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R. V. COLLEGE OF ENGINEERING
Autonomous Institution affiliated to VTU
IV Semester B. E. Examinations Fast Track July-18
Computer Science and Engineering
Object Oriented Programming with C++

*Time: 03 Hours**Maximum Marks: 100***Instructions to candidates:**

1. Answer all questions from Part A. Part A questions should be answered in the first three pages of the answer book only.
2. Answer five full questions from Part B.

PART A

1	1.1	How many elements are allocated for a four dimensional array? Calculate the amount of memory required on a machine that uses 4 bytes per integer for the four dimensional array.	02
	1.2	What is the difference between the type of values returned by the following two functions: a. int & fun1(void) b. const int & fun2(void)	
	1.3	Define "Dangling Reference"	01
	1.4	Can we overload the square function using the following two function definition? int square (int value); float square (int value)	01
	1.5	What is the difference between std::getline and the >>string operation?	01
	1.6	class Seminar { int time; public: Seminar() //Function 1 { time = 30; cout<< "Seminar Starts now"<<endl; } void lecture () //Function 2 cout<<"Lectures in the Seminar on"<<endl; Seminar(int duration) //Function 3 { Time = duration; cout<<"Seminar starts now"<<endl; } ~Seminar() //Function 4 { cout<<"Thanks"<<endl; } };	02

	<p>i. Write statements in C++ that would execute Function 1 and Function 3 of class Seminar.</p> <p>ii. In Object Oriented Programming, what is Function 4 referred and when does it get invoked/called?</p> <p>iii. In Object Oriented Programming, which is concept illustrated by Function 1 and Function 3 together?</p>	
1.7	Mention the difference between function overloading and function overriding.	02
1.8	How are prefix and postfix versions of operator++() differentiated?	01
1.9	Is it possible to have virtual constructor? If yes, How? If not, Why not possible?	01
1.10	Name the operations that cannot be overloaded.	01
1.11	<p>Consider the following declarations and answer the question given below:</p> <pre> class Vehicle { private int wheels; protected : int passenger; public: void inputdata(int, int); void outputdata(); }; class Heavyvehicle : protected Vehicle { int diesel_petrol; protected : int load; public: void readdata(int, int); void writedata(); }; class Bus : private Heavyvehicle { char make[20]; public : void fetchdata(char); void displaydata(); }; </pre> <p>i. Name the data member(s) that can be assessed from the function displaydata().</p> <p>ii. Name the data member's that can be accessed by an object of Bus class.</p> <p>iii. Is the member function outputdata() accessible to the objects of Heavyvehicle class.</p>	02
1.12	Mention functions to perform text input and output in C++.	01
1.13	What is the difference between new()/malloc() and delete()/free().	02
1.14	What is the difference between a copy constructor and an overload assignment operator?	02

PART B

2	a	<p>Write the definition for a class called Rectangle that has floating point data members length and width. The class has the following member functions:</p> <p>a. to set the length data member.</p> <p>b. to set the width data member.</p> <p>c. to calculate and return the perimeter of the rectangle.</p>	
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3		<p>d. to calculate and return the area of the rectangle.</p> <p>e. to display the length and width of the rectangle.</p> <p>f. to find whether the area of the rectangle is same or not. The function returns 1 if Rectangles have the same area, and returns 0 if they don't.</p> <p>i. Write the definitions for each of the above member functions.</p> <p>ii. Write the main function to create two rectangle objects. Take input as the length and width for the first rectangle object and length and width for the second rectangle object. Display each rectangle area and perimeter.</p> <p>iii. Check whether the two rectangles have the same area and print a message indicating the result.</p>	10
	b	<p>Write a C++ program using function overloading concept to display the following:</p> <p>a. C programming.</p> <p>b. C programming C++ programming.</p>	06
	a	<p>OR</p> <p>Define a copy constructor with syntax. Mention the cases when copy constructors will be called.</p>	06
	b	Write a program in C++ to demonstrate constructor overloading with an example.	05
	c	<p>Consider the definition of the following cases:</p> <pre> class Sample { Private; int x; double y; public : Sample(); //Constructor1 Sample(int); //Constructor2 Sample(int, int); //Constructor3 Sample(int, double); //Constructor4 }; </pre> <p>i. Write the definition of the constructor 1 so that the private member variables are initialized to 0.</p> <p>ii. Write the definition of the constructor 2 so that the private member variable x in initialized according to the value of the parameter and the private member variable y in initialized to 0.</p> <p>iii. Write the definition of the constructors 3 and 4 so that private member variables are initialized according to the values of the parameters.</p>	05
4	a	Write a program in C++ to demonstrate the use of new and delete operators. Add two integer numbers by allocating memory to pointers variables of integer type. Display the sum of two numbers and deallocate the memory allocated for the two integer variable.	04
	b	Write a note on visibility of member functions based on private and protected derivations.	04
	c	Write a C++ program to create a class to calculate the area and perimeter of a rectangle using the concept of single inheritance.	08
		OR	

