 1ms).



b) Explain the term granularity in multiprocessor scheduling. Briefly describe five different categories of synchronization granularity. 6

OR

3. a) How is scheduling implemented in windows 2000 ? 8

b) List and explain four classes of real time scheduling. 8

SECTION – II

4. a) Describe how Linux implements the following aspects of memory management.

i) Virtual memory addressing

ii) Page allocation

iii) Page replacement algorithm

iv) Kernel memory allocation. 10

b) Explain the following terms in brief : 8

i) Working set model ii) Thrashing

iii) Lazy swapper iv) Compaction

OR

4. a) Compare the following memory management techniques on their strengths and Weaknesses - fixed partition, dynamic partition, simple paging, simple segmentation Virtual memory management, Virtual memory segmentation. 8

b) Given the following page reference string : 10

1, 2, 3, 2, 5, 6, 3, 4, 6, 3, 7, 3, 1, 6, 3, 4, 5, 3, 2, 4, 3, 4, 5, 1

Number of page frames are 4

Show the page trace and calculate the number of page frames for following page replacement policies (i) LRU (ii) optimal (iii) fifo. Also explain Bledy's anomaly.



5. a) What is RAID ? Explain the advantages and disadvantages of RAID. Also explain seven RAID levels in brief. 10

b) Draw and explain UNIX I/O structure and explain in detail role and implementation of buffer cache in UNIX I/O subsystem. 6

OR

5. a) Why I/O buffering is necessary ? State and explain different I/O buffering techniques. 8

b) Define following with respect to disk scheduling : 4

i) Seek time

ii) Rotational latency

iii) Bandwidth

c) What are different disk performance parameters ? 4

6. a) Compare various access matrix schemes of implementation and revocation with respect to each other. 8

b) Write an AWK script to prepare Employee payroll report in the following format 8

Employee ID Employee Name No. of Leaves Salary

The data file contains the record in the following format -

Employee ID : Name : Basic : DA : HRA : Leaves : Days in month : Salary

Display the report in above prescribed format.

OR

6. a) Write a note on Protection Domain. 4

b) What is difference between passive and active threats ? 4

c) What is a role of shell in UNIX OS ? Explain in brief different types of shells in UNIX OS. 4

d) How password protection is implemented in UNIX OS ? 4



MULTIMEDIA SYSTEMS

Branch : T.E. (IT)

(2003 Course)

Time : 3 Hours

Max. Marks : 100

N.B.: i) Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6 from Section I and Q. 7 or Q. 8, Q. 9 or Q. 10 and Q. 11 or Q. 12 from Section II.

ii) Answers to the *two* Sections should be written in *separate* answer books.

iii) Neat diagrams should be drawn *wherever* necessary.

iv) Use of electronic pocket calculator is *allowed*.

v) Figures to the *right* indicate *full* marks.

vi) Assume suitable data *wherever* necessary.

SECTION – I

1. a) What are the different building blocks of multimedia ? Explain with the help of examples. 8
- b) Explain at least two methods for generating a line other than Bresenham's line algorithm. How Bresenham's line drawing algorithm is more accurate and advantageous over those methods ? 10
- OR
2. a) What is an optical storage device ? How is DVD superior to a CD ? 6
- b) With the help of an example explain the Scan line seed fill algorithm. 10
- c) Define multimedia. 2
3. a) Magnify the triangle A (0, 0), B (3, 0) and C (3, 4) to three times of its size while keeping P (1, 1) fixed. Show your work using homogenous coordinate system. 8
- b) Show with appropriate figures the following reflections of a 2D object 8
- i) about x axis
- ii) about y axis
- iii) about origin
- iv) about a line $y = x$.

OR

P.T.O.



4. a) Explain the steps of performing rotation on a 3D object about an axis not parallel to x, y or z co ordinate axis. 10
- b) Considering the top left corner of the screen as the origin and given a clipping window with vertices given in clockwise direction starting from P (50, 100), Q (350, 100), R (350, 300) and S (50, 300), find the visible portion of the line AB [A (30, 75), B (300, 350)] against the given window, using Cohen-Sutherland line clipping algorithm. 6
5. a) What is aliasing ? How it occurs in computer graphics ? Explain any one method for anti-aliasing. 8
- b) What is shading ? Explain Gouraud shading algorithm for polygon shading. 8
- OR
6. Write short notes on the following :
- a) Inside outside test. 4
- b) Flood fill. 6
- c) Phong shading. 6

SECTION – II

7. a) Compare RGB and CMY color models. 8
- b) What is animation ? Explain any four principles of animation with examples. 8
- OR
8. a) Explain WAV file format in detail. 8
- b) What is data compression ? Explain the steps of JPEG compression in detail. 8
9. a) Compare NTSC and SECAM video standards with respect to all the features. 8
- b) What are the types of animation ? Explain the use of animation using segmentation. 8
- OR
10. a) What is the need of compression ? Justify 'LZW is a lossless, dictionary based compression algorithm'. 8
- b) What is DPCM ? Explain in brief. 8
11. a) Write features of MPEG1, MPEG2 and MPEG4. 10
- b) Explain BMP file format. 8
- OR
12. Write short notes on **any three** : 18
- a) Lossy compression.
- b) MIDI file.
- c) Digitization of sound.
- d) Steps in designing an animation sequence.



