COLLEGE OF ENGINEERING, PUNE
(An Autonomous Institute of Govt. of Maharashtra)
End Semester Examination – November, 2014

(CT 205) Data Structures

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

Year: - 2014-15   Semester: - III
Duration: -3 Hours   Max. Marks: - 60

Instructions: 10 to 1 p.m   30 NOV 2014

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. Use the given type definitions and function prototypes for writing your answers.
5. You can make assumptions if required, but you should state them.
6. Code must be indented, commented and written in ANSI C. You can write the code with a bold pencil.
7. You can explain your answer in Marathi/Hindi.

Q1	A	What will be the output of the following program? Explain. ```int main() {\n int i = 16, j = 15;\n printf("%d\n", i & j); /* & is bitwise AND */\n}```	2
	B	What will be the output of the following program? Explain the output. ```#define MULT(a, b) a + b\nint main() {\n int i = 20, j = 30;\n printf("%d\n", MULT(i, j) * MULT(j, i)\n + MULT (2, 2));\n}```	2
	C	Show the state of the following sequence of characters, stored in an array, after each iteration of max-selection sort. *(assume alphabetical ordering for comparison)* `m  a  n  b  t  c`	2
	D	Write an implementation of a queue, using array. (Any simple implementation will get full credit).	2
	E	For a binary search tree of integers, write a function which finds the node with maximum value in the tree. Use the type definition given below. ```int max(tree t);\ntypedef struct node {\n int val;\n struct node *left, *right;\n}node;\ntypedef struct node *tree;```	2
	F	*Derive (only stating is not allowed)* the upper and lower bound for following function. $T(n) = 4n^3 + 5 + 3n\lg(n) + 10n$	2
	G	Draw any binary tree which has the following postorder traversal: `l  m  n  o  p`	2

Q2	A	Write the following function for a doubly linked circular list:
		`void swapminmax(list *l);`
		`/* Swaps the 'val' of the maximum and minimum value nodes. */`
		Use these type definitions:
		`typedef struct elem {`
		`        int val;`
		`        struct elem *prev, *next;`
		`}elem;`
		`typedef struct list {`
		`        elem *head, *tail;`
		`} list;`
			3

	B	Write a function which only checks if a given postfix expression is properly formed or not. Assume existence of suitable library functions. You can also use the getnext() function discussed in class. Function should have the following prototype:
		`int  checkpostfix(char *postfix);`
		`// returns 1 if no errors in expression, 0 otherwise.`
		`// the input string is a sequence of integer and operator`
		`tokens separated by >0 spaces.`
			3

	C	Write a program which removes all comments of the type /* */ from a C program file.	3
	D	Write a function which returns the number of non-repeated characters in a given string. Assume only alphabetical characters in the string. `int cntnotrepeated(char *str);` For example: if the input string is "abcbdedc" then it returns 2 as 'a' and 'e' are not repeated.	3
	E	Write binary search function for an array of strings. The function will return index of a specified string in the array.	3
	F	Write a Function which computes square root of a given number. Design a suitable prototype for the function.	3
	G	Find out the worst case time complexity of bubble sort with the upper and lower bound.	3

Q3	A	For dynamic implementation of sparse matrices write a function to check whether the matrix is triangular or not. Given following data structure declarations:
		`typedef struct node`
		`{ int val;`
		`   int row, col;`
		`   struct node *rptr, *cptr;`
		`}node;`
		`typedef struct spmat {`
		`    node *rows[100], *cols[100];`
		`    int nrow, ncol;`
		`}sparse_matrix;`
		
		Where: a *node* contains one element of the matrix. Each *node* is linked on a singly-linked NULL terminated list through *rptr* starting at *rows* array. Each node is similarly linked on the *cptr* starting at *cols* array. *nrow* and *ncol* are the actual
			5

		number of rows and columns of the matrix. `function prototype:  int istriangular(sparse_matrix *m);`	
	B	Write a non-recursive function for a binary tree of integers, which finds out the average of all leaf node values. Assume availability of suitable data structures. ```typedef struct node {\n int val;\n struct node *left, *right;\n} node, *tree;\nint leafaverage(tree t);```	5
	C	Write a function which sorts data of any type, using *selection* sort. Desired prototype: ```void selsort(void *base, size_t nmemb, size_t size,\n int (*compare)(const void *, const void *));``` *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.*	5
	D	Implement a queue of **integers** using a stack of **characters**.	5
	E	Design a data structure for storing a dictionary. The dictionary is expected to have around 5,00,000 entries. Each entry will have: the word, list of words sith similar meaning, one or two example sentences explaining the use. Expected operations are: searching for a word, searching for similar words (For example, if one searches for the word 'telephone' then all entries which list 'telephone' as a similar word should get displayed).	5