



Question One

(8 Points)

- a. Identify the Error (Syntax, Runtime or Logical) and correct it

```
int x = 10;  
int y = 20;  
int *ptr;  
ptr = x; → ptr = &x;  
*ptr += y;  
printf("Value of x: %d\n", x);
```

Syntax → no compilation
Runtime → no running
logical → unexpected error

- b. Show the error and correct it:

```
#include <stdio.h>  
int main() {  
    char *str = "Hello";  
    str[0] = 'M';  
    printf("%s\n", str);  
    return 0;  
}
```

Runtime Error لا تقبل
"str" is immutable

- c. The following C program is intended to count the number of vowels in a string. However, it contains errors. Identify it and its type and correct them.

(4 Points)

```
#include <stdio.h>  
int countVowels(char *str) {  
    int count = 0;  
    while (*str != '\0') {  
        if (*str == 'a' || 'e' || 'i' || 'o' || 'u') {  
            count++;  
        }  
        str++;  
    }  
    return count;  
}  
int main() {  
    char str[] = "Problem Solving and Programming";  
    printf("Number of vowels: %d", countVowels(str));  
    return 0;  
}
```

Syntax Error
*str == 'a' || *str == 'e' ...

Question Two

(12 Points)

- a. Write a C function to reverse a string in place without using any built in function.
- b. Evaluate and explain the following expressions in C:
- i. $5 == 5.0$ → 1
- ii. $1 \&\& 0 || 1$ → 1
- c. Write a C function to swap two integers using call by reference.

Q2:

Date:

a]

```
void Reverse (char str [])
```

```
{
```

```
    int i = 0;
```

```
    int j;
```

```
    int len = 0;
```

```
    while (str[len] != '\0')
```

```
        len ++;
```

```
    j = len - 1;
```

```
    while (i < j)
```

```
{
```

```
        char Temp = str[i];
```

```
        str[i] = str[j];
```

```
        str[j] = Temp;
```

```
        i ++;
```

```
        j --;
```

```
}
```

c]

```
void Swap(int *a, int *b)
{
    int Temp = *a;
    *a = *b;
    *b = Temp;
}
```

Question Three

(6 Points)

Predict the output of the following C code snippets:

a.

```
#include <stdio.h>
int main() {
    int a = 5, b = 10;
    printf("%d\n", a++ + b);
    return 0;
}
```

a b
~~5~~ 10
6

b.

```
#include <stdio.h>
int main() {
    int x = 5;
    int y = x == 6 ? 10 : 20;
    printf("%d\n", y);
    return 0;
}
```

a + + + b
5 + 10 = 15
→ 20
output

c.

```
#include <stdio.h>
int main() {
    char string[] = "Problem Solving";
    printf("%c\n", *(string+2));
    return 0;
}
```

→ * (string+2) ≡ string[2] = "o"

Question Four

(14 Points)

- Write a C program that reads a text file: (data.txt) containing several lines of numbers (integers). The program should find and print the sum of the numbers on each line. Use `fscanf` to read from the file
- Write a C program that reads a string from the user and uses a function to check if it is a palindrome (a string that reads the same forwards and backwards).

Best Wishes

Q4

Date:

a)

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

```
int main()
```

```
{ int sum=0; int value;
```

```
FILE * in;
```

```
in = fopen("data.txt", "r");
```

```
while(!feof(in))
```

```
{
```

```
fscanf(in, "%d", &value);
```

```
sum += value;
```

```
}
```

```
printf("sum = %d", sum);
```

```
return 0;
```

```
}
```

b)

No: _____

Date: _____

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

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

```
int isPal(char name[])
```

```
{
```

```
    int i = 0;
```

```
    int j = strlen(name);
```

```
    while (i < j)
```

```
    {
```

```
        if (name[i] != name[j])
```

```
            return 0;
```

```
        i++;
```

```
        j--;
```

```
    }
```

```
    return 1;
```

```
}
```

```
int main()  
{
```

```
    char word [50];
```

```
    printf("Enter word:");
```

```
    scanf("%s", word);
```

```
    if (isPal(word) == 1)
```

```
        printf("Palindrome");
```

```
    else
```

```
        printf("Not");
```

```
    return 0;
```

```
}
```



No. of Pages : 4
No. Of Questions : 3
Examiner : Dr. Ahmed Salem

Acad. Year : 2021/2022
Semester :
Department :
Time Allowed : 120 Minutes
Date : 23 / 1 / 2022

CSI43 Introduction to problem solving (Final Exam) (40 Points)

Question One

(10 Points)

1. What is the return value of the following statement if it is placed in C program?

`strcmp("ABC", "ABC");`

- (a) 0
(b) -1
(c) 1
(d) Compilation error

2. Choose a correct statement about C structures.

- X (a) A structure can contain same structure type member.
(b) A structure size is limited by only physical memory of that PC.
(c) You can define an unlimited number of members inside a structure.
(d) All the above.

