RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIFTH SEMESTER EXAMINATION, DECEMBER 2016

THIRD YEAR [BATCH 2014-17]

Date : 12/12/2016 **COMPUTER SCIENCE [Honours]**

Time : 11 am – 3 pm **Paper :** V Full Marks : 100

[Use a separate Answer Book for each Group]

Group – A

(***Answer any four questions***) [4×10]

1. a) Design an ER diagram for keeping track of information about votes taken in the U.S. House of representatives during the current two-year congressional session. The database needs to keep track of each U.S. State's Name (e.g. Texas, New York) and include the Region of the state (whose domain is {Northeast, Midwest, Southeast, Southwest, West}). Each CONGRESSPERSON in the House of Representatives is described by his or her Name, the district represented, the start date when the congressperson was first elected and the Political Party to which he or she belongs (whose domain is {Republican, Democrat, Independent, other}). The database keeps track of each BILL (i.e. Proposed law), including the billname, date of vote, whether the bill passed or failed and the SPONSOR (the congressperson(s) who sponsored — that is, proposed — the bill). The database keeps track of how each congressperson(s) voted on each bill. State clearly any assumptions you make. [8]

   b) What is "Referential Integrity"? [2]

2. a) What do you mean by structural constraints of an ER model? [1]

   b) "Foreign key is always primary key of the same table" —critically comment on it. [3]

   c) Construct a B tree index of order 3 with the following search key values.
   C, Z, X, T, B, M, K, O, I, Y, L
   What are the advantages of B^+ tree over B tree. [4+2]

3. a) Write an algorithm to check whether two sets of functional dependences are equivalent.
   Use the following two sets of functional dependences to explain the algorithm
   $F = \{A \rightarrow C,\ AC \rightarrow D,\ E \rightarrow AD,\ E \rightarrow H\},\ G = \{A \rightarrow CD,\ E \rightarrow AH\}$ [6]

   b) Explain the term "BCNF us stronger than 3NF" with proper example. [4]

4. a) A file has r = 20,000 student records of fixed length. Each record has the following fields. Name (30 bytes), Eno (9 bytes), Address (40 bytes), classcode (4 bytes), phone (9 bytes), DOB (8 bytes), Majordeptcode (4 bytes), Minordeptcode (4 bytes), Sex (1 byte) and degreeProgram (3 bytes). An additional byte is used as a deletion marker.
      i) Calculate the record size R in bytes
      ii) Calculate the blocking factor bfr and the number of file blocks f, assuming an unspanned organization. [4]

   b) Consider a relation schema R(A, B, C, D, E, F, G) and a set of functional dependencies.
   $F = \{A \rightarrow ABCDEFG,\ CE \rightarrow A,\ BD \rightarrow E,\ C \rightarrow B\}$. Give a loss-less join, dependency preserving 3NF decenposition of R. [6]

5. a) Consider the following relational schema pertaining to students database :
   Student (<u>roll_number</u>, Student_name, Address)
   Enroll (<u>roll_number</u>, <u>course_no</u>, course_name)
   where the primary keys are shown under lined. The number of tuples in the student & Enroll tables are 120 and 8 respectively. What are the maximum & minimum number of tuples that can be present in the NATURAL JOIN of the relation student with course? [3]

   b) What are difference between Dense and Sparse Index. [2]

c) Given a schedule S as follows :

T_1	T_2	T_3
	read (z)	
	read (y)	
	write (y)	
		read (y)
		read (z)
read (x)		
write (x)		
		write (y)
		write (z)
	read (x)	
read (y)		
write (y)		
	write (x)	

check whether S is serializable. [5]

6. a) Consider the relation :

Report (report_no, editor, dept_no, dept_name, dept_addrs, author_id, author_name, author_addrs)

with the set of functional dependenceies.

F = {report_no $\rightarrow$ editor; editor $\rightarrow$ dept_no; dept_no $\rightarrow$ dept_name, dept_addrs; author_id $\rightarrow$ author_name, author_addrs}

What is the key for the above relation? Decompose Report into highest normal form. [2+5]

b) Differentiate between tuple relational calculus and domain relational calculus with the help of suitable examples. [3]

Group – B

Answer <u>any one</u> question : [1×5]

7. Draw and explain the timing diagram of "OUT" instruction.

8. Discuss interrupt driven data transfer with the help of a flowchart.

Answer <u>any three</u> questions : [3×10]

9. a) Compare addressing modes of 8086 with that of 8085. [6]

b) Describe different segment registers of 8086. [4]

10. a) For a 8085 based system, let the following two instructions are carried out :

LXI SP, 0000H ; PUSH D

with D = 09H and E = FAH assumed. Show the stack content during the operation. [4]

b) Write a 8085 microprocessor program to check a binary sting is palindrome or not. [3]

c) Write a short note on 8155. [3]

11. a) 2KB RAM, 2KB ROM, one input and one output device are to be interfaced with 8085 microprocessor. Employ memory mapping scheme to execute the above. [6]

b) What features must processor and the DMA controller must ensure for proper operation in DMA mode? [4]

12. a) Show how $\overline{\text{MEMR}}$ and $\overline{\text{MEMW}}$ signals are derived in 8085? [4]

b) Write a delay subroutine of 1ms considering the clock frequency 2MHz of a 8085 microprocessor. [6]

13. a) Explain various modes of operation in 8255. [6]
    b) What is bus idle machine cycle? [2]
    c) Define SIM. [2]

Group – C

Answer <u>any one</u> question : [1×5]

14. a) What is Software Crisis? [2·5]
    b) What is CMM? [2·5]

15. What do you mean by Decision tree and Decision table? Explain with example. [2·5+2·5]

Answer <u>any two</u> questions : [2×10]

16. a) Explain how do the effort and time required to develop a product increase with the increase in product size using exploratory development style and software engineering principle. [3]
    b) Explain the different component of a structure chart. [2]
    c) Develop a DFD for Library management system of your institute. Consider any students and librarian are the external entities here, where librarian has the administrative privilege. State all your assumption. [5]

17. a) Draw the Interaction Diagram of an ATM System. [3]
    b) Briefly discuss the different phases of Prototyping software development model. Write down the major advantages of this model. [5+2]

18. a) What are the difference between logical DFD and Physical DFD? [2]
    b) What are the different categories of software development project according to the COCOMO estimation model? Explain with example. [3]
    c) For the following problem, calculate the estimated FP. Quantities of Information Domain values are given as : [5]

Information Domain Values	Quantities
Number of inputs	10
Number of outputs	8
Number of inquiries	12
Number of Files	6
Number of external interfaces	2

and complexity weighing factors are determined and the following results are obtained :

Factors	Values
Backup Recovery	4
Data Communication	1
Distributed Processing	0
Performance Critical	3
Existing Operating Environment	2
On-line data entry	5
Input transaction over multiple screen	5
Master file updated online	3
Information domain values complex	3
Internal processing complex	2
Code design for reuse	0
Conversion/Installation in design	1
Multiple installations	3
Application designed for change	5

19. a) Write down the characteristics of a good SRS document [2]

b) Write short notes on :

i) State Transition Diagram [4]

ii) Black-box Testing [4]

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