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 Fc of the following set F of functional dependencies for relation schema R = (A, B, C, D, E)

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

DATA COMMUNICATIONS
Branch : T.E. (Computer Engg.)
(2003 Course)

Time: 3 Hours Max. Marks: 100

Instructions: *1) Attempt **Q. 1** or **Q. 2**, **Q. 3** or **Q. 4**, **Q. 5** or **Q. 6** from Section **I** and attempt **Q. 7** or **Q. 8**, **Q. 9** or **Q. 10**, **Q. 11** or **Q. 12** from Section **II**.*

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

*3) **Neat** diagrams must be drawn **wherever** necessary.*

*4) Black figures to the **right** indicate **full** marks.*

*5) **Assume** suitable data, if necessary.*

SECTION – I

1. a) State various methods to suppress unwanted sideband and explain filter method of generating SSB. **8**

   b) The output voltage of a transmitter is given by $500\ (1 + 0.4 \sin 3140\ t) \sin 6.28 \times 10^7\ t$.

   This voltage is fed to a load of $600\,\Omega$.

   Determine : 1) Carrier frequency

   2) Modulating frequency

   3) Carrier power

   4) Mean Power output **8**

   OR

2. a) With the help of block diagram explain how the disadvantages of phase shift method is over come in third method of SSB generation. **5**

   b) What is pre-emphasis and de-emphasis ? Why it is required ? **5**

   c) Explain with the help of block diagram of BFSK receiver. **6**

3. a) Explain sampling theorem and its importance in data communication. **5**

   b) Find Nyquist rate and internal for the signal 10 sinc (100 t). **4**

   c) Compare PAM, PPM and PDM. **7**

OR

4. a) Explain how to generate PAM signal for various types of sampling techniques. **6**

   b) Sketch the channel interleaving scheme for time division multiplexing the following PAM channels : five 4 kHz telephone channels and one 20 kHz music channel. **10**

5. a) What is meant by quantisation noise ? Discuss the factors on which it depends and the techniques used for reducing its effect. **10**

   b) A television signal with a bandwidth of 4.2 MHz is transmitted using binary PCM. The number of quantization levels is 512. Calculate :

      1) Code word length

      2) Transmission bandwidth

      3) Final bit rate

      4) Output signal to quantization noise ratio. **8**

OR

6. a) With the help of block diagram explain the working of delta modulation receiver and transmitter. **10**

   b) Compare PCM, Adaptive Delta Modulation and Differential Pulse Code Modulation. **8**

SECTION – II

7. a) State and explain Shannon's theorem on channel capacity. **4**

   b) Explain the following terms with reference to information theory. **6**

      1) Entropy

      2) Information rate

      3) Channel capacity

c) If there are M equally likely and independent messages, then prove that amount of information carried by each message will be,
I = N bits,
Where $M = 2^N$ and N is an integer. **8**

OR

8. a) Explain the following terms :
   1) Hamming distance
   2) Code rate
   3) Code efficiency
   4) Minimum distance
   5) Height of code **10**

   b) Explain forward error correction techniques with example of Hamming code. **8**

9. Write a short note on :
   a) ESF framing b) CSU and DSU
   c) DS1 d) B8ZS. **16**

OR

10. a) Explain features of ATM. **6**

    b) Explain ATM reference model. **10**

11. a) Why computer network is required ? Explain the applications of computer network. **8**

    b) Compare LAN and WAN. **8**

OR

12. a) What is CDMA ? Explain. **4**

    b) Write a short note on : **12**
    1) Topology design issues
    2) CSMA/CD
    3) SMPS.

MICROPROCESSORS AND MICROCONTROLLERS

Branch : T.E. (Computer Engineering)

(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions: *1) Answers to the **two** Sections shall be written in **separate** answer books.*

*2) In Section **I** attempt : Q. No. **1** or Q. No. **2**, Q. No. **3** or Q. No. **4**, Q. No. **5** or Q. No. **6**. In Section **II** attempt : Q. No. **7** or Q. No. **8**, Q. No. **9** or Q. No. **10**, Q. No. **11** or Q. No. **12**.*

*3) **Neat** diagrams must be drawn **wherever** necessary.*

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

*5) Assume suitable data, if **necessary**.*

SECTION – I

1. a) Compare 80386, 80486 and Pentium, based on architectural features. **6**

   b) Which are the bus cycle definition signals (pins) of Pentium ? Give details. **6**

   c) With the help of branch prediction state diagram, explain branch prediction in Pentium. **6**