3. Choose correct statement about Functions in C Language

- X (a) Function is a group of c statements which can be reused any number of times. ✓
(b) Every Function has a return type.
(c) Every Function may or may not return a value. ✓
✓ (d) All the above.

4. A function which calls itself is called a ____ function.

- (a) Self Function
(b) Auto Function
(c) Recursive Function ✓
(d) Static Function

5. What is the file output of this program?

```
#include <stdio.h>
int main()
{
    FILE* pFile;
    char c;
    pFile = fopen("sample.txt", "wt");
    for (c = 'A'; c <= 'E'; c++) {
        putc(c, pFile);
    }
    fclose(pFile);
    return 0;
}
```

writing and Text

- (a) ABCD
(b) ABC ✓
(c) ABCDE
(d) None of the mentioned

6. What is the output of this program?

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

```
int main()
{
    int a[] = {1, 2, 3, 4, 5, 6};
    int *ptr = (int*)(a+1);
    printf("%d", *(ptr-1));
    return 0;
}
```

- (a) 1
- (b) 2
- (c) 6
- (d) run time error

7. What is the output of the following C program.?

```
int main()
{
    struct book
    {
        int pages;
        char name[10];
    }a;
    a.pages=10;
    strcpy(a.name,"Cbasics");
    printf("%s=%d", a.name,a.pages);
    return 0;
}
```

- (a) Cbasics=10 
- (b) 10
- (c) Cbasics
- (d) run time error

8. What is the output of the following C Program.?

```
int main()
{
    int a[];
    a[4] = {1,2,3,4};
    printf("%d", a[0]);
}
```

- (a) 1
- (b) 2
- (c) 4
- (d) Compiler error 

9. What is the output of the following C program.?

```
int main()
{ char grade[] = {'A','B','C'};
  printf("GRADE=%d", *grade);
  printf("GRADE=%d", grade[0]);
}
```

- (a) A A 
- (b) 65 A

- (c) 65 65
(d) None of the above

10. What is the output of the following C Program with functions

```
void myshow(int);
void main()
```

```
{
    int a=10;
    printf("%d ", a); → 10
    myshow(a);
    printf("%d", a); → 10
}
```

```
void myshow(int k)
{
    k=20;
}
```

- (a) 10 10
(b) 20 20
(c) 10 20
(d) Compiler error

Question Two

(10 Points)

Find the error in each of the following program segments and explain how the error can be corrected

a) <pre>int sum(int x, int y) { int result; result = x + y; }</pre> <i>has no return</i>	b) <pre>int sum(int n) { if (n == 0) { return 0; } else { n + sum(n - 1); } }</pre> <i>else has no return</i>
c) <pre>void product(void) { int a, b, c, result; printf("Enter three integers: ") scanf("%d%d%d", &a, &b, &c); result = a * b * c; printf("Result is %d", result); return result; }</pre> <i>has no</i>	d) <pre>char str[5]; scanf("%s", str); /* User types hello */</pre> <i>logical Error.</i>
e) <pre>int a[3]; printf("\$d %d %d\n", a[1], a[2], a[3]);</pre> <i>out of index</i> <i>Garbage</i>	

Question Three

(20 Points)

1. Write a C program that construct an array of n elements entered by a user and build the following:
 - Write a *recursive function* (recursiveMinimum) that returns the smallest element value of the array
 - Write a *binary search* function (b_Search) to search about a value entered by a user
2. Define a *structure* for an Employee having EmployeeName, EmployeeCode, BasicPay, DearnessAllowance, HRA, PF, GrossPay, NetPay. Take an array of 10 Employees. Write 'C' functions to-:
 - a) Accept data for EmployeeName, EmployeeCode, BasicPay for all the employees.
 - b) Compute-:
 - a. DearnessAllowance = 50% of BasicPay
 - b. HRA = 20% of BasicPay + DearnessAllowance
 - c. PF = 12% of BasicPay + DearnessAllowance
 - d. GrossPay = BasicPay + DearnessAllowance + HRA
 - e. NetPay = GrossPay - PF
 - c) Display the name of employee who has highest GrossPay.
 - d) Compute and display average net pay.
3. Write a program to input name, address, telephone and salary amount of 'n' persons ($n \leq 20$). Sort according to the salary. Print the sorted array.

