Problem based learning

**C/C++:**

Q1.)C Program to Split an Array from Specified Position & Add First Part to the End.

Q2.)C Program to identify missing Numbers in a given Array

Q3.)C Program to Check Whether a Number can be expressed as Sum of Two Prime Numbers.

Q4.) C++ program to reverse a Sentence Using Recursion

Q5.)C++ Program to Sort Elements in Lexicographical Order (Dictionary Order).

Q6.)C++ Program to remove all Characters in a String except Alphabets.

**DATA STRUCTURES**

**Data structure in C:**

1. WAP to Check whether a Tree is a Binary Search Tree
2. WAP To Find the Smallest and Largest Elements in the Binary Search Tree
3. C Program to sort a linked list
4. count the number of nodes in a link list using C

**Data structure in C++:**

1. C++ program to perform a PUSH operation on a dynamically allocated stack
2. C++ Program for Linked List Representation of Linear Queue

**Data structure in JAVA:**

1. How to get the maximum element from a vector?
2. How to swap two elements in a vector?
3. How to reverse a string using stack?
4. How to add an element at first and last position of a linked list?
5. Insertion of a node in Linked List

**Computer Architecture & Organization**

**Q1.) An instruction pipeline has the speedup factor 10 while operation with 80% efficiency. What could be the number of stages in the pipeline?**

**Q2.)Could you replace the CPU cache with an SRAM? if you can what would be an advantage and disadvantage.**

**Q3.)Consider a four stage pipeline with the respective delays t1=60nSeconds, t2=70nSeconds, t3=100nSeconds, t4=80nSeconds and the latch delay of 10nSeconds. What is the approximate Speedup when the very large number of instructions on pipeline?**

**Q4.) Consider a multiplexer with X and Y as data inputs and Z as control input. Z = 0 selects input X, and Z = 1 selects input Y. What are the connections required to realize the 2-variable Boolean function f = T + R, without using any additional hardware?**

**(A)** R to X, 1 to Y, T to Z

**(B)** T to X, R to Y, T to Z

**(C)** T to X, R to Y, 0 to Z

**(D)** R to X, 0 to Y, T to Z

**Q5.) Consider the partial implementation of a 2-bit counter using T flip-flops following the sequence 0-2-3-1-0, as shown below**

**To complete the circuit, the input X should be**

**(A)** Q2′

**(B)** Q2 + Q1

**(C)** (Q1 ⊕ Q2)’

**(D**) Q1 ⊕ Q2

**Q6.) A 4-bit carry lookahead adder, which adds two 4-bit numbers, is designed using AND, OR, NOT, NAND, NOR gates only. Assuming that all the inputs are available in both complemented and uncomplemented forms and the delay of each gate is one time unit, what is the overall propagation delay of the adder? Assume that the carry network has been implemented using two-level AND-OR logic.**  
**(A)** 4 time units  
**(B)** 6 time units  
**(C)** 10 time units  
**(D)** 12 time units

**Q7.) Consider the following program segment for a hypothetical CPU having three user registers R1, R2 and R3.**

**Instruction Operation Instruction Size(in words)**

**MOV R1,5000; R1 ¬ Memory[5000] 2**

**MOV R2, (R1); R2 ¬ Memory[(R1)] 1**

**ADD R2, R3; R2 ¬ R2 + R3 1**

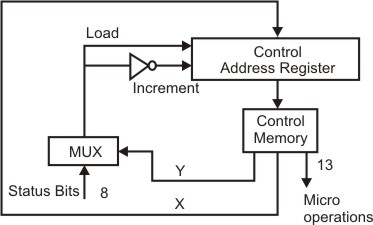
**MOV 6000, R2; Memory [6000] ¬ R2 2**

**HALT Machine halts 1**

**Consider that the memory is byte addressable with size 32 bits, and the program has been loaded starting from memory location 1000 (decimal). If an interrupt occurs while the CPU has been halted after executing the HALT instruction, the return address (in decimal) saved in the stack will be**

