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R. V. COLLEGE OF ENGINEERING

Autonomous Institution affiliated to VTU

IV Semester B. E. Examinations April/May-17

Computer Science and Engineering

OPERATING SYSTEMS

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	List any two resources of computer system.	01
	1.2	Define graceful degradation.	01
	1.3	What is command interpreter?	01
	1.4	Give two examples of virtual machines.	01
	1.5	CPU scheduler is also known as _____.	01
	1.6	List any two thread libraries.	01
	1.7	What is preemptive scheduling?	01
	1.8	Define critical section.	01
	1.9	_____ provides a set of methods for ensuring that at least one of the necessary conditions cannot hold.	01
	1.10	What is load time binding?	01
	1.11	Modify bit is also known as _____.	01
	1.12	The set of tracks that are at one arm position makes up a _____.	01
	1.13	What is Bad Blocks?	01
	1.14	What is the guiding principle for protection?	01
	1.15	Discuss load balancing.	02
	1.16	Write the requirements of critical section problem.	02
	1.17	What is enhanced second chance algorithm?	02

PART B

2	a	With an abstract view of components of a computer system, define operating system. Discuss the views of a computer.	08
	b	List and explain services provided by an operating system which are helpful to the user and system itself.	08
		OR	
3	a	With a neat diagram of $VM-WARE$ and JVM architecture explain the concept of virtual machine.	08
	b	With a process state diagram, explain the different states of a process.	04
	c	What is scheduler? Discuss different types of schedulers.	04

4 a Discuss different ways of establishing relationship between user threads and kernel threads. 08

b Suppose the following jobs arrive for processing at the time indicated below, each job will run the listed amount of time.

Job	1	2	3
Arrival time	0.0	0.4	1.0
Burst time	8	4	1

i) Give a Gantt chart for execution of these jobs using the $FCFS$ and non-preemptive SJF scheduling algorithms.

ii) What is turnaround time and waiting time of each job for the above algorithm?

iii) Compute average turnaround time if CPU is left idle for the first 1 unit then preemptive SJF is used (job 1 and job 2 will wait during this time). 08

OR

5 a What is dispatcher? Discuss different scheduling criteria. 08

b Explain in detail multilevel queue scheduling and multiple processor scheduling. 08

6 a What do you mean by a binary semaphore and counting semaphore? Explain the implementation of wait ( ) and signal ( ) semaphore operation 08

b Describe Resource allocation graph (RAG),

i) With deadlock

ii) With a cycle but no deadlock. 08

OR

7 a What is race condition? Explain reader's writer's problem with a semaphores. 08

b Consider the following snapshot of a system

Process	Allocated resources			Maximum resources			Total resources		
	R_1	R_2	R_3	R_1	R_2	R_3	R_1	R_2	R_3
P_1	2	2	3	3	6	8	7	7	10
P_2	2	0	3	4	3	3			
P_3	1	2	4	3	4	4			

i) What is the content of need matrix and available?

ii) Is the system in a safe state? If yes, give safe sequence. 08

8 a Why are the translation look-aside buffer (TLB) important? Explain paging hardware with TLB. 08

b Discuss the following terms in brief:

i) External fragmentation,

ii) Thrashing,

iii) Segmentation, and

iv) Demand paging. 08

OR

9	a	Consider the following page 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) $FCFS$, and iii) Optimal.	09
	b	Given memory partitions of $100k, 500k, 200k, 600k$ (in order) which algorithm from best fit, worst fit and first fit places processes with requirements $212k, 417k, 112k$ & $426k$ in an efficient manner?	07
10	a	Explain the different types of file allocation methods.	09
	b	Discuss different access matrix implementation ideas.	07
		OR	
11	a	Write short notes on: i) Swap – space management, and ii) Free – space management.	08
	b	Suppose that the head of a moving head disk with 200 tracks numbered 0 to 199, is currently serving a request at track 143 and has just finished a request at track 125. The queue of requests is kept in $FIFO$ order. $86, 147, 91, 177, 94, 150, 102, 175, 130$ What is the total number of head movements needed to satisfy these requests for the following disk-scheduling algorithms? i) $FCFS$, ii) $SSTF$, iii) $LOOK$, and iv) $C-SCAN$.	08

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R. V. COLLEGE OF ENGINEERING

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IV Semester B. E. Examinations April/May-17

Common to CSE / ISE

DESIGN AND ANALYSIS OF ALGORITHMS

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

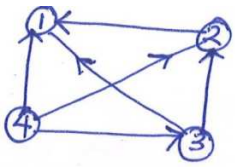
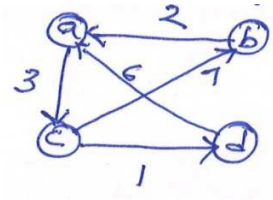
3. Answer all questions from Part A. Part A questions should be answered in the first three pages of the answer book only.
4. Answer FIVE full questions from Part B.