   OR

2. a) Explain the following for Pentium : **10**

      i) On-chip caches and their size

      ii) Physical address space

      iii) FPU data registers

      iv) An instruction for "Base + Index + Displacement" addressing mode

      v) FERR#pin.

   b) Draw memory map of Pentium when it is operating in real mode. Also list four important features of real mode. **8**

3. a) What is BIST ? What are its different parts ? After BIST, how does startup code knows that Pentium is error free ? **8**

   b) Differentiate between aligned and non-aligned addresses in Pentium Processor. **6**

   c) What is AC flag in EFLAGS register of Pentium ? **2**

OR

4. a) What is cold power-on and warm power-on in Pentium ? **4**

   b) With the help of a neat diagram, explain non-pipelined read bus cycle of Pentium. **6**

   c) Draw and explain the mechanism to interface 32-bit and 16-bit memories to Pentium. **6**

5. a) In Pentium, privilege change can be done by conforming code segments and also with the help of Call Gates. How it is different in each case ? **8**

   b) Name any four system descriptors found in protected mode of Pentium. **4**

   c) What is the use of U/S and R/W bits found in Page table entry ? **4**

OR

6. a) What are the privilege level checks performed by Pentium Microprocessor when FAR JMP or FAR CALL instruction is executed ? Under what circumstances privilege level is changed by Pentium ? Explain in detail with the help of neat diagram. **8**

   b) How a system programmer selects different page sizes in Pentium ? Give details. **4**

   c) Which descriptors are present in TLB ? How TLB can be flushed ? **4**

SECTION – II

7. a) What is Task and Task state for Pentium ? Explain. **8**

   b) Name descriptors found in IDT. **4**

   c) What is the role of I/O permission bit map in Pentium ? **6**

OR

8. a) How system software or the processor can dispatch a task for execution ? **6**

   b) How interrupts are handled in virtual mode of Pentium ? **6**

   c) How paging is helpful in Virtual 8086 mode ? Give details. **6**

9. a) Answer the following : **10**
   i) How many bits are present in bit addressable area of 8051 ?
   ii) If oscillator frequency of 8051 is 10 MHz, then what is the time required for one machine cycle ?
   iii) Where stack is located in the memory map of 8051 ?
   iv) Is memory to memory transfer allowed in 8051 ? Justify your answer.
   v) What is 'SWAP-A' instruction of 8051 ?

   b) What is 'auto-reload mode' of timers found in 8051 ? Also state applications of this mode. **6**

OR

10. a) Name SFRs involved in interrupt handling of 8051. Also write the internal polling sequence for interrupts of 8051. **6**

    b) Write TMOD value for setting the following :
    Timer 1, mode 2, counter operation, external control. **4**

    c) Explain multiprocessor communication supported by 8051. **6**

11. a) Explain in brief, the architectural features of PIC 16C61/71. **8**

    b) With help of diagram, explain STATUS register of PIC 16C61/71. **4**

    c) How many interrupts are supported by PIC 16C61/71 ? Name them. **4**

OR

12. a) How do you select RAM banks in PIC 16C61/71 ? What do they contain ? **6**

    b) With the help of neat diagram, explain the operation of Timer 0 of PIC 16C61/71. **8**

    c) What is 'Return' instruction of 16C61/71 ? **2**

DIGITAL SIGNAL PROCESSING

Branch : T.E. (Comp)

(2003 Course)

Time: 3 Hours Max. Marks: 100

Instructions : *1) Attempt 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, Q.11 or Q.12 from Section **II**.*

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

*3) Neat diagrams must be drawn **wherever** necessary.*

*4) Black figures to the **right** indicate **full** marks.*

*5) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*

SECTION – I

1. A) What is sampling ? What is aliasing observed in sampling process ? How this can be avoided ? **6**

   B) With one example difference equation, explain the stability and dynamicity property of a DT system. **6**

   C) Explain how a DT signal x(n) can be expressed by means of convolution. **6**

   OR

2. A) Define and describe Causal and Non Causal system by means of difference equation. **4**

   B) Obtain the recursive implementation of a system $y(n) = \sum_{k=0}^{n} x(k)$ and hence obtain the Impulse Response h(n). **8**

   C) Define :

   i) Odd signal

   ii) Step Response

   iii) Causal sequence

   iv) Invertible system. **6**

3. A) Obtain Z-transform of signal $x(n) = -(a)^n u(-n-1)$ specify ROC and find out another sequence having the same ZT. Comment on the result. 8

B) What is convolution property of Fourier Transform (FT) ? Use it for finding linear convolution of $x_1(n) = x_2(n) = \left\{ 1, \underset{\uparrow}{1}, 1 \right\}$ 8