**(A)** 1007  
**(B)** 1020  
**(C)** 1024  
**(D)** 1028

**Q8.) The microinstructions stored in the control memory of a processor have a width of 26 bits. Each microinstruction is divided into three fields: a micro-operation field of 13 bits, a next address field (X), and a MUX select field (Y). There are 8 status bits in the inputs of the MUX.**

**[](https://www.geeksforgeeks.org/wp-content/uploads/gq/2014/09/GATECS2004Q65.png)**

**How many bits are there in the X and Y fields, and what is the size of the control memory in number of words?**  
**(A)** 10, 3, 1024  
**(B)** 8, 5, 256  
**(C)** 5, 8, 2048  
**(D)** 10, 3, 512

**Q9.) Let A = 1111 1010 arid B = 0000 1010 be two 8-bit 2’s complement numbers. Their product in 2’s complement is**  
**(A)** 1100 0100  
**(B)** 1001 1100  
**(C)** 1010 0101  
**(D)** 1101 0101  
**Q10.) Consider an instruction pipeline with five stages without any branch prediction: Fetch Instruction (FI), Decode Instruction (DI), Fetch Operand (FO), Execute Instruction (EI) and Write Operand (WO). The stage delays for FI, DI, FO, EI and WO are 5 ns, 7 ns, 10 ns, 8 ns and 6 ns, respectively. There are intermediate storage buffers after each stage and the delay of each buffer is 1 ns. A  
program consisting of 12 instructions I1, I2, I3, …, I12 is executed in this pipelined processor. Instruction I4 is the only branch instruction and its branch target is I9. If the branch is taken during the execution of this program, the time (in ns) needed to complete the program is**

**(A)** 132  
**(B)** 165  
**(C)** 176  
**(D)** 328

**Operating System**

**Q1) What is the cyclomatic complexity of a module which has seventeen edges and thirteen nodes?**  
**(A)** 4  
**(B)** 5  
**(C)** 6  
**(D)** 7

**Q2) Which of the following types of coupling has the weakest coupling?  
(A)** Pathological coupling

**(B)** Control coupling  
**(C)** Data coupling   
**(D)** Message coupling  
  
  
**Q3) Which of the following testing methods uses fault simulation technique?**  
**(A)** unit testing   
**(B)** beta testing  
**(C)** stress testing   
**(D)** mutation testing

**Q4) The atomic fetch-and-set x, y instruction unconditionally sets the memory location x to 1 and fetches the old value of x in y without allowing any intervening access to the memory location x. consider the following implementation of P and V functions on a binary semaphore .**

**void P (binary\_semaphore \*s) {**

**unsigned y;**

**unsigned \*x = &(s->value);**

**do {**

**fetch-and-set x, y;**

**} while (y);**

**}**

**void V (binary\_semaphore \*s) {**

**S->value = 0;**

**}**

**Which one of the following is true?**  
**(A)** The implementation may not work if context switching is disabled in P.  
**(B)** Instead of using fetch-and-set, a pair of normal load/store can be used  
**(C)** The implementation of V is wrong  
**(D)** The code does not implement a binary semaphore

**Q5) Three concurrent processes X, Y, and Z execute three different code segments that access and update certain shared variables. Process X executes the P operation (i.e., wait) on semaphores a, b and c; process Y executes the P operation on semaphores b, c and d; process Z executes the P operation on semaphores c, d, and a before entering the respective code segments. After completing the execution of its code segment, each process invokes the V operation (i.e., signal) on its three semaphores. All semaphores are binary semaphores initialized to one. Which one of the following represents a deadlockfree order of invoking the P operations by the processes?**  
**(A)** X: P(a)P(b)P(c) Y:P(b)P(c)P(d) Z:P(c)P(d)P(a)  
**(B)** X: P(b)P(a)P(c) Y:P(b)P(c)P(d) Z:P(a)P(c)P(d)  
**(C)** X: P(b)P(a)P(c) Y:P(c)P(b)P(d) Z:P(a)P(c)P(d)  
**(D)** X: P(a)P(b)P(c) Y:P(c)P(b)P(d) Z:P(c)P(d)P(a)