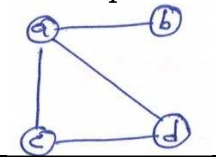
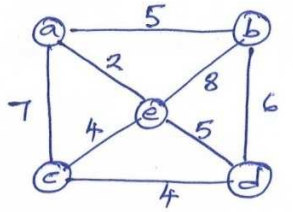
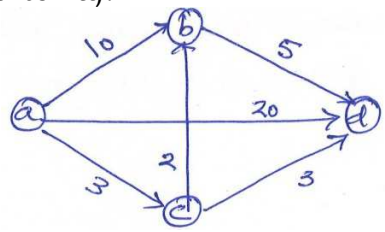
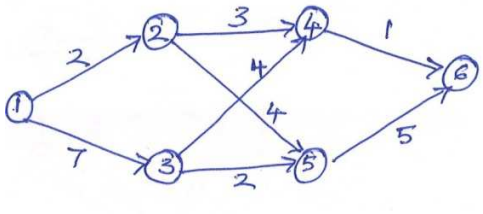
PART A

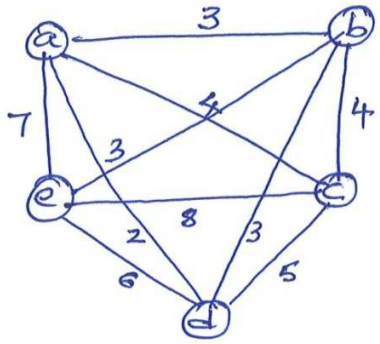
1	1.1	Name the sorting algorithm which has an efficiency of $0(n)$ in the best case.	01
	1.2	Find the time required to access $A[4][5]$ in $A[10][10]$.	01
	1.3	Define topological ordering.	01
	1.4	An AVL tree is an example of _____ in the transformation stage of transform and conquer.	01
	1.5	Describe a flow network.	01
	1.6	What are promising and non-promising nodes in a state-space tree?	01
	1.7	Compare the orders of growth of $\frac{1}{2}\ n(n-1)$ and n^2.	02
	1.8	In the empirical analysis, the scatter plots of the functions in the order of _____ and _____ has convex shape.	02
	1.9	Apply master theorem to find the efficiency of the following: i) $T(n) = 4T\left(\frac{n}{2}\right) + n^2$ ii) $T(n) = 16T\left(\frac{n}{2}\right) + n$	02
	1.10	Compare and contrast between divide and conquer and dynamic programming.	02
	1.11	Construct a max heap for the list 1,8,6,5,3,7,4 by successive key insertion.	02
	1.12	How many character comparisons will be made by Horspool's algorithm in searching the following patterns in the binary text of 1000 zeros? i) 10000 ii) 01010.	02
	1.13	There are two problems, one problem uses an algorithm whose run time is $0(logn)$ and the other uses an algorithm whose run time is $0(n!)$. Example which of the two problems is tractable and which is not.	02

PART B

2	a	Briefly explain the framework for designing and analyzing an algorithm.	08
	b	Discuss the general plan for analyzing the time efficiency of recursive algorithms.	04
	c	Design an algorithm to solve the element uniqueness problem. Analyze its efficiency.	04
		OR	

3	a	Define big-oh, big-theta and big-omega notations.	08
	b	Write the general plan for empirical analysis of algorithm time efficiency.	04
	c	Design and analyze a recursive algorithm to count the number of binary digits in $n's$ binary representation.	04
4	a	Design an algorithm that partitions an array by using its first element as pivot. Use the above algorithm to find the medium for the given set of elements: $4, 1, 10, 9, 7, 12, 8, 2, 15$	08
	b	Compute 2101×1130 by applying divide and conquer.	04
	c	Apply DFS method to solve topological ordering for the following graph. 	04
		OR	
5	a	Design an algorithm to merge two sorted arrays. Trace the algorithm for the input Array 1 : 5 10 15 20 25 Array 2 : 2 7 14 32 37	08
	b	Define $2-3$ tree. Construct a $2-3$ tree for the list $C, O, P, Y, R, I, G, H, T, E, D$.(alphabetical order of the letters).	04
	c	Design a presorting algorithm to find the mode in a given list of elements.	04
6	a	Design and analyze an algorithm to build max heap using bottom-up approach.	08
	b	Apply Floyd's algorithm for the following digraph. 	04
	c	Apply Boyer's-Moore algorithm to search for the pattern AT_THAT in the text $WHICH\_FINALLY\_HALTS.\_\_AT\_THAT$.	04
		OR	
7	a	For the instance of problem, obtain the optimal solution for the Knapsack problem by using memory function. $W = 5$ (Knapsack capacity) $Item$ | $Weight$ | $Value$ 1 | 2 | 8 2 | 1 | 6 3 | 3 | 16 4 | 2 | 11	08
	b	Write the pseudo code of Horspool algorithm.	04