OR

4. A) Obtain Inverse Z-Transform (IZT) using Residue method for a causal sequence

$$H(Z) = \frac{1}{(Z = 0.5)(Z-1)}$$

Comment on Result. 8

B) State and prove

i) Time Reversal and ii) Time shifting property of Fourier Transform (FT). 8

5. A) Express N^{th} order difference equation as a system function H(Z) and describe it for

i) Pole zero system

ii) All pole system and iii) All zero system. 8

B) Obtain the frequency response of a DT system using simple geometric construction and difference equation for $h(n) = \delta(n) - \delta(n-1)$ 8

OR

6. A) A system is described as $h(n) = a^n u(n-1)$. Obtain a system function H(z) and difference equation. Draw a pole zero plot. 8

B) Obtain the response of the system for –

$y(n) = 0.15\, x(n) + 0.85\, y(n-1)$ for the I/P $x(n) = u(n)$. 8

SECTION – II

7. A) How the computational complexity is improved in FFT algorithms ? Draw a basic butterfly structure for Radix-2, DIF and DIT FFT algorithm. Explain in brief in-place computation and Bit Reversal Indexing. 10

B) For N point DFT, why $N \geq L$ where L:Length of DT signal obtain discrete frequencies $\{\omega_k\}$ for N = 8. 8

OR

8. A) Why DFT spectrum is symmetric ? How we can obtain it from DFT X(K) ? Discuss the convolution property of DFT and define circular shifting. **8**

B) How N-pt DFT can be obtained using Goertzel algorithm as a Response of the system ? Apply it to obtain 4-pt DFT for $x(n)=\left\{\underset{\uparrow}{1},1\right\}$. **10**

9. A) Define following windows and compare them w.r.t. main lobe width and peak side lobe

i) Rectangular ii) Bartlett (Triangular)

iii) Hanning iv) Hamming **8**

B) Explain the design steps of impulse invariance method for IIR filter. Apply it for

$$H(s)=\frac{1}{s^2+3s+2}$$ with sampling frequency Fs = 10 samples/s. **8**

OR

10. A) What do you mean by a linear phase response of FIR filter ? Show that following filter has linear phase response $y(n) = x(n) - x(n-1)$. **8**

B) What is frequency prewarping used in BLT method ? Why it is essential ? Write the design steps of BLT method for IIR filter. **8**

11. A) Express the system function

$$H(Z)=\frac{\sum_{K=0}^{M} b_K Z^{-K}}{1+\sum_{K=1}^{N} a_K Z^{-K}}$$ In time domain to represent Direct Form II IIR filter structure. Draw the same. **10**

B) Draw and explain in brief the cascade form of FIR filter structure. **6**

OR

12. A) Discuss the features of ADSP 2105 DSP processor. Explain the functional block MAC in detail. **8**

B) Realize a linear phase FIR filter structure having impulse response

$$h(n)=\delta(n)+\frac{1}{2}\delta(n-1)-\frac{1}{4}\delta(n-2)+\frac{1}{2}\delta(n-3)+\delta(n-4)$$ **8**

THEORY OF COMPUTATIONS

Branch : T.E. (Computer)

(2003 Course)

Time : 3 Hours | Max. Marks : 100

*N.B. : 1) Answer **three** questions from **each** Section.*
*2) Answer to the **two** Sections should be written in **separate answer books**.*
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*4) Figures to the **right** indicate **full** marks.*
*5) **Assume** suitable data, **if necessary**.*

SECTION – I

1. a) Prove that set of all integers is countably infinite. **4**

   b) Construct a NFA and then equivalent DFA accepting strings over {0, 1}, whose every block of 4 consecutive symbol, contain at least 3 zeroes (i.e. 0's) **10**

   c) Consider a relation R = {(1,1), (2,2), (3,4), (4,3)}, defined on set A = {1,2,3,4}. Obtain R* (reflexive and transitive closure of R). **4**