**Q6) A shared variable x, initialized to zero, is operated on by four concurrent processes W, X, Y, Z as follows. Each of the processes W and X reads x from memory, increments by one, stores it to memory, and then terminates. Each of the processes Y and Z reads x from memory, decrements by two, stores it to memory, and then terminates. Each process before reading x invokes the P operation (i.e., wait) on a counting semaphore S and invokes the V operation (i.e., signal) on the semaphore S after storing x to memory. Semaphore S is initialized to two. What is the maximum possible value of x after all processes complete execution? (GATE CS 2013)**

**(A)** -2  
**(B)** -1  
**(C)** 1  
**(D)** 2

**Q7) Consider three processes, all arriving at time zero, with total execution time of 10, 20 and 30 units, respectively. Each process spends the first 20% of execution time doing I/O, the next 70% of time doing computation, and the last 10% of time doing I/O again. The operating system uses a shortest remaining compute time first scheduling algorithm and schedules a new process either when the running process gets blocked on I/O or when the running process finishes its compute burst. Assume that all I/O operations can be overlapped as much as possible. For what percentage of time does the CPU remain idle?**  
**(A)** 0%  
**(B)** 10.6%

**(C)** 30.0%

**(D)** 89.4%

**Q8) Consider three CPU-intensive processes, which require 10, 20 and 30 time units and arrive at times 0, 2 and 6, respectively. How many context switches are needed if the operating system implements a shortest remaining time first scheduling algorithm? Do not count the context switches at time zero and at the end.**  
**(A)** 1  
**(B)** 2  
**(C)** 3  
**(D)** 4  
  
**Q9) Which of the following is FALSE about SJF (Shortest Job First Scheduling)?**

**S1: It causes minimum average waiting time**

**S2: It can cause starvation**

**(A)** Only S1  
**(B)** Only S2  
**(C)** Both S1 and S2  
**(D)** Neither S1 nor S2

**Q10) The most optimal scheduling algorithm is:**  
**(A)** First come first serve (FCFS)   
**(B)** Shortest Job First (SJF)   
**(C)** Round Robin (RR)   
**(D)** None of the above

**Data Base Management System**

**Q1) Consider a relational table r with sufficient number of records, having attributes A1, A2,…, An and let 1 <= p <= n. Two queries Q1 and Q2 are given below.**

**The database can be configured to do ordered indexing on Ap or hashing on Ap. Which of the following statements is TRUE?**

(A) Ordered indexing will always outperform hashing for both queries

(B) Hashing will always outperform ordered indexing for both queries

(C) Hashing will outperform ordered indexing on Q1, but not on Q2

(D) Hashing will outperform ordered indexing on Q2, but not on Q1.

**Q2)Consider the FDs given in above question. The relation R is**

(A) in 1NF, but not in 2NF.

(B) in 2NF, but not in 3NF.

(C) in 3NF, but not in BCNF.

(D) in BCNF

**Q3)Consider the set of relations shown below and the SQL query that follows.**

Students: (Roll\_number, Name, Date\_of\_birth)

Courses: (Course number, Course\_name, Instructor)

Grades: (Roll\_number, Course\_number, Grade)

select distinct Name

from Students, Courses, Grades

where Students. Roll\_number = Grades.Roll\_number

andCourses.Instructor = Korth

andCourses.Course\_number = Grades.Course\_number

andGrades.grade = A

**Q4) Which of the following sets is computed by the above query?**

(A) Names of students who have got an A grade in all courses taught by Korth

(B) Names of students who have got an A grade in all courses

(C) Names of students who have got an A grade in at least one of the courses taught by Korth

(D) None of the above

**Q5)Given a block can hold either 3 records or 10 key pointers. A database contains n records, then how many blocks do we need to hold the data file and the dense index**

(A) 13n/30

(B) n/3

(C) n/10

(D) n/30

**Q6) Consider the following database table:  
Create table test(  
one integer,  
two integer,  
primary key(one),  
unique(two),  
check(one >= 1 and <= 10), check(two >= 1 and <= 5) ); How many data records/tuples atmost can this table contain?**