DATA COMMUNICATION & NETWORKING (2003 Course)

Time: 3 Hours

Max. Marks: 100

- Instructions :*
- Answer 3 questions from Section I and 3 questions from Section II.
 - Answers to the two Sections should be written in separate books.
 - Neat diagrams must be drawn wherever necessary.

SECTION – I

- a) Explain Hamming code with suitable example. Also state the advantages of Hamming code. 8
- b) Explain the following modulation techniques. 8
 - 1) ASK
 - 2) FSK
 - 3) PSK
 - 4) QAM

OR

- a) Explain CRC technique. Calculate the CRC if the data to be sent is 1010011110 with polynomial as x^3+1 . 8
- b) Explain the following error detection techniques with suitable example. 8
 - a) Vertical Redundancy Check (VRC)
 - b) Longitudinal Redundancy Check (LRC)
 - c) Checksum
- a) Explain how ADSL technology is used in modems. Also comment on the bandwidth distribution. 8
- b) Explain time division multiplexing in detail. Also state the specifications of different T lines. 8

OR

- a) Explain the cable modem technology with neat suitable diagram. Also state the advantages of cable modem over dial - up modem. 8
- b) What is SONET ? What are Synchronous Transport Signals? Also explain SONET frames and various SONET Devices. 8



- 5 a) Explain the losses in optical fibre. 8
- b) Explain the categories of satellites. Also explain multiple access techniques used in satellite communication. 6
- c) For an optical fibre with a glass core ($n_1 = 1.5$) and cladding ($n_2 = 1.86$). Calculate angle of acceptance and critical angle. The source to fibre medium is air. 4

OR

6. a) Explain the frequency bands used in satellite communication. Also explain why downlink frequency is lower than uplink frequency ? 4
- b) Explain different components of satellite communication. 6
- c) State the law for angle of refraction. Also derive the expression for angle of acceptance and numerical aperture. 8

SECTION – II

7. a) Explain all the layers of OSI model. 8
- b) Explain the following network topologies with suitable examples. 8
- 1) Star 2) Ring 3) bus 4) Hierarchical
- Also discuss advantages and disadvantages of each topology.

OR

8. a) Explain TCP/IP protocol stack. Compare it with OSI model. Also state atleast one protocol used per layer. 8
- b) Explain the functionality of following network components with suitable examples w.r.t OSI model 8
- 1) Bridge 2) Repeater 3) Router 4) Gateway
9. a) Explain ARQ ? Also explain stop and wait ARQ, Go-back n ARQ and selective Repeat ARQ. Also comment on each methods performance. 8
- b) Explain point - to - point protocol. Also discuss the different subprotocols of PPP along with the frame format. 8

OR



10. a) Explain HDLC. Also explain different HDLC frames with their formats. 8
- b) What is the need of multiple access techniques. Also Explain FDMA, TDMA and CDMA access techniques. 8
11. a) Explain the frame format of IEEE 802.3. Also comment on minimum and maximum frame size. 8
- b) Explain the priority and reservation access technique used in IEEE 802.5 with suitable examples . 6
- c) Explain in brief DQDB. 4

OR

12. a) Explain the token passing access used in FDDI with an appropriate example. 8
- b) Explain 10 Base 5, 10 Base 2 and 10 Base -T specifications of IEEE 802.3 LAN. 6
- c) Discuss VLAN's with neat diagram. 4



THEORY OF COMPUTATION

Branch : T.E. (Information Technology)

(2003 Course)

Time : 3 Hours

Max. Marks : 100

- Instructions :**
- 1) Answer **three** questions from Section **one** and **three** questions from Section **two**.
 - 2) Answers to the **two** sections must be in **different answer books**.
 - 3) Figures to the **right** indicate **full marks**.

SECTION – 1

1. A) Construct a DFA for accepting L over {0, 1} such that every substring of length 4 contains atleast three 1's. 8

B) Convert the following Moore machine to equivalent Mealy machine

	0	1	o/p
p	s	q	0
q	q	r	1
r	r	s	0
s	s	p	0

8

OR

2. A) Construct a FA for accepting L over {0, 1} such that each 0 is immediately preceded and immediately followed by a 1. 8

B) Design a Moore and Mealy machine for a binary input sequence such that if it has a substring 110 the machine outputs A, if it has a substring 101 machine outputs C, otherwise it outputs C. 8

3. A) Prove the following languages not regular using Pumping lemma

1) $L = \{0^n, n \text{ is prime}\}$

2) $L = \{0^i 1^{2i}, i > 0\}$

10

P.T.O.



