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Department of Computer Science and Engineering

Begum Rokeya University, Rangpur.

B.Sc. Engineering 3rd Year 1st Semester Final Examination-2017 (Session: 2014-15)

Course Code: **CSE 3101** Course Title: **Database Management Systems**

Time: 3.00 Hours **Full Marks: 50**

N.B.: Answer any **FIVE** of the following questions. The figures in the margin indicate full marks. All questions must be answered sequentially.

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1. **(a)** List four significant differences between a file-processing system and a DBMS. 3
   (b) Discuss advantage and disadvantage of storing data in a database management system. If there are some disadvantage, how they can be attributed? 3
   (c) What are five main functions of a Database Administrator? 2
   (d) Define the keywords: Touples, Schema, DDL, DML. 2

2. **(a)** How **SQL** is different from other programming language? What are the operations performed in SQL? 3
   (b) Make a comparative analysis of **HAVING, WITH** and **WHERE** clause in SQL. 3
   (c) What are the impact of **Cartesian Product** and **JOIN** over two relations? 2
   (d) Why do we need to impose **constraint** in SQL? How can we do it? 2

3. Assume we have the following application that models soccer teams, the games they play, and the players in each team. In the design, we want to capture the following: 10
   - We have a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs.
   - Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses.
   - Teams play matches, in each match there is a host team and a guest team. The match takes place in the stadium of the host team.
   - For each match we need to keep track of the following:
     - ✓ The date on which the game is played
     - ✓ The final result of the match
     - ✓ The players participated in the match. For each player, how many goals he scored, whether or not he took yellow card, and whether or not he took red card.
     - ✓ During the match, one player may substitute another player. We want to capture this substitution and the time at which it took place.
   - Each match has exactly three referees. For each referee we have an ID (unique identifier), name, DoB, years of experience. One referee is the main referee and the other two are assistant referee

   Now, Create the relational model corresponding to the described application. Basically, list the CREATE TABLE statements with the attribute names, and appropriate data types. Also make sure to have the primary keys and foreign keys clearly defined (use the back of the page if needed).

4. **(a)** How do **Stored Procedures**, **Functions**, **Views** and **Triggers** play role in database operations? Describe with proper SQL queries. 4
   (b) The following relations keep track of **airline flight information**: 6
   Flights*(flno:integer, from: string, to: string, distance:integer, departs:time, arrives:time, price:real)*
   Aircraft*(aid:integer, aname:string, cruisingrange: integer)*
   Certified*(eid: integer, aid:integer)*
   Employees*(eid:integer, ename:string, salary: integer)*

   Note that the Employees relation describes pilots and other kinds of employees as well; every

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pilot is certified for some aircraft, and only pilots are certified to fly. Write each of the following queries in SQL.

i). Find the ***names*** of aircraft such that all pilots certified to operate them have salaries more than Tk.2,00,000.

ii). For each pilot who is certified for more than three aircraft, find the ***eid*** and the maximum ***cruising range*** of the aircraft for which she or he is certified.

iii). Find the ***names*** of pilots whose salary is less than the price of the cheapest route from Dhaka to Singapore.

iv). For all aircraft with cruising range over 1000 miles, find the ***name*** of the aircraft and the ***average salary*** of all pilots certified for this aircraft.

5. **(a)** What are the main activities of query processing and optimization? Describe each step with figure. **3**

(b) How can we measure the cost of a query? Describe with a selection operation for binary search and linear search. **3**

(c) "Find the names of all instructors in the Music department together with the course title of all the courses that the instructors teach." **4**

```
instructor(ID, name, dept name, salary)
teaches(ID, course id, sec id, semester, year)
course(course id, title, dept name, credits)
```

i. Find out the all possible expression tree for the query
ii. Create query evaluation plan
iii. Write down the ultimate relational algebra.

6. **(a)** Indices speed query processing, but it is usually a bad idea to create indices on every attribute, and every combinations of attributes, that is a potential search keys. Explain why. 2

(b) When is it preferable to use a dense index rather than a sparse index? Explain your answer. 3

(c) Construct a B+-tree for the following set of key values: 5

(2, 3, 5, 7, 11, 17, 19, 23, 29, 31, 33, 35,37, 39 41)

Assume that the tree is initially empty and values are added in ascending order. Construct B+ -trees for the cases where the number of pointer is Three (03) that will fit in one node.