**(A)** 5  
**(B)** 10  
**(C)** 15  
**(D)** 50

**Q7) Suppose ORACLE relation R(A, B) currently has tuples {(1, 2), (1, 3), (3, 4)} and relation S(B, C) currently has {(2, 5), (4, 6), (7, 8)}. Consider the following two SQL queries SQ1 and SQ2 :  
SQ1 : Select \*  
From R Full Join S  
On R.B = S.B;  
SQ2 : Select \*  
From R Inner Join S  
On R.B = S.B;  
The numbers of tuples in the result of the SQL query SQ1 and the SQL query SQ2 are given by:**

**(A)** 2 and 6 respectively  
**(B)** 6 and 2 respectively  
**(C)** 2 and 4 respectively  
**(D)** 4 and 2 respectively  
  
**Q8) Consider the following three SQL queries (Assume the data in the people table):  
(a)Select Name from people where Age > 21;  
(b)Select Name from people where Height > 180;  
(c)Select Name from people where (Age > 21) or (Height > 180);  
If the SQL queries (a) and (b) above, return 10 rows and 7 rows in the result set respectively, then what is one possible number of rows returned by the SQL query (c) ?**

**(A)** 3  
**(B)** 7  
**(C)** 10  
**(D)** 21

**Q9) Three concurrent processes X, Y, and Z execute three different code segments that access and update certain shared variables. Process X executes the P operation (i.e., wait) on semaphores a, b and c; process Y executes the P operation on semaphores b, c and d; process Z executes the P operation on semaphores c, d, and a before entering the respective code segments. After completing the execution of its code segment, each process invokes the V operation (i.e., signal) on its three semaphores. All semaphores are binary semaphores initialized to one. Which one of the following represents a deadlock-free order of invoking the P operations by the processes?**  
**(A)** X: P(a)P(b)P(c) Y: P(b)P(c)P(d) Z: P(c)P(d)P(a)  
**(B)** X: P(b)P(a)P(c) Y: P(b)P(c)P(d) Z: P(a)P(c)P(d)  
**(C)** X: P(b)P(a)P(c) Y: P(c)P(b)P(d) Z: P(a)P(c)P(d)  
**(D)** X: P(a)P(b)P(c) Y: P(c)P(b)P(d) Z: P(c)P(d)P(a)

**Q10) Which of the following statements is/are FALSE?**

**1. For every non-deterministic Turing machine,**

**there exists an equivalent deterministic Turing machine.**

**2. Turing recognizable languages are closed under union**

**and complementation.**

**3. Turing decidable languages are closed under intersection**

**and complementation.**

**4. Turing recognizable languages are closed under union**

**and intersection.**

**(A)** 1 and 4 only  
**(B)** 1 and 3 only  
**(C)** 2 only  
**(D)** 3 only

**Algorithms**

**Q1) What is recurrence for worst case of QuickSort and what is the time complexity in Worst case?**  
**(A)** Recurrence is T(n) = T(n-2) + O(n) and time complexity is O(n^2)  
**(B)** Recurrence is T(n) = T(n-1) + O(n) and time complexity is O(n^2)  
**(C)** Recurrence is T(n) = 2T(n/2) + O(n) and time complexity is O(nLogn)  
**(D)** Recurrence is T(n) = T(n/10) + T(9n/10) + O(n) and time complexity is O(nLogn)

**Q2) Suppose we are sorting an array of eight integers using quicksort, and we have just finished the first partitioning with the array looking like this:  
2 5 1 7 9 12 11 10  
Which statement is correct?**  
**(A)** The pivot could be either the 7 or the 9.  
**(B)** The pivot could be the 7, but it is not the 9  
**(C)** The pivot is not the 7, but it could be the 9  
**(D)** Neither the 7 nor the 9 is the pivot.

