



**INDIAN INSTITUTE OF TECHNOLOGY  
KHARAGPUR**

Stamp / Signature of the Invigilator

**EXAMINATION ( End Semester )**

**SEMESTER ( Autumn )**

<b>Roll Number</b>										<b>Section</b>		<b>Name</b>	
<b>Subject Number</b>	C	S	1	1	0	0	1			<b>Subject Name</b>	<i>Programming and Data Structures</i>		
<b>Department / Center of the Student</b>										<b>Additional sheets</b>			

**Important Instructions and Guidelines for Students**

1. You must occupy your seat as per the Examination Schedule/Sitting Plan.
2. Do not keep mobile phones or any similar electronic gadgets with you even in the switched off mode.
3. Loose papers, class notes, books or any such materials must not be in your possession, even if they are irrelevant to the subject you are taking examination.
4. Data book, codes, graph papers, relevant standard tables/charts or any other materials are allowed only when instructed by the paper-setter.
5. Use of instrument box, pencil box and non-programmable calculator is allowed during the examination. However, exchange of these items or any other papers (including question papers) is not permitted.
6. Write on both sides of the answer script and do not tear off any page. **Use last page(s) of the answer script for rough work.** Report to the invigilator if the answer script has torn or distorted page(s).
7. It is your responsibility to ensure that you have signed the Attendance Sheet. Keep your Admit Card/Identity Card on the desk for checking by the invigilator.
8. You may leave the examination hall for wash room or for drinking water for a very short period. Record your absence from the Examination Hall in the register provided. Smoking and the consumption of any kind of beverages are strictly prohibited inside the Examination Hall.
9. Do not leave the Examination Hall without submitting your answer script to the invigilator. **In any case, you are not allowed to take away the answer script with you.** After the completion of the examination, do not leave the seat until the invigilators collect all the answer scripts.
10. During the examination, either inside or outside the Examination Hall, gathering information from any kind of sources or exchanging information with others or any such attempt will be treated as **'unfair means'**. Do not adopt unfair means and do not indulge in unseemly behavior.

**Violation of any of the above instructions may lead to severe punishment.**

**Signature of the Student**

*To be filled in by the examiner*

<b>Question Number</b>	1	2	3	4	5	6	7	8	9	10	<b>Total</b>
<b>Marks Obtained</b>											
<b>Marks obtained (in words)</b>				<b>Signature of the Examiner</b>				<b>Signature of the Scrutineer</b>			



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1. Answer in **one** word.

**Marks:**  $10 \times 1 = 10$

(a) What would be returned to the pointer if dynamic memory allocation fails?

(b) What is the minimum array size required for storing a string "IIT"?

(c) What is the name of the operation for deleting an element from a stack?

(d) Address of which element of an array is also denoted by its name?

(e) Write the octal code of the binary string 11100001.

(f) Which header file is required to be included for dynamic memory allocation?

(g) What is the maximum unsigned integer represented by a 16 bit binary number?

(h) What should be passed as parameter to the function that is called-by-reference?

(i) Which statement should be preferably used for conditional branching at different values of a variable?

(j) Name the operator for determining the size of a data type.

2. State whether the following statements are True/False. Justify your answer in at most two simple sentences. **Marks:  $5 \times 2 = 10$**

(a) A structure should preferably be passed as a parameter to a function using call-by-reference.

(b) A string cannot be assigned to another string.

(c) Iterative function call is more efficient than a recursive function call for the same computation.

(d) Dynamically allocated memory should be freed after its use.

(e) Linked list is a more dynamic data structure than a list implemented by an array through dynamic memory allocation.

3. Write statements (corresponding to a C program segment) for the following: **Marks:**  $5 \times 2 = 10$

(a) Declare an integer variable  $i$  and a pointer to the corresponding data type  $p$ . Assign address of  $i$  to  $p$ .

(b) Define a structure consisting of an integer variable  $x$  and a real variable  $y$ . Declare a variable  $s$  corresponding to the structure.

(c) Declare  $p$  as a pointer to a pointer of data type  $\text{int}$ , and allocate an array of 20 pointers to  $p$  by dynamic memory allocation.

(d) Define a node of a linked list which stores a name of a student as a string not exceeding 50 characters and the student's CGPA as a real number. Declare a variable for a node using the definition.

(e) Declare a function prototype named  $\text{swap}$  for swapping two integer variables passed as parameters to it. No need to define the function.

4. What will be printed when the following programs/ program segments execute? **Marks:** 3+3+4 = 10

```
(a) char fname[12]="Pineapple", drname[12];
    int i=0, j=0;

    while(fname[i]!='\0') {
        if(i%2==0)
            drname[j]=fname[i];
        i++;    j++;
    }
    drname[j]='\0';
    printf("i=%d j=%d drname=%s \n", i, j, drname);
```

```
(b) int compute( int n)
    {
        if(n<1)
            return(1);
        return(n*compute(n-2));
    }

void main()
{
    printf("val1=%d val2=%d val3=%d\n", compute(5), compute(4), compute(-5));
}
```

```
(c) struct _st {
    int x,y;
    struct _st *lnk1,*lnk2;
} a,b,c, *p;

a.x=b.y=10;    a.y=b.x=15;
c.x=a.x+b.x;    c.y=a.x+b.y;
a.lnk1=&b; b.lnk1=&c; a.lnk2=&c; b.lnk2=&a;
c.lnk1=c.lnk2=NULL;    p=&b;
printf("val1=%d val2=%d \n",p->lnk1->x,p->lnk2->y);
printf("val3=%d val4=%d \n",p->lnk2->lnk1->x, p->lnk2->lnk1->y);
```

5. Write C program statements for the following operations.

**Marks:** 4 + 6 = 10

(a) Define a node of a circular linked list which contains a complex number.