5	a	Discuss the problems associated with multiple inheritances and how are they resolved.	06
	b	Write a C++ program with a base class student. Get the student details such as name, studentID and semester. Define sports class and get as input the various games played and sports score gained pertaining to a particular sports game played. Create a class score that is derived from student and sports. Define display member function to find out the total average sports score. Declare the derived class object, call the necessary functions to read the input, game played, score gained and display the average score along with the student name, ID for the game played.	10
6	a	Write a C++ program to overload '=', '>', '<' operator to check whether a string that is input is equal to, greater than or lesser than the other string.	10
	b	Create a class Rational with suitable data members and member functions. Write a program in C++ to add rational numbers by overloading the binary operator '+'. OR	06
7	a	Create a class Distance with meters and centimeters as data members and include suitable member functions. Write a program in C++ to overload the relational operator '>' to compare two objects of distance class.	06
	b	List advantages of operator overloading feature of object oriented programming.	04
	c	Write the operator function to overload the increment and decrement operators (both prefix and postfix notations).	06
8	a	Discuss the importance of pure virtual functions.	02
	b	What is the Standard Template Library? Name any four of the template classes that are available in STL.	04
	c	Write a C++ program that uses map STL to store and retrieve employee information. The map class should store employee ID and employee name. Display the employee name for the given employee ID. OR	10
9	a	Write a function template for finding the maximum value from list of numbers.	06
	b	Create a class Person with data member to store name of the person and member function to read the name of the person from the user. Declare a member function print to be a pure virtual function. Derive class Employee from Person class. Include private member variables salary and designation. Derive class Student from person class, include GPA as private member. Override getData() and print() function in both Employee and Student class. Write a C++ program, add 2 functions in the program to invoke getdata() and print() that pass Person object by reference or pointer to both the functions. Show the use of virtual functions.	10
10	a	Write a C++ program to find the mean value for a set of numbers. The program should throw an error when the mean value is zero.	10
	b	With the help of a neat diagram, explain the hierarchy of I/O stream classes. OR	06
11	a	Write a code segment to illustrate the formatted I/O functions.	10
	b	Write a C++ program to input numbers to an array for size 5. The program should throw an error when the program attempts to access locations above 5.	06

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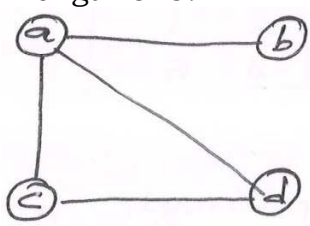
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R. V. COLLEGE OF ENGINEERING
Autonomous Institution affiliated to VTU
IV Semester B. E. Fast Track Examinations July-18
Computer Science and Engineering
DESIGN AND ANALYSIS OF ALGORITHMS

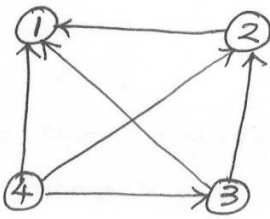
*Time: 03 Hours**Maximum Marks: 100**Instructions to candidates:*