**Q3) Suppose we are sorting an array of eight integers using heapsort, and we have just finished some heapify (either maxheapify or minheapify) operations. The array now looks like this:  
16 14 15 10 12 27 28  
How many heapify operations have been performed on root of heap?**  
**(A)** 1  
**(B)** 2  
**(C)** 3 or 4  
**(D)** 5 or 6

**Q4) You have to sort 1 GB of data with only 100 MB of available main memory. Which sorting technique will be most appropriate?**

**(A)** Heap sort  
**(B)** Merge sort  
**(C)** Quick sort  
**(D)** Insertion sort

**Q5) What is the worst case time complexity of insertion sort where position of the data to be inserted is calculated using binary search?**

**(A)** N  
**(B)** NlogN  
**(C)** N^2  
**(D)** N(logN)^2

**Q6) What is the value of following recurrence.**

**T(n) = T(n/4) + T(n/2) + cn^2**

**T(1) = c**

**T(0) = 0**

**Where c is a positive constant**

**(A)** O(n^3)  
**(B)** O(n^2)  
**(C)** O(n^2 Logn)  
**(D)** O(nLogn)

**Q7) What is the worst case time complexity of following implementation of subset sum problem.**

**(A)** O(n \* 2^n)  
**(B)** O(n^2)  
**(C)** O(n^2 \* 2^n)  
**(D)** O(2^n)

**Q8) Consider the following recurrence:**

**[gate_2006_51](https://www.geeksforgeeks.org/wp-content/uploads/gq/2013/04/gate_2006_51.gif)**

**Which one of the following is true?**

**(A) T(n) = (loglogn)  
(B) T(n) = (logn)  
(C) T(n) = (sqrt(n))  
(D) T(n) = (n)**

**(A)** A  
**(B)** B  
**(C)** C  
**(D)** D

**Q9) The running time of an algorithm is represented by the following recurrence relation:**

**if n<= 3 then T(n) = n**

**else T(n) = T(n/3) + cn**

**Which one of the following represents the time complexity of the algorithm?  
(A) (n)  
(B) (n log n)  
(C) (n^2)  
(D) (n^2log n)**  
**(A)** A  
**(B)** B  
**(C)** C  
**(D)** D

**Q10) What is the time complexity of the following recursive function:**

**(A) (n)   
(B) (nlogn)  
(C) (logn)  
(D) (loglogn)**

**(A)** A  
**(B)** B  
**(C)** C  
**(D)** D

**Computer Networks**

**Q1) Which of the following statements are TRUE?**

**I. The context diagram should depict The system as  
 a single bubble.**

**II. External entities should be identified clearly  
 at all levels of DFDs.**

**III. Control information should not be represented  
 in a DFD.**

**IV. A data store can be connected either to another  
 data store or to an external entity.**  
**(A)** II and III  
**(B)** II and III  
**(C)** I and III  
**(D)** I, II and III

**Q2) Consider the following statements about the cyclomatic complexity of the control flow graph of a program module. Which of these are TRUE?**

**I. The cyclomatic complexity of a module is equal to the maximum number of linearly independent circuits in the graph.**

**II. The cyclomatic complexity of a module is the number of decisions in the module plus one,where a decision is effectively any conditional statement in the module.**

**III.Thecyclomatic complexity can also be used as a number of linearly independent paths that should be tested during path coverage testing.**

**(A)** I and II  
**(B)** II and III  
**(C)** I and III  
**(D)** I, II and III

**Q3) A hard disk has 63 sectors per track, 10 platters each with 2 recording surfaces and 1000 cylinders. The address of a sector is given as a triple (c, h, s), where c is the cylinder number, h is the surface number and s is the sector number. Thus, the 0th sector is addressed as (0, 0, 0), the 1st sector as (0, 0, 1), and so on  
The address <400,16,29> corresponds to sector number:**  
**(A)** 505035  
**(B)** 505036  
**(C)** 505037  
**(D)** 505038  
**Q4) Consider the data given in previous question. The address of the 1039th sector is**

