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COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Govt. of Maharashtra)

End Semester Examination - November, 2013

(CT 205) Data Structures

Class: - T.Y. B.Tech (Computer Engineering &Information Technology)

Year: - 2013-14 Duration: - Max 5 Hours Semester: - III Max. Marks: - 60

Instructions:

1. All questions are compulsory.

- 2. This is an open book test. You can read your textbooks/notes, but exchange is not allowed.
- 3. Some questions may not have definite answers.
- 4. You can make assumptions if required, but you should state them.
- 5. Code must be indented, commented and written in ANSI C and looking clean. You can write the code with a bold pencil.
- 6. You can explain your answer in Marathi/Hindi.

A	Draw diagram of the data structure created by following code:	2		
	<pre>int main() {</pre>			
	char a[6], *p, *q;			
	p = a + 3;			
	q = a + (p - a) + 2;			
	q[-2] = 'c';			
	p[-1] = 'd';			
	}			
В	What will be the output of the following program?	2		
	<pre>int main() {</pre>			
	int i = 11, j = 10;	=1		
	<pre>printf("%d\n", i j); /* is bitwise OR */</pre>			
	}			
C	Derive the equation for time taken by following function:	2		
	<pre>int f(int n) {</pre>			
	int i, j, x;			
	for(i = 0; i < n/2; i+= 2)			
	for(j = 0; j < n; j += 4)			
	x = i + j;			
	}			
D	Write a program, which opens a file (filename given as command line argument) and	2		
	prints the contents of the file on screen.			
E	Write a function which returns the index of first occurence of a given character, in a	2		
	string.			
	<pre>int chridx(char *string, char ch);</pre>			
	For example: if string="somethinges" and ch='e' then the function returns 3.			
F	Write max selection sort for an array of characters.	2		
	<pre>void selectsort(char a[], int n);</pre>			
	// 'n' is the size of array 'a'	120		
G	Write the prefix expression for the following infix expression	2		
	(((1 + 2) * (3 + 4)) / (5 / 6))			

2	Н	Draw a diagram of a singly-linked NULL terminated linked list, after following	2
		operations on it:	
		<pre>init(&1); insert(&1, 0, 2); */ insert at position 0, value 2</pre>	
		append(&1, 5);	
		insert(&1, 1, 4);	2.2
		remove(&1, 0); // remove from position 0	
		append(&1, 10);	
		insert(&1, 2, 6);	
	I	Show the state of the following sequence of numbers, stored in an array, after each	2
		iteration of improved bubble sort. (assume alphabetical ordering for comparison)	
		100 50 30 20 40 60 80	
	J	Write the inorder and postorder traversals of the tree given below	2
		G	
		B	
		E S	
		- cabe	
Q2	Α	Write an implementation of a quque of characters using an array and ONLY one	3
		index in the array. (Explanation: You have to write the type-definition and the	
		functions init(), enqueue(), dequeue(), empty(); for the queue)	
	В	Using the given type definition of a binary tree, write a recursive function which	3
		computes the average of all the numbers stored in the tree. (Do not assume to be a	
		search tree).	
		typedef struct node {	
		<pre>int val; struct node *left, *right;</pre>	
		}node;	
		typedef struct node *tree;	
	С	Draw the diagram of the hash table, using following hash function, and after the	3
		given insertions are made into it. Assume linear probing for collision resolution.	
		int ht[7];	
		int hash(int n) { return (n - 1) % 7; }	
		insertions: 20, 5, 19, 4, 3	
	D	Write a complete program which reads following structures written in a binary-file,	3
		into an array. Then the program writes the structures into a text-file. The names of the	
		two files are given as command line arguments.	
		typedef struct data {	
		char name[16];	
		int age;	
		int marks;	
		}data;	
	Е	Write a function which creates transpose of a sparse matrix. The sparse matrix is	5
		stored using following type definition.	

```
void transpose(spm *s);
        typedef struct elem {
                 int r, c, v;
        }elem;
        typedef struct spm {
                 elem arr[128];
                /* elements are stored sorted in (r,c) pairs */
                 int nrow, ncol, nelem;
        }spm;
        What is the output of the following program? Explain in 2-3 lines.
        #include <stdio.h>
        #define A
        #define B
        #define C
        #define D
        int f(int a, int b) {
                 if((a & A) && (a & B))
                          return A;
                 if((a & B) && (a & C))
                          return B;
                 if((a & D) && (a & C))
                          return C;
                 return b;
       int main() {
                 printf("%d\n", f(A | B, D));
                 printf("%d\n", f(B | C | D, A));
                 printf("%d\n", f(B | D, C));
       The C type 'int' has a limitation of size. Write an implementation of a new data type
Q3
       which gives us "integers of unlimited size", using a linked-list type of
       implementation. The type will be called "Integer". Write the following functions for
       your type:
       Integer *init(void);
       /* returns a new & empty variable of type Integer * /
       void add digit(Integer *i, int x);
       /* Adds a new digit at the end of an existing integer */
       Integer *add(Integer a, Integer b);
       /* Adds two integers a and b, and returns the result as
       another "Integer" */
       Write a function which will print a binary tree so that it "looks like" a binary tree.
                                                                            4
       Use the following typedefs:
       typedef struct node {
                char ch;
                struct node *left, *right;
       }node;
       typedef struct node *tree;
```

C	Write a function which given 'n' as base of a number system, and 'm' as no. of	4				
	positions, prints all numbers in that number system having 'm' positions. Find the					
	time complexity of your function.					
	Suppose the function is ., *					
	void printall(int m, int n);					
	Then when called as printall(2, 2), it will print 00,01,10,11 (Numbers having 2 bits.					
	in binary number system); when called as printall(2,3) it will print					
	00,01,02,10,11,12,20,21,22 (Numbers having 2 positions, in ternary number system).					
D	The C library has a function 'qsort' for sorting of data of any type. Write a function	4				
	which imitates this function, using bubble sort. Desired prototype:					
	<pre>void bsort(void *base, size t nmemb, size t size,</pre>					
	<pre>int (*compare)(const void *, const void *));</pre>					
	The function sorts an array with 'nmemb' elements of size 'size'. The 'base' argument					
	points to the start of the array. Here 'compare' is a function pointer, for a function					
	which compares two data elements of the data to be sorted.					
E	Design data structures for an application which manages a library. Write the type	4				
	definitions and draw relevent diagrams of the data structure. No need to write any					
	explanation, your type definitions and diagrams should be self-sufficient.					