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART A

1	1.1	Name the algorithm design technique that tends to be ideally suited for parallel computation.	01
	1.2	What is the recursion relation to represent the best case of quick sort?	01
	1.3	State the height of binary heap with respect to number of nodes.	01
	1.4	In empirical analysis if efficiency class of the algorithm is n^2 , what will be the shape of the scatter plot?	01
	1.5	Apply Master theorem and calculate the efficiency of the following recurrence relation	
		$t(n) = T\left(\frac{2n}{3}\right) + 1$	01
	1.6	Mention the efficiency of finding an element in an array of n elements given its position.	01
	1.7	Discuss the efficiency of DFS and BFS.	02
	1.8	What are the maximum number of keys that a 2-3 tree can have if the height of the tree is 3. (assume root is at height 0).	02
	1.9	Discuss the principal difference between dynamic programming and divide and conquer.	02
	1.10	Formulate the recursive relation to find the number of additions done while calculating the binomial coefficient using dynamic programming.	02
	1.11	Find the number of character comparisons made by the Boyer's Moore algorithm for searching the pattern 01010 in the binary text of 1000 Zero's.	02
	1.12	Apply transform and conquer strategic on the given graph to count the number of paths with a path length of 3.	
			02
	1.13	Compute 23×24 using divide and conquer.	02

PART B

2	<p>a Illustrate the general plan for analyzing the efficiency of a recursive algorithm. Apply the same to find the factorial of a number.</p> <p>b Discuss with a neat flow chart the process of algorithm design and analysis.</p> <p>c Setup and solve a recurrence relation for the number of calls made by $F(n)$, the recursive algorithm to count the number of bits in the binary representation of a positive decimal number.</p>	06 06 04															
3	<p>a Discuss with a neat diagram the general plan of solving a problem using divide and conquer. Apply the same to multiply the given two matrices. $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}$</p> <p>b Design an algorithm to perform partition used in quick sort. Use the same to sort the elements. $5 \ 3 \ 1 \ 9 \ 8 \ 2 \ 4 \ 7$</p> <p>c Generate all permutations of $\{1,2,3,4\}$ by the Johnson-Trotter algorithm.</p>	06 06 04															
OR																	
4	<p>a Write an algorithm to perform DFS traversal. Perform DFS based topological ordering on the given graph.</p> <div style="text-align: center;">  </div> <p>b Write an algorithm to sort elements using decrease and conquer and discuss its efficiency.</p> <p>c Apply merge sort to sort the list $16 \ 10 \ 24 \ 8 \ 13 \ 20 \ 15$ in ascending order. Find the elements whose position is unchanged in the sorted list.</p>	06 06 04															
5	<p>a Apply memory function to the following instance of the knapsack problem to find the optimal solution (knapsack capacity = 5)</p> <table border="1" data-bbox="659 1496 1029 1691" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Item</th><th>Weight</th><th>Profit</th></tr> </thead> <tbody> <tr> <td>1</td><td>2</td><td>8</td></tr> <tr> <td>2</td><td>1</td><td>6</td></tr> <tr> <td>3</td><td>3</td><td>16</td></tr> <tr> <td>4</td><td>2</td><td>11</td></tr> </tbody> </table> <p>b Write and analyze the efficiency of the algorithm to find the transitive closure of a directed graph using dynamic programming.</p> <p>c Apply Boyer's Moore algorithm to find the pattern AT_THAT in the text WHICH_FINALLY_HALTS.2_AT_THAT.</p>	Item	Weight	Profit	1	2	8	2	1	6	3	3	16	4	2	11	06 06 04
Item	Weight	Profit															
1	2	8															
2	1	6															
3	3	16															
4	2	11															
OR																	
6	<p>a Sort the list in non-decreasing order 4 1 3 2 16 9 10 14 8 7 using heap sort. Show the heapification at every step. (construct heap using bottom up method).</p>	06															

b	Construct a 2-3 tree for the list <i>C, O, M, P, U, T, I, N, G</i> . Discuss the efficiency of constructing a 2-3 tree.	06															
c	Develop a C function to generate the Fibonacci series using dynamic programming.	04															
7	<p>a Write an algorithm to perform the single source shortest path. Listing the same find shortest path form vertex A to the remaining vertices.</p> <div data-bbox="523 517 1158 808" data-label="Diagram"> </div> <p>b Define spanning tree. Discuss any algorithm to find the minimum spanning tree for a given graph using greedy technique. Apply the same for the given input.</p> <div data-bbox="539 958 1150 1279" data-label="Diagram"> </div>	08															
8	<p>a Solve the following instance of the knapsack problem by the branch and bound algorithm.</p> <table border="1" data-bbox="659 1473 1031 1666"> <thead> <tr> <th>Item</th><th>Weight</th><th>Profit</th></tr> </thead> <tbody> <tr> <td>1</td><td>4</td><td>40</td></tr> <tr> <td>2</td><td>7</td><td>42</td></tr> <tr> <td>3</td><td>5</td><td>25</td></tr> <tr> <td>4</td><td>3</td><td>12</td></tr> </tbody> </table> <p>The knapsack capacity <i>W</i> is 10.</p> <p>b Apply backtracking to solve the following instance of the subset-sum problem $s = \{1,3,4,5\}$ and $d = 8$</p> <p>c Draw the decision tree for the three-element selection sort.</p>	Item	Weight	Profit	1	4	40	2	7	42	3	5	25	4	3	12	08
Item	Weight	Profit															
1	4	40															
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R. V. COLLEGE OF ENGINEERING
Autonomous Institution affiliated to VTU
IV Semester B. E. Fast Track Examinations July-18
Computer Science and Engineering
OBJECT ORIENTED PROGRAMMING USING JAVA