**(A)** (0, 15, 31)  
**(B)** (0, 16, 30)  
**(C)** (0, 16, 31)  
**(D)** (0, 17, 31)

**Q5) Three concurrent processes X, Y, and Z execute three different code segments that access and update certain shared variables. Process X executes the P operation (i.e., wait) on semaphores a, b and c; process Y executes the P operation on semaphores b, c and d; process Z executes the P operation on semaphores c, d, and a before entering the respective code segments. After completing the execution of its code segment, each process invokes the V operation (i.e., signal) on its three semaphores. All semaphores are binary semaphores initialized to one. Which one of the following represents a deadlock-free order of invoking the P operations by the processes?**

**(A)** X: P(a)P(b)P(c) Y: P(b)P(c)P(d) Z: P(c)P(d)P(a)  
**(B)** X: P(b)P(a)P(c) Y: P(b)P(c)P(d) Z: P(a)P(c)P(d)  
**(C)** X: P(b)P(a)P(c) Y: P(c)P(b)P(d) Z: P(a)P(c)P(d)  
**(D)** X: P(a)P(b)P(c) Y: P(c)P(b)P(d) Z: P(c)P(d)P(a)

**Q6) Which of the following statements is/are FALSE?**

**1. For every non-deterministic Turing machine,**

**there exists an equivalent deterministic Turing machine.**

**2. Turing recognizable languages are closed under union**

**and complementation.**

**3. Turing decidable languages are closed under intersection**

**and complementation.**

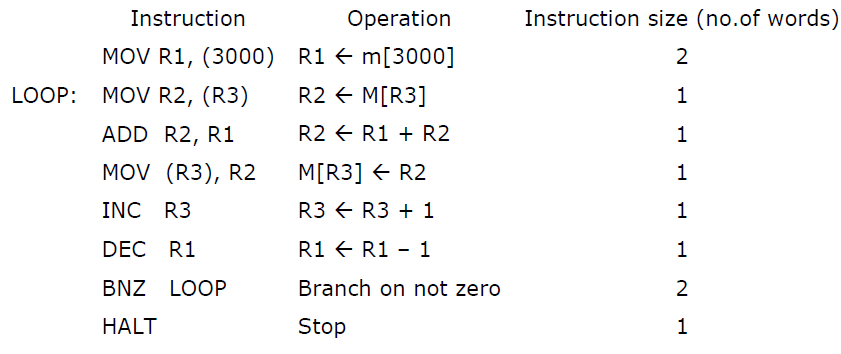
**4. Turing recognizable languages are closed under union**

**and intersection.**

**(A)** 1 and 4 only  
**(B)** 1 and 3 only  
**(C)** 2 only  
**(D)** 3 only

**Q7) The transport layer protocols used for real time multimedia, file transfer, DNS and email, respectively are:**  
**(A)** TCP, UDP, UDP and TCP  
**(B)** UDP, TCP, TCP and UDP  
**(C)** UDP, TCP, UDP and TCP  
**(D)** TCP, UDP, TCP and UDP

**Q8) Consider the following program segment. Here R1, R2 and R3 are the general purpose registers.**

****

**Assume that the content of memory location 3000 is 10 and the content of the register R3 is 2000. The content of each of the memory locations from 2000 to 2010 is 100. The program is loaded from the memory location 1000. All the numbers are in decimal. Assume that the memory is word addressable. The number of memory references for accessing the data in executing the program completely is:**

**(A)** 10  
**(B)** 11  
**(C)** 20  
**(D)** 21

**Q9) Consider the data given in above question. Assume that the memory is word addressable. After the execution of this program, the content of memory location 2010 is:**

**(A)** 100  
**(B)** 101  
**(C)** 102  
**(D)** 110

**Q10) Consider different activities related to email:**

**m1: Send an email from a mail client to a mail server**

**m2: Download an email from mailbox server to a mail client**

**m3: Checking email in a web browser**

**Which is the application level protocol used in each activity?**

**(A)** m1: HTTP m2: SMTP m3: POP  
**(B)** m1: SMTP m2: FTP m3: HTTP  
**(C)** m1: SMTP m2: POP m3: HTTP  
**(D)** m1: POP m2: SMTP m3: IMAP

# **Automata Theory**

**Q1) S –>aSa| bSb| a| b; The language generated by the above grammar over the alphabet {a,b} is the set of**

(A) All palindromes.  
(B) All odd length palindromes.  
(C) Strings that begin and end with the same symbol   
(D) All even length palindromes.

