COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)

EndSem Examination

Programme: B.Tech
Course Code:
Branch: Computer Engineering
Duration: 3 hours
Student PRN No.

Semester: III
Course Name: DSA I
Academic Year: 2022- 2023
Max Marks: 60

Instructions: For programming questions, define only the expected function(s)
Use C Programming Language for all answers.
Write all answers of a section together. Clearly mention Section name on the top.

SECTION A

			CO	PO
1.	a.	If an array, of size n, is already sorted what will be the complexity of sorting it using Bubble Sort, Selection Sort, Quick Sort, and Merge Sort?	2	3	1 2

	b.	The equation for time taken by this code is:
		`int f(int x, int y) {`
		`  while(x) {`
		`  y = x;`
		`  while(y) {`
		`  y = y - x;`
		`  y = y / 2;`
		`  }`
		`  x--;`
		`  }`
		`}`
			2	3	1
					2

	c.	Let P be a quicksort program to sort numbers in ascending order using the first element as the pivot. Let t_1 and t_2 be the number of comparisons made by P for the inputs [1, 2, 3, 4, 5] and [4, 1,5, 3, 2] respectively. Which one of the following hold? Explain. i. $t_1 = t_2$ ii. $t_1 > t_2$ iii. $t_1 < t_2$ iv. Not related	2	3	1

	d.	Will the code segment given below result to a segmentation fault? Explain your answer with the help of a memory diagram.
		`int *p, *q;`
		`p = (int *)malloc(sizeof(int) * 3);`
		`q = p;`
		`p = p + 2;`
		`p[-2] = q - p;`
		`q = p + p[-2];`
		`q[-1] = --p - q;`
			2	2	1
					2

	e.	Write the output of the following code:
		`int main() {`
		`  stack t;`
			2	3
				2
					1
					2

```
    int no, i;
    init(&t);
    for(i = 0; i < 7; i++) {
        if(i % 2)
            push(&t, i + 1);
        if(i % 5 == 2 && !isempty(&t))
            push(&t, pop(&t) + 1);
        if(i % 4 == 0 && !isempty(&t))
            pop(&t);
    }
    while(!isempty(&t))
        printf("%d\t", pop(&t));
    return 0;
}
```

f. The given code represents which data structure: Array/Stack/Queue/Singly Linked List/Doubly Linked List or something else? Explain. **2** 2 1 3 2

```
#define MAX 5
typedef struct rec {
    int array[MAX];
    int i;
}something;
void init(something *d) {
    d->i = 0;
}
int empty(something *d) {
    return d->i == 0;
}
int full(something *d) {
    return d->i == MAX;
}
void store(something *d, int val) {
    d->array[d->i] = val;
    d->i++;
}
int retrieve(something *d) {
    int val = d->array[0];
    int i;
    for(i = 0; i< d->i; i++)
        d->array[i] = d->array[i + 1];
    d->i--;
    return val;
}
```

2. Assume you are provided an ADT Stack of integers implemented using an array. Define a function with the given prototype: **6** 1 1 4 3 5

```
void Sort(Stack *S);
```

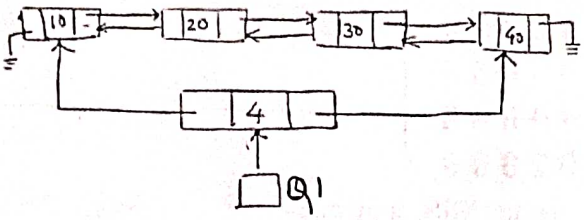
The function sorts the content of the stack in ascending order (with the smallest element on the top) without using any additional array. (4 marks)
Analyse the time complexity of your function. (2 marks)

3. A queue is implemented using a doubly linked list as shown in the diagram below: **6** 2 1

Where Q1 is a variable of type Queue, that maintains address of the first and last nodes in the queue and also the count of number of elements in the queue. 3

a. Write the typedef for Queue and each node in the Queue. (2 marks)

b. Write Enqueue and Dequeue functions for this queue. (2 marks each)



Q1

4. Write a function having following prototype: 6 1 2 1 3

```
void printPostfix(char *in_fix, int n);
```

The function accepts an infix arithmetic expression having digits 0 – 9 and operators (+, -, *, /, ^) as argument along with the size of the expression. The function prints the equivalent postfix expression.

Note: Assume you are provided with the required data structures.

SECTION B

5 Which of the following data structures can be used for parentheses matching? 1 3 1, 4

a) linked list
b) queue
c) array
d) stack

6 In a stack, if a user tries to remove data from an empty stack it is called _____ 1 2 1

a) Underflow
b) Empty top
c) Overflow
d) Garbage top

7 a. Convert given infix expression (P + Q) * (R * S - T) * U / V into postfix using stack. 6 4 3

b. What is the value of the postfix expression 7 8 5 1 + - * using stack?

8 Queue_____ 2 2 1

a. is FIFO
b. has two ends, front and rear
c. is non-linear data structure
d. is LIFO

9 Pizza parlor accepting maximum M orders. Orders are served in first come first served basis. Order once placed cannot be cancelled. To simulate the system, implement the operations enqueue() and dequeue() performed by queue ADT using Linked List. 6 5 3, 4

10 How many pointers are contained as data members in the nodes of a circular doubly linked list of integers with six nodes? 2 3 1

11	Explain best-case and worst-case complexity of Linear Search and Binary Search	**4**	3	7
12	For given matrix, find linked list representation of the transpose of given sparse matrix.	**2**	4	1, 7

$$\begin{pmatrix} 0 & 0 & 1 & 0 & 0 \\ 5 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 0 & 8 \\ 0 & 2 & 0 & 0 & 0 \end{pmatrix}$$

13	You have a structure student having name, MIS, and marks of 5 subjects. Declare array of student structure to store marks of 150 students. Write a function to sort this array based on total marks of all subjects and display names of first 5 students.	**6**	1	3

Instructions: Write brief to the point answers in this sheet itself.
Use C Programming Language for all answers.