7. **(a)** Database-system implementers have paid much more attention to the ACID properties than have file-system implementers. Why might this be the case? 2

(b) Explain the distinction between the terms serial schedule and serializable schedule. 2

(c) What is the phantom problem? 2

(d) Suppose two schedules T1 andT2 are given. Initial values of A and B are 25. Now check for the serial schedules and also their **serializability**. 4

T_1	T_2
READ(A,t)	READ(A,s)
t := t+100	s := s*2
WRITE(A,t)	WRITE(A,s)
READ(B,t)	READ(B,s)
t := t+100	s := s*2
WRITE(B,t)	WRITE(B,s)

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Department of Compute Science and Engineering
Begum Rokeya University, Rangpur.
B.Sc. Engineering 3rd Year 1st Semester Final Examination -2017

Course Title: Design & Analysis of Algorithm **Full Marks: 50**
Course Code: CSE 3103 **Time: 3 Hours**

Answer any FIVE of the Following Questions

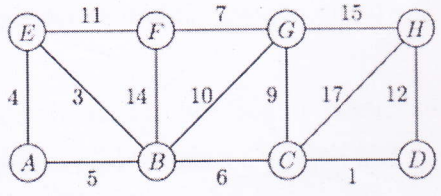
(Note: Numbers in the right margin indicate marks for each question. All questions must be answered sequentially)

1. (a) What are the characteristics of an algorithm? 4
   (b) Write the asymptotic notations used for best case, average case and worst case analysis of algorithms and Write an algorithm for finding maximum element of an array perform best, worst and average case complexity with appropriate order notations. 6

2. (a) Suppose we have an array A of numbers of size **n** and suppose that the array is already sorted in increasing order with no duplicates. Indexing into the array is an O(1) operation. For each of the following problems, give a brief description of a simple algorithm and state the running time of your algorithm. No proof required. 4
      i. Compute the maximum value in the array, i.e., $\max_{1\le t\le n} A[t]$
      ii. Compute the mean or average value in the array, i.e., $\frac{1}{n}\sum_{t=1}^{n} A[t]$
      iii. Compute the minimum value in the array, i.e., $\min_{1\le t\le n} A[t]$
      iv. Compute the median of the array.
   (b) How can you extend the Depth-first-search (DFS) to implent the *topological sorting algorithm?* Explain your answerl. 6

3. (a) Let $A[1.....n]$ be an array of n distinct numbers. If $i < j$ and $A[i] > A[j]$, then the pair (i, j) is called an *inversion* of A. List the inversions of the array $\{2, 3, 8, 6, 1\}$ 2
   (b) Compare and contrast mergesort and insertion sort algorithms. Illustrate the operation of merge sort on the array $A = \{3, 41, 52, 26, 38, 57, 9, 49\}$ 5
   (c) Write down the complexities of the folloing algorithms: i) Floyd-Warshall All-Pairs Shortest Paths ii) counting sort iii) KMP-pattern-matching 3

4. (a) Discuss an algorithm that detects cycle existance in an undirected graph and has complexity of O(V+E) 6
   (b) 2



Consider the weighted graph above.
i) Run Kruskal's algorithm starting from vertex A. Write the edges in the order which they are added to the minimum spanning tree.

   (c) How would you optimize bubble-sort algorithm after the array becomes already sorted to skip extra passes? 2

5. (a) Explain shortest path algorithm with example. 4
   (b) What is the running time of BFS if its input graph is represented by an adjacency matrix and the algorithm is modified to handle this form of input? 4
   (c) List the lower bounds for sorting, searching and multiplication. 2

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6. **(a)** We can model a data network as a directed graph, with each vertex corresponding to a router and each edge corresponding to a connection between routers. In routing data through a network, there is a time delay associated with going through a connection — but there is also a time delay associated with passing through the router from one connection to the next. How can we use Dijkstra's algorithm so that it still finds the fastest route between two points in the network?