With my best wishes



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- (a) 0
(b) -1
(c) 1
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(d) All the above.

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- (a) Function is a group of c statements which can be reused any number of times.
(b) Every Function has a return type.
(c) Every Function may or may not return a value.
(d) All the above.

4. A function which calls itself is called a ____ function.

- (a) Self Function
(b) Auto Function
(c) Recursive Function
(d) Static Function

5. What is the file output of this program?

```
#include <stdio.h>
int main()
{
    FILE* pFile;
    char c;
    pFile = fopen("sample.txt", "wt");
    for (c = 'A'; c <= 'E'; c++) {
        putc(c, pFile);
    }
    fclose(pFile);
    return 0;
}
```

- (a) ABCD
(b) ABC
(c) ABCDE
(d) None of the mentioned

6. What is the output of this program?

```
#include <stdio.h>

int main()
{
    int a[] = {1, 2, 3, 4, 5, 6};
    int *ptr = (int*)(&a+1);
    printf("%d ", *(ptr-1));
    return 0;
}
```

- (a) 1
- (b) 2
- (c) 6**
- (d) run time error

7. What is the output of the following C program.?

```
int main()
{
    struct book
    {
        int pages;
        char name[10];
    } a;
    a.pages = 10;
    strcpy(a.name, "Cbasics");
    printf("%s=%d", a.name, a.pages);
    return 0;
}
```

- (a) Cbasics=10**
- (b) 10
- (c) Cbasics
- (d) run time error

8. What is the output of the following C Program.?

```
int main()
{
    int a[];
    a[4] = {1, 2, 3, 4};
    printf("%d", a[0]);
}
```

Syntax Error

- (a) 1
- (b) 2
- (c) 4
- (d) Compiler error**

9. What is the output of the following C program.?

```
int main()
{
    char grade[] = {'A', 'B', 'C'};
    printf("GRADE=%d, ", *grade);
    printf("GRADE=%d", grade[0]);
}
```

→ 65
→ 65

- (a) A A
- (b) 65 A

(c) 65 65

(d) None of the above

10. What is the output of the following C Program with functions

```
void myshow(int);
```

```
void main()
```

```
{
```

```
    int a=10;
```

```
    printf("%d ", a);
```

```
    myshow(a);
```

```
    printf("%d", a);
```

```
}
```

```
void myshow(int k)
```

```
{
```

```
    k=20;
```

```
}
```

(a) 10 10

(b) 20 20

(c) 10 20

(d) Compiler error

Question Two

(10 Points)

Find the error in each of the following program segments and explain how the error can be corrected

a) <pre>int sum(int x, int y) { int result; result = x + y; }</pre> - has no return statement	b) <pre>int sum(int n) { if (n == 0){ return 0; } else { n + sum(n - 1); } }</pre> → Syntax Error return n + sum(n-1);
c) <pre>void product(void) { int a, b, c, result; printf("Enter three integers: ") scanf("%d%d%d", &a, &b, &c); result = a * b * c; printf("Result is %d", result); return result; }</pre>	d) <pre>char str[5]; scanf("%s", str); /* User types hello */</pre> ← char str[15]; logical Error
e) <pre>int a[3]; printf("Sd %d %d %d\n", a[1], a[2], a[3]);</pre> %d → logical Error Garbage	

Question Three

(20 Points)

1. Write a C program that construct an array of n elements entered by a user and build the following:
 - Write a *recursive function* (recursiveMinimum) that returns the smallest element value of the array
 - Write a *binary search* function (b_Search) to search about a value entered by a user

2. Define a **structure** for an Employee having EmployeeName, EmployeeCode, BasicPay, DearnessAllowance, HRA, PF, GrossPay, NetPay. Take an array of 10 Employees. Write 'C' functions to:-
 - a) Accept data for EmployeeName, EmployeeCode, BasicPay for all the employees.
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 - a. DearnessAllowance = 50% of BasicPay
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 - c. PF = 12% of BasicPay + DearnessAllowance
 - d. GrossPay = BasicPay + DearnessAllowance + HRA
 - e. NetPay = GrossPay - PF
 - c) Display the name of employee who has highest GrossPay.
 - d) Compute and display average net pay.