*Time: 03 Hours**Maximum Marks: 100**Instructions to candidates:*

3. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
4. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6.

PART-A

1	1.1	Distinguished between object-oriented and object-based languages.	02
	1.2	List the major and minor elements of object model.	02
	1.3	Write the output of the following program. <pre> class sample { public static void main (String args []) { try { int b = 0; int c = 44/b; } catch (Exception e) { System.out.println ("Generic exception catch"); } catch (Arithmetic Exception e) { System.out.println ("Arithmetic Exception catch"); } } } </pre>	01
	1.4	Write a neat diagram that represents the relationship among thread states.	02

1.5	Write the output of the following code: <pre>import java.util.*; class Sample B { public static void main (String args[]) { TreeSet < String > ts = new TreeSet < String > (); ts.add("D"); ts.add("B"); ts.add("C"); ts.add("A"); System.out.println(ts); } }</pre>	02
1.6	Write the purpose of four abstract classes for Java's stream-based I/O operations.	02
1.7	Write the output of the following code in Java: <pre>class Sample C { public static void main (String args[]) { int a = 0, d = 100, e = 52; double f = 53.25; if (a == 1 && e + + < 100) { d = 150; } System.out.println("e = " + e); System.out.println("e = " + e%10); System.out.println("f = " + f%10); } }</pre>	02
1.8	Summarize the steps of the <i>JDBC</i> process.	02
1.9	Describe the life –cycle methods of Java <i>FX</i> application class.	02
1.10	Differentiate between greedy behavior and reluctant behavior of find() method of matches class for pattern matching?	02
1.11	What is Connection Pooling in <i>JDBC</i> ?	01

PART-B

2	a	Illustrate with a real world example, the relationship between Object Oriented Analysis(<i>OOA</i>), Object-Oriented Design (<i>OOD</i>) and Object-Oriented Programming (<i>OOP</i>).	05
	b	Explain the five metrics that measure the quality of abstraction which aid on building quality classes and objects.	05
	c	Draw the state of a car as an aggregation of part states (ignition, transmission, accelerator, brake).	06

3	a	<p>Assume that a Bank maintain <u>two kinds of accounts</u> for customers, one called as <u>Savings Account</u> and other as <u>Current Account</u>. The <u>Savings Account</u> provides Compound Interest and withdrawal facilities, but no cheque book facility. The <u>Current Account</u> provides cheque book facility but no interest. Current Account provides cheque book facility but no interest. Current Account holders should also maintain a minimum balance and if balance falls below this level, a service charge is imposed.</p> <p>Create a class <u>Account</u> that stores Customer Name, Account Number and Type of account. From this <u>derive</u> the classes <u>Cur_Acct</u> and <u>Sav_Acct</u> to make them more specific to their requirements. Include the necessary <u>methods</u> in order to achieve the following tasks:</p> <ul style="list-style-type: none"> i) Accept deposit from the customer and update the balance. ii) Display the balance. iii) Compute and deposit interest. iv) Permit withdrawal and update balance. v) Check for the minimum balance impose penalty, if necessary and update the balance. <p>Develop a Java Program to <u>demonstrate</u> these.</p>	10 06
	b	<p>What is an Exception? Discuss the various keywords Java provides for exception handling, with a suitable Java code.</p>	06
	OR		
4	a	<p>Write a Java program to create a class Queue, with methods insert(), delete() and display() for insertion, deletion and display of elements from Queue respectively. Handle the Queue full and empty conditions using exception handling. Demonstrate the usage of all the keywords provided by Java for exception handling.</p>	06
	b	<p>Discuss Multiple inheritance considering a real world example. Demonstrate how this is achieved in Java with suitable code.</p>	05
	c	<p>Create a user defined package Distance with the Dist Class which has methods to read two co-ordinates x-cord and y-cord of a point, method to compute distance between two points and a method to display the coordinates of a point and distance. Write an appropriate program to use this package.</p>	05
5	a	<p>Explain the various ways of achieving synchronization in multithreaded application in Java with suitable example code</p>	06
	b	<p>Write a program in Java to reverse the characters in a string using block lambda method.</p>	05
	c	<p>Demonstrate with suitable Java code, the differences between iterator and list iterator interfaces to traverse Array list collection.</p>	05
OR			
6	a	<p>Develop a multithreaded Java application to implement the producer consumer problem.</p>	05
	b	<p>Discuss the different types of method references related to lambda expressions, with example code.</p>	05