(b) Trace the dynamic programming algorithm for the longest common subsequence problem with strings X[1…4] = "bacb" and Y[1…6] = "abcabc". Complete all the entries in the table below, and also build all of the optimal solutions **5**

	0	1	2	3	4	5	6	6
0								
1								b
2								a
3								c
4								b
	a	b	c	a	b	c		

(c) Explain how cross product can help to determine whether two line segment intersect with necessary illustrations. **2**

7. **(a)** Briefly explain the bubble sort algorithm and derive its complexity. **3**

(b) Discuss the role of algoirthm in today's technology driven world. **4**

(a) Write an algorithm to the maximum and minimum in an unsorted array. **3**

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Course Title: Computer Architecture **Full Marks: 50**
Course Code: CSE 3105 **Time: 3 Hours**

N.B.: Answer any **FIVE** of the following questions. The figures in the margin indicate full marks. All questions must be answered sequentially.

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1 a. Distinguish among following terms: 3
   i) Computer Organization;
   ii) Computer Design; and
   iii) Computer Architecture.

   b. Briefly illustrates how major parts of a computer are connected? 2

   c. Describe different types of computer architecture. What type of computer architecture do we use in a general-purpose computer? 2+1

   d. Using basic gates, implement logic circuits that can perform two De-Morgan's law. Verify you circuit with Truth Table. 2

2 a. Categorize Digital logic circuit and briefly describe their basic properties. 2

   b. Consider you are developing an electrical device which requires a 4 X 16 decoder. However, you have several 2 X 4 decoders. How can use your available decoders to suffice your requirement. Draw the schematic diagram and explain it accordingly. 6

   b. Differentiate functions between a Decoder and a Multiplexer. 2

3 a. Consider you have a number system with radix *r* value 3 with number symbols A, B and C (shown in ascending order of value). Perform following operations for such a number system. 4
   i) ABB + AB =?
   ii) CAB – ABC =?

   b. When an overflow occurs in addition? How overflow can be detected? 3

   c. With proper example, describe on how floating points integers are represented? 3

4 a. Why do we need to use Bus to transfer data? 0.5

   b. A digital computer has a common bus system for 16 registers of 32 bit each. The bus is constructed with multiplexers 4.5
      a. How many selection inputs are there in each multiplexer?
      b. What sizes of multiplexers are needed?
      c. How many multiplexers are there in the bus?

   c. Consider an equation 5

$$D = A + Y + C_{in}$$

   To perform this equation, implement a 4-bit arithmetic circuit.

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5 a. A computer uses a memory unit with 256K words of 32 bits each. A binary instruction code is stored in one word memory. The instruction has four parts: an indirect bit, an operation code, a register code part to specify one of 64 registers, and an address part. 6

i. How many bits are there in the operation code, the register code part, and the address part?
ii. Draw the instruction word format and indicate the number of bit in each part.
iii. How many bits are there in the data and address input of the memory?

b. What is the main difference between a direct and an indirect address instruction? 1

c. Write down at least 8 different computer registers that are commonly used along with their functions. 3

6 a. Classify machine languages in categories. 2

b. The following program is stored in the memory unit of the basic computer. Show the contents of the *AC*, *PC* and *IR* (in hexadecimal), at the end, after each instruction is executed. All numbers listed below are in hexadecimal. 6

Location	Instruction
010	CLA
011	ADD 016
012	BUN 014
013	HLT
014	AND 017
015	BUN 013
016	C1A5
017	93C6

c. What do you mean by Instruction Set Completeness? What are the four sufficient properties that identify completeness of an Instruction Set? 2

7 Write short notes on the followings (Any **FOUR**) 4x2.5 =10

i. Op-code
ii. Three-State Bus Buffers
iii. ALU
iv. The Assembler
v. Parallel Processing

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B.Sc. Engineering 3rd Year 1st Semester Final Examination -2017

Course Title: Communication Engineering **Full Marks: 50**
Course Code: CSE 3107 **Time: 3 Hours**

Answer any FIVE of the Following Questions

(Note: Numbers in the right margin indicate marks for each question. All questions must be answered sequentially)

1. a) What do you mean by protocol? Briefly describe the key elements of protocol. 4
   b) Describe the layer of OSI model which is responsible for the delivery of individual packets from the source host to the destination host. 3
   c) Describe the responsibilities of session layer in OSI model. 3

2. a) How many levels of addresses are used at internet employing in TCP/IP protocols? Describe each level with suitable example. 7
   b) Explain each parameter to represent a sine wave. 3