B) State and prove the pumping lemma Theorem.

6

OR

4. A) Consider the following NFA with ϵ -transitions

$M = (\{q_1, q_2, q_3, q_4\}, \{a, b\}, \delta, q_1, \{q_4\})$, where

$\delta(q_1, a) = q_2, \delta(q_1, \epsilon) = q_3, \delta(q_2, \epsilon) = q_2, \delta(q_2, b) = q_3$

$\delta(q_3, a) = q_3, \delta(q_3, a) = q_4, \delta(q_4, b) = q_1, \delta(q_4, b) = q_4$

convert this to NFA without ϵ and DFA.

10

B) Prove the following :

The set of sentences/strings accepted by a finite automata M with n states is Non-empty if and only if the finite automata accepts a string of length less than n.

6

5. A) Construct DFA accepting the regular language generated by the left linear grammar given below

$S \rightarrow Ca/Bb$

$C \rightarrow Bb$

$B \rightarrow Ba/b$

6

B) Find a reduced Grammar equivalent to

$S \rightarrow aC/SB$

$A \rightarrow bSCa$

$B \rightarrow aSB/bBC$

$C \rightarrow aBC/ad$

6

C) Write a CFG for the following language

$L = \{uawb \mid u, w \text{ are in } \{a, b\}^* \text{ and } |u| = |w|\}$

6

OR

6. A) Write CFG's for the following languages

1) $L = \{a^m b^n c^p d^q \mid m + n = p + q\}$

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

6

B) Find GNF of the grammar given below

$$S \rightarrow ABAb/ab$$

$$B \rightarrow ABA/a$$

$$A \rightarrow a/b$$

6

C) Test whether the following Grammars are ambiguous

$$1) S \rightarrow 0S1S \mid 1S0S \mid \wedge$$

$$2) S \rightarrow AA$$

$$A \rightarrow aAb/ bAa/\wedge$$

6

SECTION - 2

7. A) For the PDA $(\{q_0, q_1\}, \{0, 1\}, \{0, 1, Z_0\}, \delta, q_0, Z_0, \Phi)$ where δ is

$$\delta(q_0, \wedge, Z_0) = \{(q_1, \wedge)\}$$

$$\delta(q_0, 0, Z_0) = \{(q_0, 0Z_0)\}$$

$$\delta(q_0, 0, 0) = \{(q_0, 00)\}$$

$$\delta(q_0, 1, 0) = \{(q_0, 10)\}$$

$$\delta(q_0, 1, 1) = \{(q_0, 11)\}$$

$$\delta(q_0, 0, 1) = \{(q_1, \wedge)\}$$

$$\delta(q_1, 0, 1) = \{(q_1, \wedge)\}$$

$$\delta(q_1, 0, 0) = \{(q_1, \wedge)\}$$

$$\delta(q_1, \wedge, Z_0) = \{(q_1, \wedge)\}$$

Obtain CFG accepted by the above PDA and simplify the CFG and describe the language it accepts.

12

B) Write a note on 'Closure properties of CFLs'.

6

OR



8. A) Write a note on Post machines. 6

B) For the PDA $(\{q_0, q_1\}, \{0, 1\}, \{Z_0, X\}, \delta, q_0, Z_0, \Phi)$ where δ is

$$\delta(q_0, 1, Z_0) = \{(q_0, X Z_0)\}$$

$$\delta(q_0, 1, X) = \{(q_0, XX)\}$$

$$\delta(q_0, 0, X) = \{(q_1, X)\}$$

$$\delta(q_0, \wedge, Z_0) = \{(q_0, \wedge)\}$$

$$\delta(q_1, 1, X) = \{(q_1, \wedge)\}$$

$$\delta(q_1, 0, Z_0) = \{(q_0, Z_0)\}$$

Obtain CFG accepted by the above PDA and simplify the CFG and describe the language it accepts. 12

9. A) State any 2 problems known to be unsolvable and prove the unsolvability of any one of them. 8

B) Design a TM to check languages over $\{0, 1\}$ having equal number of 0's and 1's. 8

OR

10. A) Design TM for the language $L = \{a^n b^n c^n \mid n \geq 0\}$ 8

B) Design the post machine which accepts the strings of a and b having odd length and the element at the centre is 'a'. 8

11. A) Write a note on 'Universal Turing machine'. 8

B) Explain Chomsky Hierarchy and describe the machines that you have learnt in this course that accept each type of grammar of Chomsky Hierarchy. 8

OR

12. A) Write a note on limitations of Finite Automata. 6

B) Compare PDA and PM. 4

C) Write a note on Recursive sets, Partial Recursive Functions and Recursively Enumerable sets. 6