**Q2) Which one of the following languages over the alphabet {0,1} is described by the regular expression: (0+1)\*0(0+1)\*0(0+1)\*?**

(A) The set of all strings containing the substring 00.  
(B) The set of all strings containing at most two 0’s.  
(C) The set of all strings containing at least two 0’s.  
(D) The set of all strings that begin and end with either 0 or 1.

**Q3) Which one of the following is FALSE?**

(A) There is unique minimal DFA for every regular language   
(B) Every NFA can be converted to an equivalent PDA.  
(C) Complement of every context-free language is recursive.  
(D) Every nondeterministic PDA can be converted to an equivalent deterministic PDA.

**4) . Let L = L1 ∩ L2, where L1 and L2 are languages as defined below:  
L1 = {ambmcanbn | m, n >= 0 }  
L2 = {aibjck | i, j, k >= 0 }, Then L is**

(A) Not recursive   
(B) Regular  
(C) Context free but not regular  
(D) Recursively enumerable but not context free.

5) **Let P be a regular language and Q be context-free language such that Q ⊆ P. (For example, let P be the language represented by the regular expression p\*q\* and Q be {pnqn|n∈ N}). Then which of the following is ALWAYS regular?**

(A) P ∩ Q  
(B) P – Q  
(C) ∑\* – P  
(D) ∑\* – Q

6) **Consider the language L1, L2, L3as given below.**  
**L1={0p1q | p,q∈ N}  
L2={0p1q| p,q∈ N and p=q}  
L3={0p1q0r | p,q,r∈N and p=q=r}  
Which of the following statements is NOT TRUE?**  
(A) Push Down Automata (PDA) can be used to recognize L1 and L2  
(B) L1 is a regular language  
(C) All the three languages are context free  
(D) Turing machine can be used to recognize all the three languages

7) **Definition of a language L with alphabet {a} is given as following. L= { ank | k > 0, and n is a positive integer constant} What is the minimum number of states needed in a DFA to recognize L?**  
(A) k+1  
(B) n+1  
(C) 2n+1  
(D) 2k+1

8) **Let L={w ∈ (0 + 1)\*|w has even number of 1s}, i.e. L is the set of all bit strings with even number of 1s. Which one of the regular expression below represents L?**  
(A) (0\*10\*1)\*  
(B) 0\*(10\*10\*)\*  
(C) 0\*(10\*1\*)\*0\*  
(D) 0\*1(10\*1)\*10\*

9) **Consider the languages L1={0i1j | i != j}, L2={0i1j | i = j}, L3 = {0i1j | i = 2j+1}, L4 = {0i1j | i != 2j}. Which one of the following statements is true?**  
(A) Only L2 is context free  
(B) Only L2 and L3 are context free  
(C) Only L1 and L2 are context free  
(D) All are context free

10) **Let w be any string of length n is {0,1}\*. Let L be the set of all substrings of w. What is the minimum number of states in a non-deterministic finite automaton that accepts L?**

(A) n-1  
(B) n  
(C) n+1  
(D) 2n-1

**Structured Query Language (SQL)**

Q1) **Creating three tables:**

1. student
2. marks
3. details

Q2) **How to print duplicate rows in a table?**

# Q3) **What isNested Queries in SQL:**

 Q4) **How to find Nth highest salary from a table**

Q5)

Table A

Id Name Age

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12 Arun 60

15 Shreya 24

99 Rohit 11

Table B

Id Name Age

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15 Shreya 24

25 Hari 40

98 Rohit 20

99 Rohit 11

Table C

Id Phone Area

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10 2200 02

99 2100 01

Consider the above tables A, B and C. How many tuples does the result of the following SQL query contains?

SELECT A.id

FROM A

WHERE A.age> ALL (SELECT B.age

FROM B

WHERE B. name = "arun")

**(A)** 4  
**(B)** 3  
**(C)** 0  
**(D)** 1