c	<p>Illustrate the following operations as a Vector class with suitable Java program.</p> <ul style="list-style-type: none"> i) Add an element to a vector. ii) Obtain the element at a specific location. iii) Retrieve the first and last element of a vector. iv) Remove an element. v) Obtain capacity and number of elements currently in a vector. 	06
7 a	<p>Design an interactive JavaFX <i>GUI</i> as shown in figure below, with controls (or components); a label for “Student Details”, labels for Name, <i>USN</i>, Gender and Address details; Text fields for entering Name, <i>USN</i>, Address; Radio button for selecting Gender Male/Female; Two push buttons: to display passport size photo of the students when “Passport Size Photo” button is pressed and the other to save the data entered with an appropriate message “Saved the Student details”.</p> <div data-bbox="638 801 1050 1187" data-label="Image"> </div>	10
b	<p>Develop a JavaFX application with the specifications described.</p>	06
8 a	<p>Differentiate between the various types of statement objects used to execute the query with suitable code.</p>	06
b	<p>Write a <i>JSP</i> program that creates a session attribute “<i>USN</i>” for student <i>USN</i> with value “<i>IPE10CS010</i>”, reads session attribute and then sends the attribute name and value to the browser.</p>	05
c	<p>Illustrate with appropriate example code, JavaBeans introspection where simple naming conventions are used to infer information about properties, events and methods of a Java Bean.</p>	05

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R. V. COLLEGE OF ENGINEERING
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IV Semester B. E. Fast Track Examinations July-18
Computer Science and Engineering
OPERATING SYSTEMS

*Time: 03 Hours**Maximum Marks: 100**Instructions to candidates:*

5. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
6. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART A

1	1.1	List any two advantages of Multiprogramming.	02
	1.2	What are clustered systems?	01
	1.3	Differentiate between CPU-Bound and IO-Bound processes.	02
	1.4	Define context switching.	01
	1.5	List the different states a process goes through during its life cycle, along with its diagram.	02
	1.6	List the two ways in which a thread can be cancelled.	01
	1.7	How many processes are created by the following code snippet? <pre>pid_tpid = fork(); pid = fork(); pid = fork(); if(pid == 0) { fork(); } fork();</pre>	02
	1.8	Define Race condition.	01
	1.9	What is priority Inversion?	01
	1.10	Give two hardware instructions and their definitions, which can be used for implementing mutual exclusion.	02
	1.11	Mention any two methods of handling deadlocks.	02
	1.12	Define logical and physical address space.	02
	1.13	Name the different accessing methods of a file.	01

PART B

2	a	List And explain the services provided by an operating system, which are helpful to the user and the system itself.	06
	b	Write a program to find the sum of 'n' positive integers, using pthread library.	04
	c	Define a system call. Explain the different categories of system calls.	06