	c	What is problem reduction? For the following graph, using problem reduction strategy find the number of paths of length 2.  	04
8	a	Write the pseudo code for Prim's algorithm. Apply the same for the following graph.  	08
	b	Construct a Huffman tree for the following data and obtain the Huffman code. $Character$ A B C D E $Probability$ 0.35 0.1 0.2 0.2 0.15	04
	c	Draw a decision tree for the three-element selection sort.	04
		OR	
9	a	Write the pseudo code for Dijkstra's algorithm and apply the same for the following graph (source vertex a).  	08
	b	Apply the shortest augmenting path algorithm to find the maximum flow and a minimum cut in the following network.  	06
	c	Define Bipartite graph.	02
10	a	Find the optimal solution for the assignment problem given below by branch and bound technique. $J1$ $J2$ $J3$ $J4$ A 9 2 7 8 B 6 4 3 7 C 5 8 1 8 D 7 6 9 4	08
	b	Construct and explain the state-space tree for solving sum of subset problem with inputs as $S = \{5, 10, 12, 13, 15, 18\}$ and $d = 30$	08
		OR	

11 a	Solve the following raveling salesman problem by branch and bound method.  	08
b	What is backtracking? Construct a state space tree for solving four-queen's problem by backtracking.	08

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IV Semester B. E. Examinations April/May-17

Computer Science and Engineering

OBJECT ORIENTED PROGRAMMING WITH C++

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

5. Answer all questions from Part A. Part A questions should be answered in the first three pages of the answer book only.
6. Answer FIVE full questions from Part B.

PART A

1	1.1	Justify why should we write our own copy constructor.	02
	1.2	Giving default values to arguments of overloaded member functions can lead to ambiguity errors. Depict the same with an example.	02
	1.3	Define a namespace and nested classes.	02
	1.4	Show how to define static variable for template class shown below: $Template < class\ t >$ $class\ A$ { $\quad static\ \ int\ s;$ };	01
	1.5	What are mutable data members?	02
	1.6	Analyze the output of the following program: $\#include < iostream >$ $int\ val = 0;$ $class\ A$ { $\quad public: A()$ $\quad$ { $\quad\quad cout << ++val;$ $\quad$ } $\quad \sim A()$ $\quad$ { $\quad\quad cout << val--;$ $\quad$ } }; $int\ main()$ { $\quad A\ A1, A2, A3;$ $\quad$ { $\quad\quad A\ A4, A5;$ $\quad$ } $\quad return\ 0;$ }	02
	1.7	List ant two open mode bits with functionality for file operations.	02

1.8	Write the syntax to create float list with 5 elements initialized with default value 10.0;	01
1.9	Will the below given order of catch blocks handle multiple exceptions? Comment. *main*() { *try* { *throw* 20; } *catch*(...) { *cout* << "*default exception*" ; } *catch*(*int P*) { *cout* << "*intexception*" ; } *catch*(*char P*) { *cout* << "*char exception*" ; } }	02
1.10	Write the output of the following program: *#include* < *iostream* > *#include* < *map* > *#include* < *string* > *using namespace std*; *int main*() { *multimap* < *string*, *string* > *car*; *car*.*insert*(*pair* < *string*, *string* > ("*Pranav*", "*Ford*"); *car*.*insert*(*pair* < *string*, *string* > ("*Anu*", "*Jaguar*"); *car*.*insert*(*pair* < *string*, *string* > ("*Pranav*", "*Nissan*"); *cout* << "*Pranav has*" << *car*.*count*("*Pranav*") << "*Cars*"; }	02
1.11	Write the output for the following program: *main*() { *int x* = 0; *int &y* = *x*; *y* = 5; *while* (*x* <= 5) { *cout* << *y* + +<< " "; *x* + + ; } *cout* << *x* ; }	02

