Reg. No: 21BCE1297 **Name: Vidhi Shah** **Date: 07/04/22**

PPS10

Q1

Aim:
There are ‘n’ concentric rectangles one inside another. The length and breadth of the surrounding rectangle is one unit more than the inner one. Write a C program with a recursive function that finally returns the area of the outermost rectangle. Get the number of rectangles ‘n’ and dimensions (length and breadth) of innermost rectangle as user input.

Procedure:

Input:
Number of rectangles, ‘n’
Length of outermost rectangle, ‘l’
Breadth of outermost rectangle, ‘b’

Output:
Area of outermost rectangle

Algorithm:
Step 1: Declare ‘arearect’ function with return type ‘int’ and arguments ‘int l’, ‘int b’ and ‘int n’.

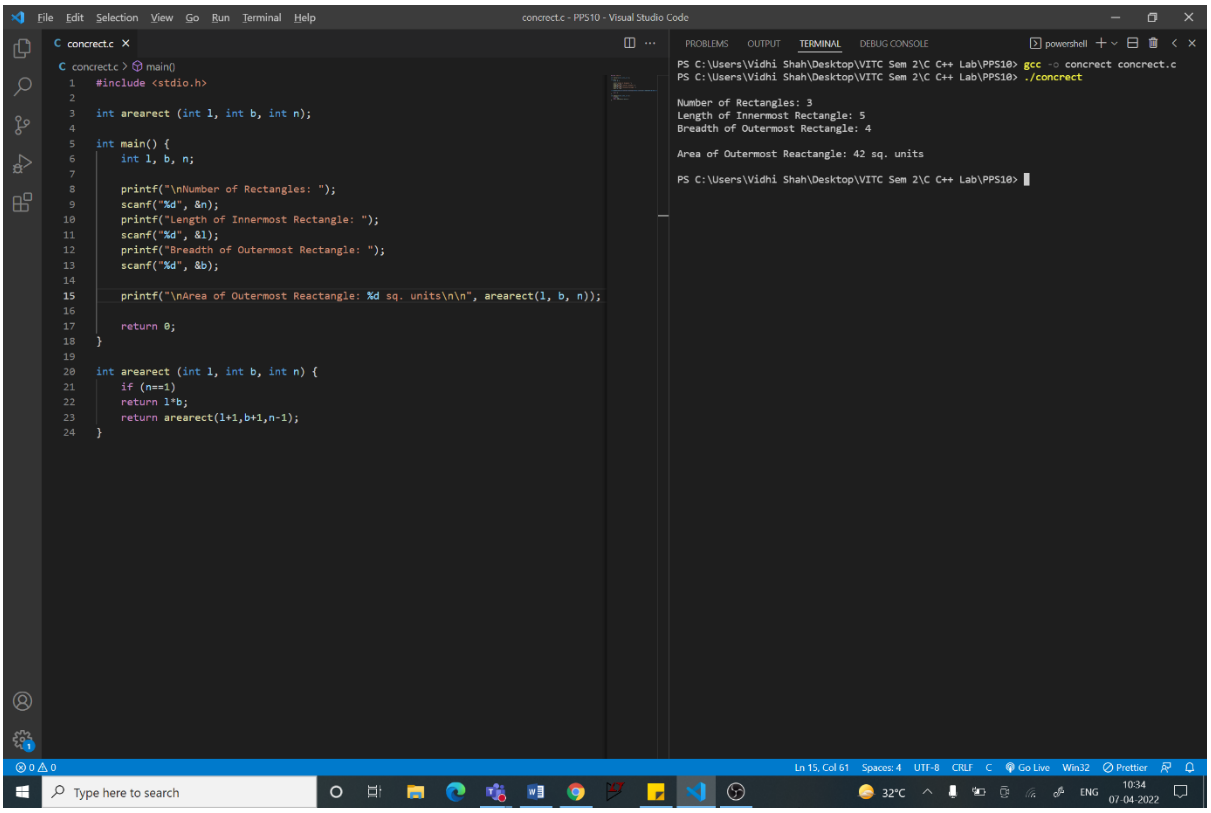
Main Function

```
Step 1: Read integer variables ‘l’, ‘b’ and ‘n’.
Step 2: Call ‘arearect’ function with input parameters ‘l’, ‘b’ and ‘n’.
Step 3: Print the area (return value of the ‘arearect’ function)
Step 4: Return 0
```

AreaRect Function

```
Step 1: If n is equal to 1
            Step A: Return l*b
Step 2: Return arearect(l+1, b+1, n-1)
```