1.	Classify valid and invalid identifiers from the given list. a. 2-year-dsa b. dsa_1 c. _DSA_sem_III d. DSA div 1 2	1

2.	What will be displayed when the following program executes?
	
	#include<stdio.h>
	int main()
	{
	int a, b, c=5;
	for (a=b=c; b<=a; a=a+c)
	b=b+a;
	printf("a=%d, b=%d\n",a,b);
	return 0;
	}
		1

3.	int A[] = {34, 45, 50, 66, 76, 89, 90, 100, 123, 134, 150}; If key 134 is searched in array A using Binary Search, which all elements that will be compared till the key is found? How many comparisons will take place for same key, if Linear Search is used?	2
4.	Write a function to accept a week number (1 – 7) and display weekday using switch case.	2
5.	Write a C code to declare a structure: Student having MIS, Name and array of 5 marks as members. Write a function to accept a parameter of type student and return average marks.	4
6.	Write a function to determine a number is a palindrome or not and return 0 or 1. Palindrome is a number that is equal to its reverse. For eg: 12321, 10001, 9999, 6556.	4
7.	Write a C function to input amount from user and print minimum number of notes (Rs. 500, 100, 50, 20, 10, 5, 2, 1) required for the amount. **Input :** Input amount: 575 **Output:** Total number of notes: 500: 1 100: 0 50: 1 20: 1 10: 0 5: 1 2: 0 1: 0	6

COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)

T2 Examination

Programme: B.Tech
Course Code:
Branch: Computer Engineering
Duration: 1 hour
Student PRN No.

Semester: III
Course Name: DSA I
Academic Year: 2022- 2023
Max Marks: 20

Instructions: For Programming questions, define only the expected function(s)
Use C Programming Language for all answers.
Write all answers of a section together. Clearly mention Section name on the top.

	SECTION A	
1	Which Sorting Algorithm(s) use(s) Divide-and-Conquer technique? [1] Merge Sort [2] Selection Sort [3] Insertion Sort [4] Bubble Sort [5] Quick Sort	1
2	Write the contents of array after every pass of Insertion Sort. How many passes with it have? A[ ] = { 38, 12, 16, 10, 25, 8, 15, 9}	2

3	Draw the neat memory allocation diagram for the give code segment:
	
	`#define MALLOCSTRUCT()  (test *)malloc(sizeof(test))`
	`int main() {`
	`  typedef struct test {`
	`  int x;`
	`  struct test *p, *q;`
	`  }test;`
	`  test a, b, *t;`
	`  a.p = &b;`
	`  b.p = MALLOCSTRUCT();`
	`  b.q = MALLOCSTRUCT();`
	`  b.q->p = &a;`
	`  b.q->q = MALLOCSTRUCT();`
	`  a.q = MALLOCSTRUCT();`
	`  a.q->p = b.q->q;`
	`  a.q->q = MALLOCSTRUCT();`
	`  a.q->q->p = a.q;`
	`  a.q->q->q = b.q->q;`
	`  a.x = 20;`
	`  b.x = 30;`
	`  a.p->p->x = 40;`
	`  a.q->q->x = 50;`
	`  b.q->q->x = 60;`
	`  b.p->x = 70;`
	`  return 0;`
		3

	)	
4	Assume a number is broken into digits and each digit is stored in a node of a Singly Linked List in reverse. Eg: Number 5431 is stored as: **L1 → 1→3→4→5→NULL** Write a function that accepts two such lists as parameters and returns the sum of numbers represented in the same form. INPUT: **L1 → 1→3→4→5→NULL** **L2 → 3→7→6→NULL** Returned List **L3 → 4→0→1→6→NULL**	4

SECTION B

5	Consider the following code snippet:
	p = (int *)malloc(sizeof(int));
	q = &p;
	r = &q;
	Write the data types of q, and r.
		1

6	Which of the following gives the value stored at the address pointed to by pointer a? a. &a b. val(a) c. a d. *a	1

7	What will be the output of the program?
	`#include <stdio.h>`
	`int main(){`
	`  int arr[] = {1, 2, 3, 4, 5};`
	`  int *p = arr;`
	`  ++*p;`
	`  p += 2;`
	`  printf("%d", *p);`
	`  return 0;`
	`}`
		2

8	Fill in the blank for given code of insertion at position function of SLL. (start is a 1st node of SLL and newnode will be the node to be insert in SLL) struct node {	2

```
    int data;
    struct node* next;
};
struct node* start = NULL;
void insertAtPosition()
{
    struct node *temp, *newnode;
    int pos, c, i = 1;
    newnode = malloc(sizeof(struct node));
    printf("\n Enter position and data :");
    scanf("%d %d",&pos, &c);
    temp = start;
    newnode->data = c;
    newnode->next = NULL;
    while (i < pos - 1) {
        temp = temp->next;
        i++;
    }
_____
_____
}
```

9	Write a function Selectionsort() that takes an array A, containing n integers as input and uses selection sort to sort the array.	4