3	a	Differentiate between longterm, medium term and short term schedulers, with a neat block diagram.	04																																																	
	b	What is a critical section problem? List and explain the necessary conditions required for the solution to critical section problem.	04																																																	
	c	Suppose the following jobs arrive for processing at the time indicated below and each will run the listed amount of time. <table border="1"><tr><td>Job</td><td>1</td><td>2</td><td>3</td></tr><tr><td>Arrival time</td><td>0.0</td><td>0.4</td><td>1.0</td></tr><tr><td>Burst time</td><td>8</td><td>4</td><td>1</td></tr></table> <div><div>i) Give a Gantt chart for the execution of jobs using FCFS and non-pre-emptive SJF scheduling algorithms.</div><div>ii) What is the turn around time and waiting time of each job for the above algorithms.</div><div>iii) (iii) Compute average turn around time if CPU is left idle for the first 1 unit of time then pre-emptive SJF is used(Job1 and Job2 will wait during this time).</div></div>	Job	1	2	3	Arrival time	0.0	0.4	1.0	Burst time	8	4	1	08																																					
Job	1	2	3																																																	
Arrival time	0.0	0.4	1.0																																																	
Burst time	8	4	1																																																	
OR																																																				
4	a	What is race-around condition? Explain.	04																																																	
	b	Differentiate between pre-emptive and non-pre-emptive scheduling algorithms. Consider the following set of processes with a length of the CPU Burst time given in milliseconds: (lower numbers have higher priority) <table border="1"><tr><td>Process</td><td>Arrival Time</td><td>Burst Time</td><td>Priority</td></tr><tr><td>P₁</td><td>0</td><td>7</td><td>3</td></tr><tr><td>P₂</td><td>3</td><td>2</td><td>2</td></tr><tr><td>P₃</td><td>4</td><td>3</td><td>1</td></tr><tr><td>P₄</td><td>4</td><td>1</td><td>1</td></tr><tr><td>P₅</td><td>5</td><td>3</td><td>3</td></tr></table> <div><div>i) Compute Gantt chart for the following scheduling algorithms: FCFS, SRTF, Pre-emptive Priority and Round Robin(Quantum-1ms)algorithm.</div><div>ii) Compute average waiting time and average turnaround time for the above algorithms.</div></div>	Process	Arrival Time	Burst Time	Priority	P ₁	0	7	3	P ₂	3	2	2	P ₃	4	3	1	P ₄	4	1	1	P ₅	5	3	3	12																									
Process	Arrival Time	Burst Time	Priority																																																	
P ₁	0	7	3																																																	
P ₂	3	2	2																																																	
P ₃	4	3	1																																																	
P ₄	4	1	1																																																	
P ₅	5	3	3																																																	
5	a	Illustrate the use of Semaphores in the First Readers-Writers problem along with its structure.	06																																																	
	b	List and explain the necessary conditions which hold simultaneously in a system for a deadlock to occur.	04																																																	
	c	Consider the following snapshots of a system. <table border="1"><tr><td>Process</td><td colspan="3">Allocation Matrix</td><td colspan="3">Max Matrix</td><td colspan="3">Available Vector</td></tr><tr><td></td><td>A</td><td>B</td><td>C</td><td>A</td><td>B</td><td>C</td><td>A</td><td>B</td><td>C</td></tr><tr><td>P₁ ———</td><td>2</td><td>2</td><td>3</td><td>3</td><td>3</td><td>6</td><td>7</td><td>7</td><td>10</td></tr><tr><td>P₂ ———</td><td>2</td><td>0</td><td>3</td><td>4</td><td>3</td><td>3</td><td></td><td></td><td></td></tr><tr><td>P₃ ———</td><td>1</td><td>2</td><td>4</td><td>3</td><td>4</td><td>4</td><td></td><td></td><td></td></tr></table> <div><div>i) What is the content of the need matrix?</div><div>ii) Is the system in a safe state? If yes, give the safe sequence. If No, give reasons.</div></div>	Process	Allocation Matrix			Max Matrix			Available Vector				A	B	C	A	B	C	A	B	C	P ₁ ———	2	2	3	3	3	6	7	7	10	P ₂ ———	2	0	3	4	3	3				P ₃ ———	1	2	4	3	4	4			
Process	Allocation Matrix			Max Matrix			Available Vector																																													
	A	B	C	A	B	C	A	B	C																																											
P ₁ ———	2	2	3	3	3	6	7	7	10																																											
P ₂ ———	2	0	3	4	3	3																																														
P ₃ ———	1	2	4	3	4	4																																														
OR																																																				