PART B

2	a	Write a $C++$ program that implements a class Student (int ID, string name, double grade) private and the following member functions: i) Default constructor to initialize name to "Anu", ID to 84596 and grade to 87.5. ii) Set name to assign new value to the data member name, but ensure that name has at most 20 characters. iii) Set grade to assign new value to grade, but ensure that grade be >= 60. iv) Print to print student information. Write a main function and create object of class Student as S and use S to test all operations of class Student.	10
	b	Discuss the circumstances under which the compiler adds definition of copy constructor to the class.	06
		OR	
3	a	Implement a $C++$ program to create two classes Manager (name, basic, deduct1) and Deputy_Manager(name, basic, deduct2). Write a friend function contribute(), which adds deduct1 and deduct2. Note: deduct1 is 20% of basic and deduct2 is 15% of basic. And data members of both classes are declared as private.	06
	b	Differentiate between: i) Inline function and macros ii) Procedure oriented and object oriented programming.	04
	c	Discuss constructor overloading with an example. Comment on "can destructors be overloaded".	06
4	a	Considering any two forms of hybrid inheritance in $C++$, answer the following: i) Give the diagrams describing the inheritance ii) State the classes that will be prefixed with virtual keyboard	04
	b	Create a class First(book_no, book_name) and member functions getdata() and putdata(). Create a class Second(author_name, publisher) and member functions getdata() and showdata(). Derive a class Third from First and Second with members, number of pages and year of publication. Display all threse information using array of objects of third classes. Your code should handle all ambiguities.	07
	c	What is the new handler? How is the set_new_handler() function used to set our new handler?	05
		OR	
5	a	Write a $C++$ program that creates an array dynamically when its size is specified during runtime.	04
	b	Discuss multiple inheritance with its ambiguities and what are the possible ways to resolve these ambiguities. Illustrate with an example.	08
	c	Discuss inheritance using protected accessspecifier by considering private, protected and public data members.	04
6	a	Write a $C++$ program which tackles all the three conditions given below: $03 = 01 + 02;$ $04 = 01 + 4.25;$ $05 = 8.5 + 01;$ Where $01, 02, 03, 04, 05$ are objects.	06

	b	Discuss the circumstances under which operator overloading becomes mandatory.	06
	c	Write a $C++$ program to overload new operator.	04
		OR	
7	a	Create a class called $STRING$ with data members as len and char array. Discuss assignment operator overloading for the following cases: i) LHS string and RHS strings are $NULL$. ii) LHS string and RHS strings are $NOT\ NULL$.	06
	b	Illustrate with examples, the rules for overloading an operator.	05
	c	Write a $C++$ program to create a class called Distance (ifeet, finches). Overload the 'greater than' operator for Distance class through a member function.	05
8	a	Implement a $C++$ program using template class queue with enqueue and dequeue member functions. Implement a queue of integers and doubles. Display the contents of queues.	08
	b	Constructors cannot be virtual, but if the need arises to construct virtually, how to solve this problem? Exemplate.	04
	c	Write a $C++$ code, illustrate how a generic function exhibits polymorphic behavior.	04
		OR	
9	a	In a library management system, the book arrived needs to be inserted to a shelf. Each book has $ISBN$, title and $LIBID$. Each shelf is sorted in increasing order if $LIBID$. The new book/returned book may be placed in shelf without disturbing the order and the same hold good for removal of book from a shelf. Give a $C++$ solution for these scenarios by performing the following: i) Give the STL class that can be employed to this scenario. ii) Insert book by looking at $LIBID$. iii) Remove the book from shelf with changing the order. iv) Display all the books in a shelf.	08
	b	Briefly explain the mechanism of virtual functions.	04
	c	Explain abstract base class.	04
10	a	With pictorial representation, discuss the complete taxonomy of library classes and their hierarchy that handle streams.	06
	b	Explain unwinding of stack when an expression is thrown with appropriate $C++$ code. Illustrate reversal of flow of control from the point of throw to try block.	07
	c	Discuss extracting characters, strings, integers from input streams using the extraction operator.	03
		OR	
11	a	Discuss the 'C' style of error handling and $C++$ way of handling exceptions with suitable examples.	10
	b	Write a program in $C++$ to create and open a file for writing. Do error handling for file creation/opening for writing. If the file can be opened successfully, then write some integers to the file and close the file.	06