Code:



```c
#include <stdio.h>

int arearect (int l, int b, int n);

int main() {
    int l, b, n;

    printf("\nNumber of Rectangles: ");
    scanf("%d", &n);
    printf("Length of Innermost Rectangle: ");
    scanf("%d", &l);
    printf("Breadth of Outermost Rectangle: ");
    scanf("%d", &b);

    printf("\nArea of Outermost Reactangle: %d sq. units\n\n", arearect(l, b, n));

    return 0;
}

int arearect (int l, int b, int n) {
    if (n==1)
    return l*b;
    return arearect(l+1,b+1,n-1);
}
```

```
PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10> gcc -o concrect concrect.c
PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10> ./concrect

Number of Rectangles: 3
Length of Innermost Rectangle: 5
Breadth of Outermost Rectangle: 4

Area of Outermost Reactangle: 42 sq. units

PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10> 
```

```c
#include <stdio.h>

int arearect (int l, int b, int n);

int main() {
    int l, b, n;

    printf("\nNumber of Rectangles: ");
    scanf("%d", &n);
    printf("Length of Innermost Rectangle: ");
    scanf("%d", &l);
    printf("Breadth of Outermost Rectangle: ");
    scanf("%d", &b);

    printf("\nArea of Outermost Reactangle: %d sq. units\n\n", arearect(l, b,
n));

    return 0;
}

int arearect (int l, int b, int n) {
    if (n==1)
    return l*b;
    return arearect(l+1,b+1,n-1);
}
```

Q2

Aim:
Write a ‘C’ program using function pointers to insert a number ‘n’ at position ‘p’ of an array.

Procedure:

Input:
Number of elements in the array, ‘x’
Number to be inserted, ‘n’
Index of new element, ‘p’
Elements of the array

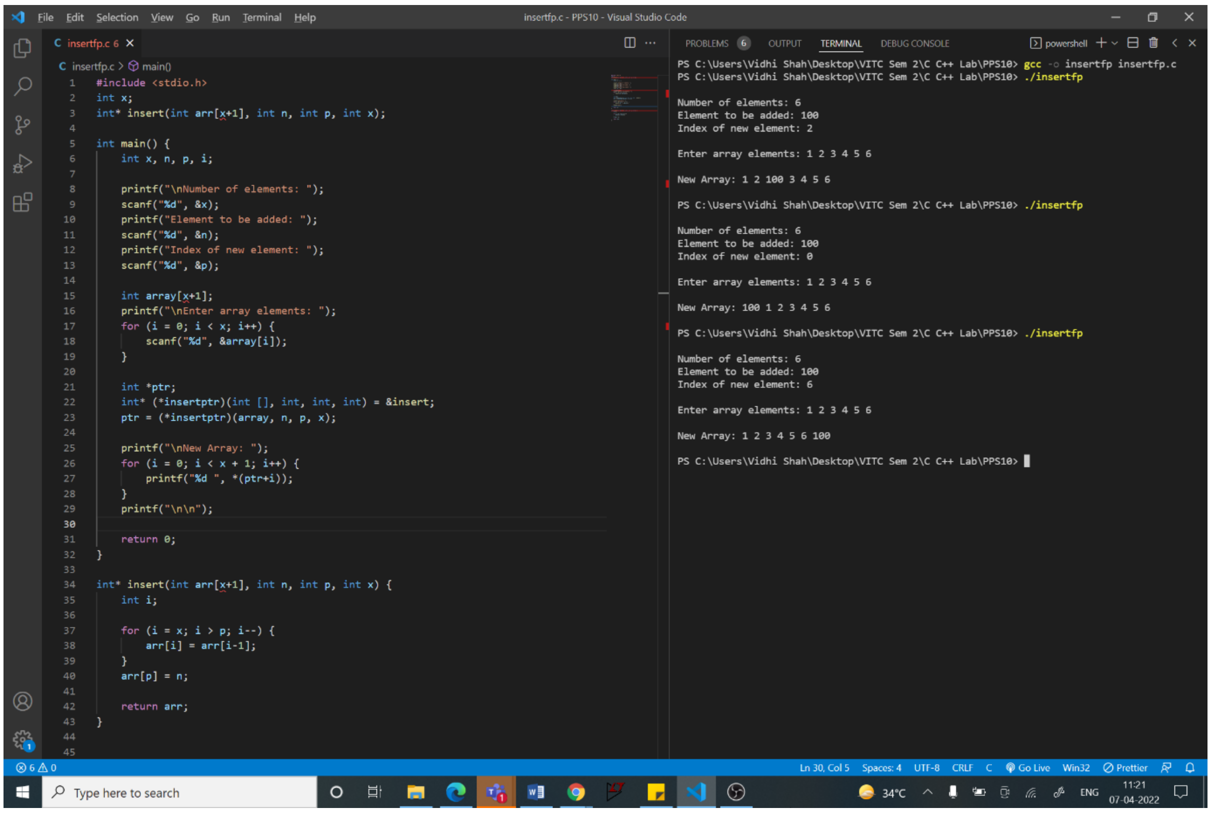
Output:
Array with inserted element

Algorithm:
```
Step 1: Declare global integer variable, ‘x’
Step 2: Declare ‘insert’ function with return type integer pointer, ‘int*’ and arguments ‘int arr[x+1]’, int ‘n’, int ‘p’ and int ‘x’.
```