3. Write a program to input name, address, telephone and salary amount of 'n' persons ($n \leq 20$). Sort according to the salary. Print the sorted array.

With my best wishes

```
#include<stdio.h>
#include<conio.h>
```

```
int min(int a,int b)
{
```

```
    if(a<b)
```

```
        return a;
```

```
    else
```

```
        return b;
```

```
}
```

```
int minArr(int arr[],int size)
```

```
{
```

```
    if(size==1)
```

```
        return arr[0];
```

```
    else
```

```
        return min(arr[size-1],minArr(arr,size-1));
```

```
}
```

```
void bubbleSort(int x[],int size)
```

```
{
```

```
    for(int i=0;i<size;i++)
```

```
    {
```

```
        for(int j=0;j<size-i-1;j++)
```

```
        {
```

```
            if(x[j]>x[j+1])
```

```
            {
```

```
                int temp=x[j];
```

```
                x[j]=x[j+1];
```

```
                x[j+1]=temp;
```

```
            }
```

```
        }
```

```
    }
```

```
}
```

```

int binarySearch(int x[],int size,int key)
{
    int low=0;
    int high=size-1;
    int mid;

    while(low<=high)
    {
        mid=(low+high)/2;
        if(key<x[mid])
            high=mid-1;
        else if(key>x[mid])
            low=mid+1;
        else
            return mid;
    }
    return -1;
}

int main()
{
    int x[100];
    int mySize;
    int key;
    int minElement;
    printf("Enter size : ");
    scanf("%d",&mySize);
    for(int i=0;i<mySize;i++)
    {
        printf("Enter num : ");
        scanf("%d",&x[i]);
    }
    minElement=minArr(x,mySize);
    printf("Enter key : ");
    scanf("%d",&key);

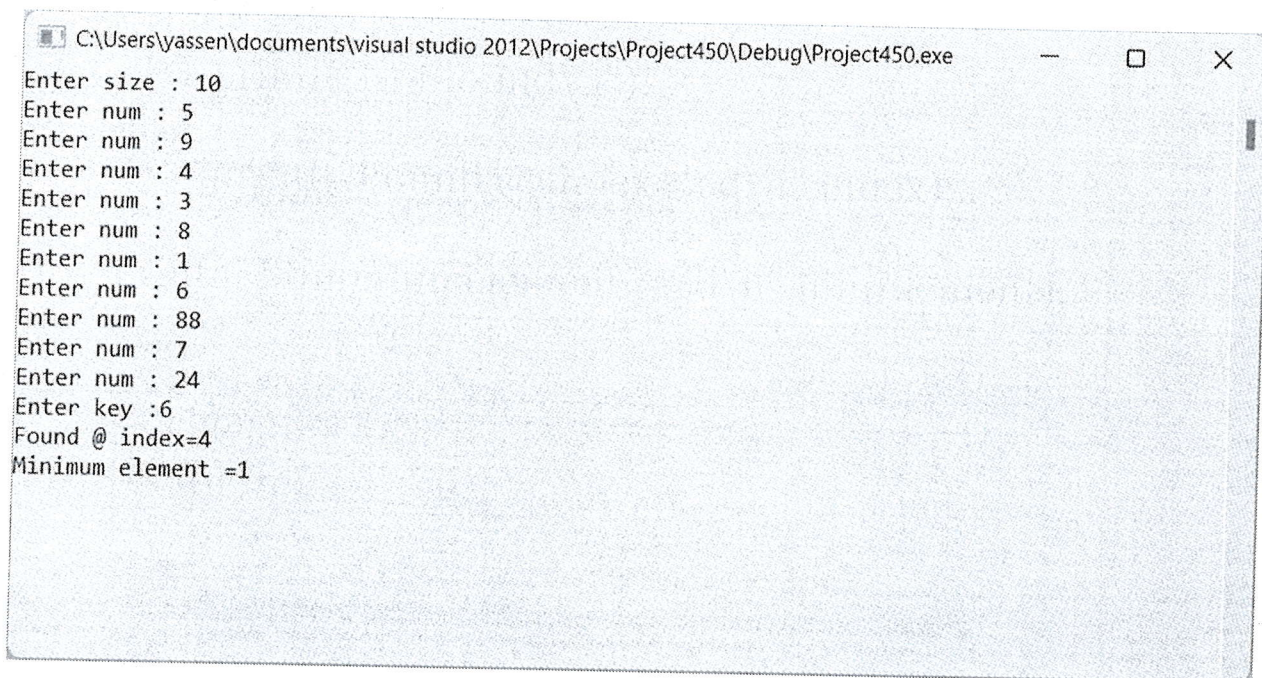
    int index;
    bubbleSort(x,mySize);

