Indian Association for the Cultivation of Science
(Deemed to be University under *de novo* Category)
Masters/Integrated Masters-PhD Program/Integrated Bachelors-Masters Program/PhD Course
End-Semester Examination-Autumn 2024

Subject: Introduction to Computing   *Subject Code: COM 1101*
Full Marks: 50   *Time Allotted: 3 h*

Instructions *(please read carefully each point)*

★ Write as little as possible without missing out on any details
  o   Think carefully before answering
  o   There are no marks on being verbose
  o · Sometimes, adding an example makes things easier
★ If you are making any valid assumption(s) while writing an answer, do remember to mention that information clearly and concisely
★ Answering guidelines
  o   Section A: Write the answers along with 1-2 lines to indicate justification/reasoning.
  o   Section B: Write the required code portion, not the entire program.
  o   Section C: Write the entire program.
★ *Consider all questions are for C language and assume the size of int and float as 4 bytes, char as 1 byte, double as 8 bytes, pointer variables as 8 bytes in this exam; also note the characters are evaluated using their ASCII values A-Z are valued 65-90 and a-z are valued 97-122 respectively*

Section A: (1 mark each)   ***Answer any ten questions (10 questions × 1 mark = 10 marks)***

1. Predict the output of the following code snippet:
```
int arr[5] = {1, 2, 3, 4, 5};
int *ptr = arr + 2;
printf("%d", *(ptr - 1) + *(ptr + 1));
```

2. Given the string char str[] = "Hello";, what is the output of the following code?
```
printf("%d", sizeof(str));
```

3. Evaluate the value of result after execution:
```
int x = 5, y = 8;
int result = (x ^ y) + (x & y);
```

4. Given a file opened in read mode:
```
FILE *fp = fopen("data.txt", "r");
```
Predict the behaviour of the code snippet above if the file named *data.txt* does not exist.

1

5. What will be printed by the following program?

```c
#include <stdio.h>
#define SQUARE(x) x * x
int main() {
printf("%d", SQUARE(4 + 1));
return 0;
}
```

6. Evaluate the following pointer arithmetic:

```c
int arr[] = {2, 4, 6, 8, 10};
int *ptr = arr + 4;
printf("%d", *(ptr - 3));
```

7. Write the output of the following code snippet:

```c
char str1[] = "abc";
char str2[] = "def";
printf("%s", strcat(str1, str2));
```

8. Predict the output of the following code:

```c
unsigned char x = 3;
for (unsigned char i = 1; i <= x; i++) {
x++;
}
printf("%d", x);
```

9. Given the 2D array int arr[3][3] = {{1, 2, 3}, {4, 5, 6}, {7, 8, 9}};, what will be printed by:

```c
printf("%d", *(*(arr + 1) + 2));
```

10. For the structure:

```c
struct data { int a; char b; };
struct data arr[5];
```
Calculate the memory required to store this array (assume no padding).

11. Predict the content of the file output.txt after executing the program:

```c
FILE *fp = fopen("output.txt", "w");
fprintf(fp, "%d", 10 * 5);
fclose(fp);
```

12. Write the output of the following recursive function when called with fun(5):

```c
int fun(int n) {
if (n == 0) return 2;
return n * fun(n - 1);
}
```

13. Given int *p = NULL;, explain what happens when the following statement is executed:

```c
*p = 10;
```

2

1. Write a code snippet to find the sum of all elements in a 3D array of size 3x3x3.

2. Write a C function to reverse a string using pointers.

3. Predict the output of the following code:
   ```
   int a[4] = {10, 20, 30, 40};
   printf("%d", *(a + (*(a + 1) - 10) / 10));
   ```

4. Write a C program snippet to count the number of lines in a text file.

5. Write a C function that takes an array of integers and its size, and returns the largest element using pointer arithmetic.

6. Write a C function that accepts a string and reverses it **in-place** using pointer arithmetic. Demonstrate how this function would work with the string "hello".

7. Write a C code snippet to count the frequency of each character in a string, using an array to store frequencies. For example, given "programming", the output for r should be 2.

8. Using the following structure:
   ```
   struct point {
   int x;
   int y;
   };
   ```
   Write a function that calculates the distance between two points. Use the formula:

   Demonstrate with a sample input.

9. Write a program snippet to dynamically allocate memory for a 1D array of integers, initialize it with values from 1 to n, and print the sum of all elements. Free the allocated memory afterward.

1. Write a complete C program that reads a text file containing integers and writes the squares of these integers into another file. The file names should be provided as command-line arguments.

2. Implement a recursive function to generate the Fibonacci series up to n terms. Include a main program to test your function.

3. Write a C program that uses a structure to store information about books (title, author, price). Use an array of these structures and write a function to find and print the details of the most expensive book.

4. Write a C program to find the smallest and largest elements in a 2D array of size m x n using pointer arithmetic.