(b) Assume that the head of the above circular list is pointed by a pointer named `head`. Write a function which takes the head of the list as argument and returns the sum of complex numbers in the list.

6. Write C program segments/statements to serve the following purposes. **Marks:** 3 + 3 + 4 = 10

(a) Define a structure for implementing a stack of integers using an array.

(b) Write a function for creating a stack.

(c) Write a function for pushing an integer into the stack.



7. Write a C function which takes an array of  $N$  integers and returns the range of its value (i.e., maximum value - minimum value). **Marks: 10**

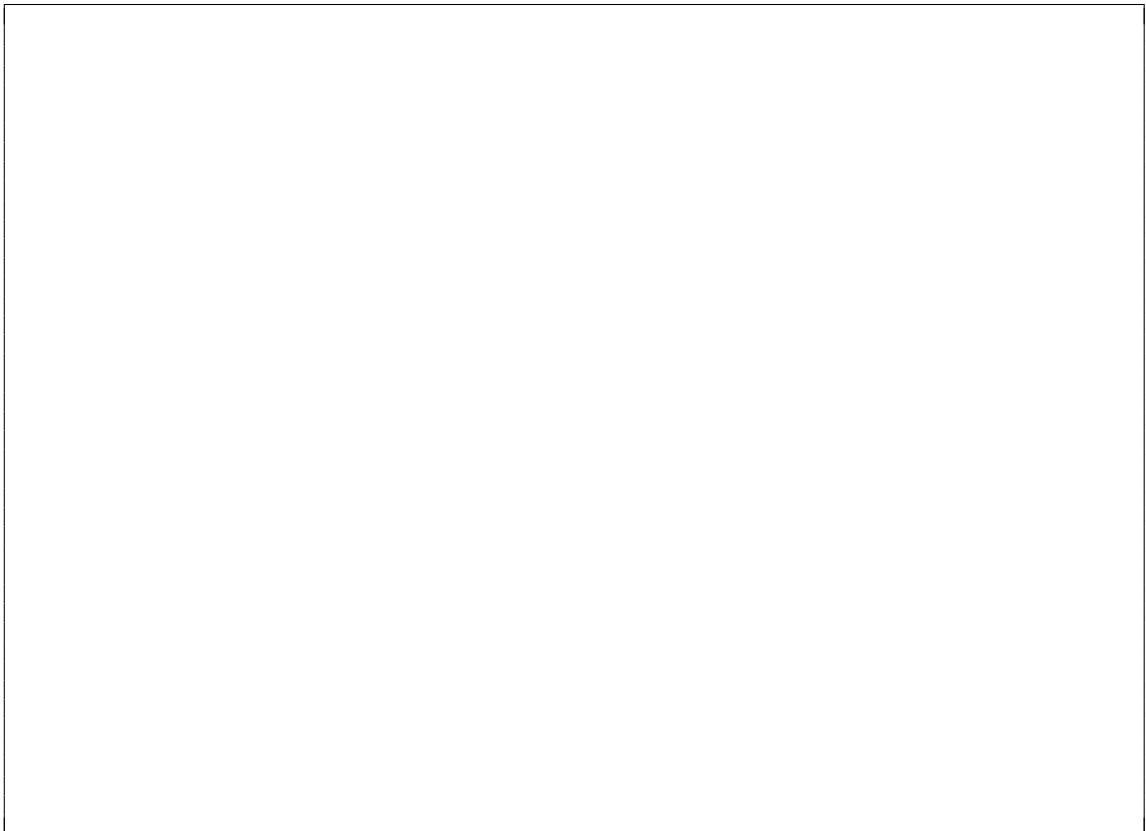
8. Write C program statements for the following operations.

**Marks:**  $2 \times 5 = 10$

- (a) Dynamically allocate a 2-D array of characters to a pointer for storing 100 strings each of maximum character length 80.



- (b) Read four command line arguments and print them as strings in the same order.



9. Write a C program with loop to evaluate the following series summation with an accuracy of 5th decimal place. **Marks: 10**

$$x - \frac{x^2}{2!} + \frac{x^3}{3!} - \frac{x^4}{4!} + \dots$$

10. Fill in the gaps of the following statements for the operations mentioned in parantheses beside the questions. **Marks:**  $10 \times 1 = 10$

(a) `int x= _____ 5.0;` (type cast).

(b) `struct cplx{ float a,b}; struct cplx m=_____.`  
(Initialize to values of member variables a and b to 4.5 and 4.9, respectively.)

(c) `int x,*p; p=&x; _____ = 10;`  
(Assign 10 to the variable x accessed through the pointer p.)

(d) `char name[20]="Kharagpur",dst[20]; _____`  
(Copy the content of the string name to dst using string library function.)

(e) `int x; float y; _____`  
(Read variables x and y from keyboard.)

(f) `char line[80]; _____`  
(Read a line in the character array line as a string from the keyboard. The line may or may not contain space(s). You need to store space(s).)

(g) `char *p, string="Mango"; p=_____`  
(The string should be accessed through the pointer p.)

(h) `#define sqr(x) _____`  
(Implement squaring of x using the macro definition.)

(i) `int p[3][2]=_____`  
(Initialize the array with natural numbers starting from 1.)

(j) `FILE *fp=_____;`  
(Open the file named "input.txt" in read mode.)

**[Extra Page/ Rough Work]**

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