6	a	Describe Resource Allocation graph, for the following : (i) With Deadlock, (ii) With a cycle but No deadlock. Also represent the same with its corresponding wait-for-graph.	08
	b	Explain the Dining Philosophers problem. Illustrate the same using Semaphores. Give the solution to the dining philosophers problem which ensures freedom from deadlocks.	08
7	a	Illustrate the importance of Translation Look-Aside Buffer(TLB). Explain Paging Hardware with TLB.	04
	b	Discuss the following terms in brief: (i) Fragmentation, (ii) Thrashing, (iii) Segmentation, (iv) demand paging.	08
	c	Consider the following reference string 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1. How many page faults would occur for the following page replacement algorithms assuming 3 frames? All frames are initially empty. (i) LRU, (ii) Optimal.	04
8	a	Explain the different types of File Allocation Methods.	06
	b	Suppose that the head of a moving head disk with 200 tracks numbered 0 to 199 is currently servicing a request at track 143 and has just finished a request at track 125. The queue of request is kept in fifo order: 86, 147, 91, 177, 94, 150, 102, 175, 130. Give the total number of head movements needed to satisfy these requests using the following Disk scheduling algorithms: (i) FCFS, (ii) SSTF, (iii) LOOK, (iv) C-SCAN. Identify the efficient Disk scheduling algorithm and give reasons.	10

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R. V. COLLEGE OF ENGINEERING
Autonomous Institution affiliated to VTU
IV Semester B. E. Fast Track Examinations July-18
Computer Science and Engineering
THEORY OF COMPUTATION

*Time: 03 Hours**Maximum Marks: 100**Instructions to candidates:*

7. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
8. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART-A

1	1.1	Define ϵ -NFA.	01												
	1.2	“All automata should have final states”. State true or false with justification.	02												
	1.3	Write Regular Expression for the language consisting of the set of strings over alphabet $\{a, b, c\}$ containing atleast one ‘a’ and atleastone ‘b’.	01												
	1.4	Given two finite automata M_1 and M_2 , are there any strings that are accepted by neither?	02												
	1.5	State Pumping Lemma for regular language.	01												
	1.6	Construct two different Parse trees for the string “abbabbab” generated by the CFG, $S \rightarrow aS bS b$	02												
	1.7	What is the language generated by the CFG with the productions: $S \rightarrow aSb aaSb \epsilon$	01												
	1.8	Define language accepted by PDA.	02												
	1.9	“CFGs accept all non-linear languages.” Justify the statement given.	02												
	1.10	Construct DPDA equivalent to the DFA whose transition table is as below. Here start state is A and final state is C.													
		<table border="1"><tr><td></td><td>0</td><td>1</td></tr><tr><td>A</td><td>B</td><td>A</td></tr><tr><td>B</td><td>B</td><td>C</td></tr><tr><td>C</td><td>C</td><td>C</td></tr></table>		0	1	A	B	A	B	B	C	C	C	C	02
		0	1												
A	B	A													
B	B	C													
C	C	C													
1.11	Draw the Chomsky hierarchy diagram.	02													
1.12	Give example for blank tape non-halting problem in TM.	02													

PART-B

<p>2</p> <p>a</p> <p>b</p> <p>c</p>	<p>Derive a regular expression for the <i>DFA</i> given below using state elimination method. And also mention the language accepted by the given automata.</p> <div style="text-align: center;"> </div> <p>For each of the regular expression below, find an <i>NFA-ε</i> recognizing the language corresponds to the regular expressions by applying the Kleen's theorem part-I. Do not attempt to simplify the answer.</p> <p>i) $(a^* + b^* + c^*)^*$</p> <p>ii) $(ab + (bab)^*)(a)$</p> <p>Minimize the given <i>DFA</i> below, using table filling algorithm and identify the language recognized by the <i>DFA</i>.</p> <div style="text-align: center;"> </div>	<p>04</p> <p>04</p> <p>08</p>
<p>3</p> <p>a</p> <p>b</p> <p>c</p>	<p>Using Pumping Lemma for regular sets show that the language below is not regular.</p> $L = \{0^n \mid n \text{ is prime}\}$ <p>Let M_1 and M_2 be the <i>DFAs</i> as shown below, accepting the languages L_1 and L_2 respectively. Draw <i>DFAs</i> accepting the following languages.</p> <p>i) $L_1 \cup L_2$</p> <p>ii) $L_1 \cap L_2$</p> <p>iii) $L_1 - L_2$</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>M_1:</p> </div> <div style="text-align: center;"> <p>M_2:</p> </div> </div> <p>Given below a <i>CFG</i> G find a <i>CGF</i> G' in <i>GNF</i> generating $L(G) - \{\epsilon\}$.</p> $\begin{aligned} S &\rightarrow AB \\ A &\rightarrow BS a \\ B &\rightarrow SA b \end{aligned}$ <p style="text-align: center;">OR</p>	<p>04</p> <p>06</p> <p>06</p>
<p>4</p> <p>a</p>	<p>Design <i>CFG</i> to generate the language</p> <p>i) $L = \{a^i b^j c^k : i + j = k, i \geq 0, j \geq 0\}$</p> <p>ii) $L = \{a^n b^m c^n : n, m \geq 1\}$</p>	<p>04</p>

