PES University, Bengaluru

(Established under Karnataka Act 16 of 2013)

END SEMESTER ASSESSMENT (ESA) - JULY - 2023

UE22CS151B - Problem Solving With C

Total Marks : 100.0

1.a. Categorize the following into valid and invalid variables in C language. If invalid, give reasons for invalidity.
i) num of digits (ii) %avg (iii) double (iv)1stnum (4.0 Marks)

1.b. i) Predict the output of the below code: (2M)

```
#include<stdio.h>
int main()
{
        int i=0;
        for(;i<=5;)
        {
                i++;
                printf("%d ", i);
        }
        return 0;
}
```

ii) Predict the output of the below code: (2M)

```
#include<stdio.h>
int main()
{
        int h=5;
        int b=5*2<h*2?1:0;
        printf("%d\n",b);
        return 0;
}
```

iii) State true or false: (1M)
Statements inside a while loop are executed at least once. (5.0 Marks)

1.c. Write a C program to find and display the sum of first n natural numbers using: i) while loop (ii) for loop (iii) do while loop
Note: Natural numbers are integers beginning from 1. (7.0 Marks)

1.d. Write a C program to read a 3 digit integer through keyboard and check if the middle digit in it is odd. If it is odd print 1 else print 0. (4.0 Marks)

2.a. What is an array? What the following function does? What is the output of the following function for the input: a[]={20,50,10,30} and n=4.

```
int what(int a[],int n)
{
        int res=a[0];
        for(int i=1;i<n;i++)
        {
                if(a[i]<res)
                        res=a[i];
        }
        return res;
}
```

(4.0 Marks)

2.b. Explain the terms Function declaration, Function definition, Argument, Parameter with the help of an example. (6.0 Marks)

2.c. An integer sequence is defined as follows: First number in the sequence is 1 and second number in the sequence is 2. Third number onwards the sequence is obtained by adding the previous 2 numbers. Write a recursive C function to take the value of n as input and return back the nth number in such a sequence, where n>=1. (4.0 Marks)

2.d. Predict the output of the below code: (2M * 3 = 6M)

i)

```
#include <stdio.h>
int main()
{
        int arr[]={1,2,3,4,5,6};
        int i, j, k;
        j=++arr[2];
        k=arr[1]++;
        i=arr[j++];
        printf("i=%d, j=%d, k=%d",i,j,k);
        return 0;
}
```

ii)

```
#include<string.h>
int main()
{
        char str1[] = "University";
        char str2[20];
        char str3[] = "PES";
        int i = strcmp(strcat(str3, strcpy(str2, str1)), "PESUniversity");
        printf("%d\n",i);
        return 0;
}
```

iii)

```
#include<stdio.h>
#include<string.h>
int main()
{
        char p[] = "PESUB";
        char t;
        int i,j=strlen(p)-1;
        for(i=0; i<=j; i++)
        {
                t = p[i];
                p[i] = p[j-i];
                p[j-i] = t;
        }
        p[i]='\0';
        printf("%s\n",p);
        return 0;
}
```

(6.0 Marks)

3.a. Write a C function to subtract 2 square matrices. (4.0 Marks)

3.b. What is a Structure? Give an example.
Create an array of strings named months which can hold the first 3 letters of all the 12 months. (4.0 Marks)

3.c. Explain malloc and free functions in C. (4.0 Marks)

3.d. Consider the following node structure:

```
typedef struct node
{
        int info;
        struct node *next;
}NODE;
```

Implement the following functions:

void displayList(NODE* head);

displayList takes a pointer to the first node if the list is non empty and prints all the elements in the linked list and returns nothing. If the list is empty then prints "Empty list".

NODE* destroyList(NODE *head);

destroyList takes a pointer to the first node if the list is non empty and deletes all the dynamically allocated nodes and returns NULL to set the head pointer to NULL in the calling function. If the list is empty then just returns back NULL. (8.0 Marks)

4.a. Write a C program to copy contents of one file to another file using fgetc() and fputc(). (5.0 Marks)

4.b. Write a C function named binarySearchIterative which takes an integer array 'a' sorted in ascending order, the no. of elements 'n' and the element to be searched 'key'.

Searches for the key element iteratively in the given array and if the search is successful then it returns back the index of the element in array, otherwise returns -1.

The function declaration for the same is as follows:

int binarySearchIterative(int a[],int n,int key); (5.0 Marks)

4.c. Write a C function to sort the integer data in descending order using selection sort. (5.0 Marks)

4.d. What is a callback function? How is it implemented in C language. Write the declaration of a function pointer 'fp' which takes 2 float values as parameters and returns back a float.
Write the output of the below code:

```
#include<stdio.h>
int what(int x, int y, int (*op)(int,int))
{
	return op(x, y);
}
int add(int x, int y)
{
	return x + y;
}
int div(int x, int y)
{
	return x / y;
}

int main()
{
	printf("Result=%d\n", what(1, 3, add));
	printf("Result=%d\n", what(4, 2, div));
	return 0;
}
```

(5.0 Marks)

5.a. i) Mention any two differences between structure and union.
ii) State true or false: enum names are automatically assigned values if no value is specified.
iii) What is the range of integer values (lowest and highest value) that the member c of bitFieldDemo structure can hold?

```
struct bitFieldDemo
{
	unsigned int c:4;
};
```

(5.0 Marks)

5.b. List 4 different storage classes in C. Explain the storage class auto and extern.
(5.0 Marks)

5.c. Predict the output of the below code:

```
#include<stdio.h>
#define sqr1(x) x*x
#define sqr2(y) (y)*(y)
int main()
{
        printf("%d ",sqr1(2+2));
        printf("%d\n",sqr2(2+3));
        return 0;
}
```

(4.0 Marks)

5.d. i) What is conditional compilation? List any 2 conditional compilation directives.
Assume size of int is 4 bytes, char is 1 byte, double is 8 bytes.
ii) What is the output of the below code?

```
#include<stdio.h>
#pragma pack(1)

struct demo
{
        int a;
        char b;
        double d;
};
int main()
{
        printf("Size of structure is %lu bytes\n",sizeof(struct demo));
        return 0;
}
```

(6.0 Marks)