3. a) Draw a composite signal with frequencies 1Hz, 3Hz, and 5Hz in time domain and frequency domain. 3
   b) Draw a digital signal with four levels where bit rate is 16bps. 3
   c) Describe all impairment causes when signals travel through transmission media. 4

4. a) Define Bandwidth, Throughput, Latency, and Jitter. 4
   b) Describe the working principle of Pulse Code Modulation (PCM). 4
   c) Depict delta modulation. 2

5. a) How data elements differ from signal element? 2
   b) What problem arises if the receiver has big bit duration than sender? How it can be resolved? 2
   c) Find out NRZI and Manchester code of binary string: 010111000110. 4
   d) Note down some advantages and disadvantages of serial and parallel transmission. 2

6. a) Define Hamming Distance. Write the problems and prospects for Hamming Code. Generate Hamming Code for the message 1101. 6
   b) Define Piggybacking. 1
   c) Using CRC determine the message to be send (T(x)), where message=1001011101 and Polynomial key, p=110101. 3

7. a) Explain the working principle of multistage switch. 3
   b) When you use circuit switching in telephone communication, how many phases are required? Explain each phases. 4
   c) Discuss Roaming as the feature of cellular telephony in short. Find out period of the moon. [The Moon is located 384000 km above the earth and the radius of the earth is 6378 km]. 3

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Course Title; Theory of Computation and Automata **Full Marks: 50**
Course Code: CSE 3109 **Time: 3 Hours**

N.B.: Answer any **FIVE** of the following questions. The figures in the margin indicate full marks. All questions must be answered sequentially.

1. a) Differentiate between natural and formal languages. 2
   b) Prove the following by principle of induction. $\sum_{x=1}^{n} x^2 = \frac{n(n+1)(2n+1)}{6}$ 3
   c) Prove the following statement: 'Corresponding to every transition graph, there need not exist an FSM, but converse is always true'. 3
   d) Show that 'the set of real numbers R is not countable'. 2

2. a) What is the need of finite automata? 2
   b) Consider the following grammar $E \to E + T|T \quad T \to T * F|F \quad F \to (E)|id$. Illustrate the working procedure of a shift-reduce parser for the string 'id + id * id'. 4
   c) Discuss the problems that may occur while constructing the top-down parser and their solutions. 4

3. a) Consider the following NFA with $\varepsilon -$ transitions. Assume 'p' to be initial state and 'r' as final state. 6

δ	ε	a	b	c
p	{ ∅ }	{p}	{q}	{r}
q	{p}	{q}	{r}	{ ∅ }
r	{q}	{r}	{ ∅ }	{p}

   i) Compute $\varepsilon -$closure of each state.
   ii) List all the strings of length three or less accepted by the automata.
   Convert the automata to its equivalent NFA.
   b) Construct a NFA with epsilon for the regular expression$RE = (a/b)^*ab$. 4

4 a) Explain the concept of 'first' and 'follow' sets using suitable examples. In addition discuss the rules to compute 'first' and 'follow'. 5
   b) Let G be the grammar: $S \to 0A|1A, A \to 0|0S|1AA, B \to 1|1S|0BB$. 5
   For the string 1101101001, find i) Leftmost derivation
   ii) Rightmost derivation
   iii) Parse tree

5. a) Define context free grammar with example. 2
   b) What is parsing? Describe Exhaustive search Parsing and Top down parsing in short. 4
   c) Show that the grammar: $S \to S|S \quad S \to a$ is ambiguous. 4

6. a) What is the purpose of normalization? Construct CNF and GNF for the following grammar and explain the steps 6
   $S \to aAa|bBb|\varepsilon \quad A \to C|a \quad B \to C|b \quad C \to CDE|\epsilon \quad D \to A|B|ab$
   c) Explain Halting problem. Is it solvable or unsolvable problem? Discuss. 4

7. a) What do you know about Chomsky Hierarchy? Convert the following right-linear grammar to its equivalent left-linear grammar. $S \to bB \quad B \to bC \quad B \to aB \quad B \to b \quad C \to a$ 1+4
   b) Explain BACKUS-NAUR form. Briefly discuss the application of context-free grammar. 2+3