Main Function
```
Step 1: Read integer variables ‘x’, ‘n’ and ‘p’
Step 2: Read elements of the integer array, ‘array’
Step 3: Initialise an integer pointer variable, ‘ptr’
Step 4: Initialise a function pointer, ‘insertptr’
Step 5: Assign the address of ‘insert’ function to ‘insertptr’ function pointer
Step 6: Call the ‘insert’ function and assign the return value to pointer variable, ‘ptr’
Step 7: Print the new array using pointer variable ‘ptr’
Step 8: Return 0
```

Insert Function
```
Step 1: For ‘i' from x to p+1
            Step A: arr[i] = arr[i-1]
            Step B: i = i - 1
Step 2: arr[p] = arr[n]
Step 3: Return arr (Pointer to the array)
```

Code:



```c
#include <stdio.h>
int x;
int* insert(int arr[x+1], int n, int p, int x);

int main() {
    int x, n, p, i;

    printf("\nNumber of elements: ");
    scanf("%d", &x);
    printf("Element to be added: ");
    scanf("%d", &n);
    printf("Index of new element: ");
    scanf("%d", &p);

    int array[x+1];
    printf("\nEnter array elements: ");
    for (i = 0; i < x; i++) {
        scanf("%d", &array[i]);
    }

    int *ptr;
    int* (*insertptr)(int [], int, int, int) = &insert;
    ptr = (*insertptr)(array, n, p, x);

    printf("\nNew Array: ");
    for (i = 0; i < x + 1; i++) {
        printf("%d ", *(ptr+i));
    }
    printf("\n\n");

    return 0;
}

int* insert(int arr[x+1], int n, int p, int x) {
    int i;

    for (i = x; i > p; i--) {
        arr[i] = arr[i-1];
    }
    arr[p] = n;

    return arr;
}
```

```
PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10> gcc -o insertfp insertfp.c
PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10> ./insertfp

Number of elements: 6
Element to be added: 100
Index of new element: 2

Enter array elements: 1 2 3 4 5 6

New Array: 1 2 100 3 4 5 6

PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10> ./insertfp

Number of elements: 6
Element to be added: 100
Index of new element: 0

Enter array elements: 1 2 3 4 5 6

New Array: 100 1 2 3 4 5 6

PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10> ./insertfp

Number of elements: 6
Element to be added: 100
Index of new element: 6

Enter array elements: 1 2 3 4 5 6

New Array: 1 2 3 4 5 6 100

PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10>
```

Code Snippets:

```c
// Function Pointer
    int *ptr;
    int* (*insertptr)(int [], int, int, int) = &insert;
    ptr = (*insertptr)(array, n, p, x);

// Pointer Arithmetic
    printf("\nNew Array: ");
    for (i = 0; i < x + 1; i++) {
        printf("%d ", *(ptr+i));
    }

// Insert function
int* insert(int arr[x+1], int n, int p, int x) {
    int i;

    for (i = x; i > p; i--) {
        arr[i] = arr[i-1];
    }
    arr[p] = n;

    return arr;
}
```

Q3

Aim:

Write a ‘C’ program using function pointers to check if the given string is palindrome or not.

Procedure:

Input:

String, ‘name’

Output:

Given string is a Palindrome or Not a Palindrome

Algorithm:

```
Step 1: Declare ‘palindrome’ function with return type ‘int’ and arguments ‘char name[15]’
```