OR

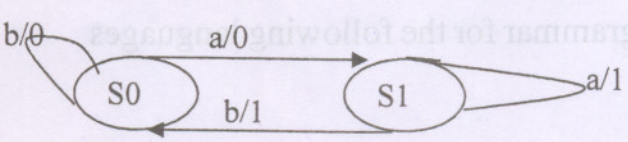
2. a) Prove **4**

   a) $\Phi^* = \in$

   b) $(r^*s^*) = (r + s)^*$

   b) Construct a NFA and then equivalent DFA accepting strings over {0, 1}, which accepts the set of all strings of zeroes (i.e. 0's) and ones (i.e. 1's) with at most one pair of consecutive zeroes (i.e. 0's) and with at most one pair of consecutive ones (i.e. 1's). **10**

   c) Convert the following Mealy machine to Moore machine. **4**

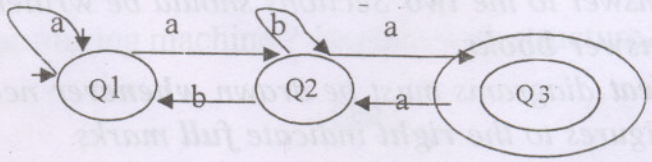


3. a) Explain your answer in **each** of the following : **6**

   1) Every subset of a regular language is regular

   2) Every regular language has a regular proper subset

   b) Consider the following transition diagram convert it to equivalent regular expression using Arden's theorem. **6**



   c) Prove that for any two regular expressions r and s over Σ, $(r^*s^*)^* = (r+s)^*$. **4**

OR

4. a) Design the finite automata and then equivalent regular expression using Arden's theorem that accepts the set of all strings over the alphabet {a, b} with an equal number of a's and b's, such that each prefix has atmost one more a than b's and atmost one more b than a's. **10**

   b) Using pumping lemma for regular sets prove that the language **6**
   $L = \{a^m b^n \mid m > n$ is not regular$\}$

5. a) Give the context free grammars for the following languages **12**

   a) $L = \{0^m 1^n 0^{m+n} \mid m, n >= 0\}$

   b) $L = \{0^a 1^b 2^c \mid |a-c| = b\}$

   b) Prove that the language **4**
   $L = (ww \mid w$ is in $(0+1)^*\}$ is not a CFL

OR

6. a) For right linear grammar given below, obtain an equivalent left linear grammar **4**

   $S \rightarrow 10A \mid 01$
   $A \rightarrow 00A \mid 1$

   b) Give the context free grammar for the following languages **12**

   a) $L = \{a^n b^{2n} \mid n > 1\}$

   b) $L = \{a^m b^n \mid n > m\}$

SECTION – II

7. a) Consider the PDA with the following moves : 8

$\delta(q0, a, z0) = \{(q0, a, z0)\}$

$\delta(q0, a, a) = \{(q0, aa)\}$

$\delta(q0, b, a) = \{(q1, \in)\}$

$\delta(q1, b, a) = \{(q1, \in)\}$

$\delta(q0, \in, z0) = \{(q1, \in)\}$

Obtain CFG equivalent to PDA

b) What is normal forms ? Explain Chomsky Normal Form (CNF) and Greibach Normal Form (GNF) with suitable example. 4

c) Using pumping lemma for CFL prove that the language 6
$L = \{a^i b^j c^k \mid I<j<k\}$ is not context free language.

OR

8. a) Give the CFG generating the language accepted by the following PDA : 10

$M = (\{q0, q1\}, \{0, 1\}, \{Z0, X\}, \delta, q0, Z0, \phi)$ where δ is given below

$\delta(q0, 1, Z0) = \{(q0, XZ0)\}$

$\delta(q0, 1, X) = \{(q0, XX)\}$

$\delta(q0, 0, X) = \{(q1, X)\}$

$\delta(q0, \in, Z0) = \{(q0, \in)\}$

$\delta(q1, 1, X) = \{(q1, \in)\}$

$\delta(q1, 0, Z0) = \{(q0, Z0)\}$

b) Prove "Let L be a language accepted by deterministic PDA, then the complement of L, can also be accepted by a DPDA". 8

9. a) Construct turing machine that computes 2's complement of a positive integer, represents in binary form. 6

b) Design a turing machine that computes : 6

$F(m,n) = m-n$, if $m >= n$

$= 0$, otherwise

c) What is multitape turing machine ? Explain with structure. 4

OR

10. a) Design a turing machine for accepting the strings with an equal number of 0's and 1's. 6

b) Design the post machine which accepts the strings of a and b having odd length and the element at the center is 'a'. 6

c) What is universal turing machine ? Explain with the structure. 4

11. a) Let G be a CFG and r be a regular expression. Show that the problem 10

1. $L(G) = L(r)$
2. $L(r) \in L(G)$ are undecidable

b) Define recursive and recursively enumerable languages and specify relationship between them. 6

OR

12. a) If L1 and L2 are two recursive languages and if L is defined as : 8
$L = \{w \mid w$ is in L1 and not in L2, or w is in L2 and not in L1$\}$. Prove or disprove that L is recursive.

b) Prove that "The set of real numbers, R, is not countable". 4

c) Show that any subset of a countable set is countable. 4

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