b	Convert the $CFG(V, T, P, S)$ with the following productions to CNF . $S \rightarrow abAB$ $A \rightarrow bAB \epsilon$ $B \rightarrow Baa A \epsilon$	06
c	Consider the Grammar $E \rightarrow +EE *EE -EE x y$. i) Find leftmost and rightmost derivations and also a derivation tree for the string $+ * - xyxy$. ii) Define sentential forms and also Unambiguous Grammar. And prove that the given Grammar is unambiguous.	06
5	a Prove the CFL 's are not closed under intersection using example. b Define $DPDA$. Construct a $DPDA$ to accept the Language $L = \{x \in \{0,1\}^* n_0(x) > n_1(x)\}$. c State and prove pumping lemma for CFL .	04 06 06
OR		
6	a Construct a PDA to accept the Language $L = \{a^n b^{2n} n \geq 1\}$. And trace the string $abb, aabb$. b For the given grammar obtain the corresponding PDA with empty stack acceptance $S \rightarrow aABB aAc$ $A \rightarrow aBB a$ $B \rightarrow bBB A$ $C \rightarrow a$	04 04
c	Convert the given $PDA(M)$ into equivalent $CFG(G)$. $M = (\{q_0, q_1\}, \{a, b\}, \{A, B, Z\}, \delta, q_0, Z)$ where δ is defined as., $\delta(q_0, a, Z) = (q_0, AZ)$ $\delta(q_0, b, Z) = (q_0, BZ)$ $\delta(q_0, a, A) = \{(q_0, AA), (q_1, \epsilon)\}$ $\delta(q_0, b, B) = \{(q_0, BB), (q_1, \epsilon)\}$ $\delta(q_0, a, B) = \{(q_0, AB)\}$ $\delta(q_0, b, A) = \{(q_0, BA)\}$ $\delta(q_1, a, A) = (q_1, \epsilon)$ $\delta(q_1, b, B) = (q_1, \epsilon)$ $\delta(q_1, \epsilon, Z) = (q_1, \epsilon)$	08
7	<div data-bbox="507 1624 1204 1780" data-label="Diagram"> </div> <p>Convert the given finite automata to:</p> <p>i) Right Linear Grammar. ii) Left Linear Grammar.</p> <p>b Define Linear Bounded Automata with proper example.</p> <p>c Define Context Sensitive Grammar (CSG). And design CSG for the language $L = \{a^n b^n c^n n \geq 1\}$.</p>	08 04 04

8	a	Design a <i>TM</i> for the following language i) $L = \{ww^R w \text{ is any string of 0's and 1's}\}$ and also trace the string '0110" and '11100111".	06														
	b	Design a <i>TM</i> to subtract 2 non-negative integers. Function is precisely defined below: $f = m - n \quad \text{if } m \geq n$ $= 0 \quad \text{otherwise}$	04														
	c	i) Design unrestricted Grammar for the Language: $L = \{ww : w \in (a, b)^*\}$ ii) Solve the <i>PCP</i> given below:															
		<table><tr><td></td><td><i>List A</i></td><td><i>List B</i></td></tr><tr><td><i>i</i></td><td>w_i</td><td>x_i</td></tr><tr><td>1</td><td>10</td><td>101</td></tr><tr><td>2</td><td>011</td><td>11</td></tr><tr><td>3</td><td>101</td><td>011</td></tr></table>		<i>List A</i>	<i>List B</i>	<i>i</i>	w_i	x_i	1	10	101	2	011	11	3	101	011
	<i>List A</i>	<i>List B</i>															
<i>i</i>	w_i	x_i															
1	10	101															
2	011	11															
3	101	011															