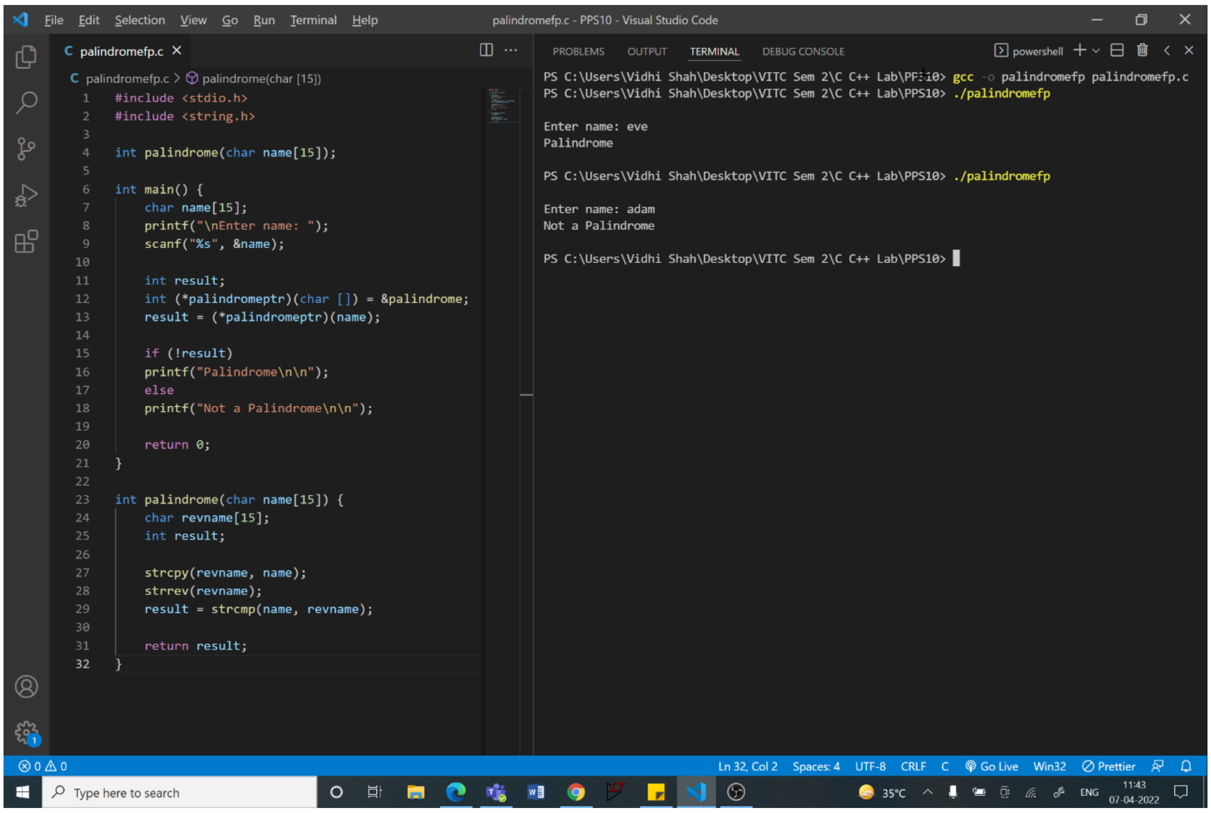
Main Function

```
Step 1: Initialise char array, ‘name’, of size 15
Step 2: Read the string from user into variable ‘name’
Step 3: Declare integer variable ‘result’
Step 4: Initialise a function pointer, ‘palindromeptr’
Step 5: Assign the address of ‘palindrome’ function to ‘palindromeptr’ function pointer
Step 6: Call the ‘palindrome’ function and assign the return value to variable ‘result’
Step 7: If result is equal to 0
            Step A: Print “Palindrome”
Step 8: Else
            Step B: Print “Not a Palindrome”
Step 9: Return 0
```

Palindrome Function

```
Step 1: Initialise char array, ‘revname’, of size 15 and integer variable ‘result’
Step 2: Copy string ‘name’ to ‘revname’
Step 3: Reverse the string ‘revname’
Step 4: Compare the strings ‘name’ and ‘revname’ and store the value in ‘result’ variable
Step 5: Return ‘result’ variable
```

Code:



```c
#include <stdio.h>
#include <string.h>

int palindrome(char name[15]);

int main() {
    char name[15];
    printf("\nEnter name: ");
    scanf("%s", &name);

    int result;
    int (*palindromeptr)(char []) = &palindrome;
    result = (*palindromeptr)(name);

    if (!result)
    printf("Palindrome\n\n");
    else
    printf("Not a Palindrome\n\n");

    return 0;
}

int palindrome(char name[15]) {
    char revname[15];
    int result;

    strcpy(revname, name);
    strrev(revname);
    result = strcmp(name, revname);

    return result;
}
```

```
PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10> gcc -o palindromefp palindromefp.c
PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10> ./palindromefp

Enter name: eve
Palindrome

PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10> ./palindromefp

Enter name: adam
Not a Palindrome

PS C:\Users\Vidhi Shah\Desktop\VITC Sem 2\C C++ Lab\PPS10>
```

```c
int palindrome(char name[15]);

int main() {
    char name[15];
    printf("\nEnter name: ");
    scanf("%s", &name);

    int result;
    int (*palindromeptr)(char []) = &palindrome;
    result = (*palindromeptr)(name);

    if (!result)
    printf("Palindrome\n\n");
    else
    printf("Not a Palindrome\n\n");
    return 0;
}

int palindrome(char name[15]) {
    char revname[15]; int result;

    strcpy(revname, name);
    strrev(revname);
    result = strcmp(name, revname);
    return result;}
```