```

```
index=binarySearch(x,mySize,key);
if(index==-1)
    printf("Not found\n");
else
    printf("Found @ index=%d\n",index);

printf("Minimum element =%d\n",minElement);

getch();
return 0;
}
```



```
C:\Users\yassen\documents\visual studio 2012\Projects\Project450\Debug\Project450.exe
Enter size : 10
Enter num : 5
Enter num : 9
Enter num : 4
Enter num : 3
Enter num : 8
Enter num : 1
Enter num : 6
Enter num : 88
Enter num : 7
Enter num : 24
Enter key :6
Found @ index=4
Minimum element =1
```

3

```
#include <stdio.h>
void main()
{
    FILE *inp;
    int a, b, c, i=1;
    inp=fopen("Data.txt","r");
    while (i<=3)
    {
        fscanf(inp,"%d %d %d", &a, &b, &c);
        printf("%d:%dX%d=%d\n", a, b, c, b*c);
        i++;
    }
    fclose(inp);
}
```

(5 Points)

Data.txt

1000 5 1

1001 4 2

1003 8 7

$$1000 : 5 \times 1 = 5$$

$$1001 : 4 \times 2 = 8$$

$$1003 : 8 \times 7 = 56$$

Question Four:

(15 Points)

Write C program to solve the following problems.

1. It is required to ask the user to enter the following data items for 10 students:

(6 Points)

- a. Student ID.
- b. Student GPA.

These data must be stored in a structure containing: Student ID (*int Type*) and Student GPA (*double Type*).

Then, it is required to print these data sorted in a descending order (*using any sorting algorithm of your choice*) as follows:

Student ID	(2 tabs)	GPA
20105051		3.95
20103440		3.84

Your solution should contain the following functions:

- a. A function to accept the student ID and GPA, which will be stored in *an array of structure*. The function prototype is:
`void GetData(struct STD std[]);`
- b. A function to sort the data using any sorting technique (e.g. bubble sort or selection sort). The function prototype is:
`void DataSort(struct STD std[], int n);`
- c. A function to display the data as previously mentioned. The function prototype is:
`void DispData(struct STD std[], int n);`

2. Write a program using, a **recursive function**, to compute the element value of with a specific index for the sequence having the equation:

(5 Points)

$$2*(n-1) + 3*(n-2) \quad \text{for } n > 2$$

For example: 0, 1, 2, 7, 20, 61,

Your program should ask the user for the element index and then output the element value.

Note that: the program must include a recursive function and using any other method rather than recursion will not be counted.

3. Using for-loop, write a program that accept a series of positive numbers (with unknown count) ended by zero, then compute and display the following:

- a. Sum and average of even numbers.
- b. Sum and average of odd numbers.

(4 Points)

Note that: DO NOT USE while or do-while loops.

Best Wishes

3

No: -----

Date: -----

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

```
int main( )
```

```
{
```

```
    int num;
```

```
    int SumEven = 0;
```

```
    int CountEven = 0;
```

```
    int SumOdd = 0;
```

```
    int CountOdd = 0;
```

```
    printf("Enter num :");
```

```
    scanf("%d", &num);
```

```
    for( ; num != 0; )
```

```
{
```

```
    if ( num % 2 == 0 )
```

```
{
```

```
        SumEven += num;
```

```
        CountEven ++;
```

```
}
```

else

{

SumOdd += num;

{ CountOdd ++;

printf("Enter num:");

scanf("%d", &num);

{

// end loop

Float avgEven, avgOdd;

avgEven = SumEven / (Float) CountEven;

avgOdd = SumOdd / (Float) CountOdd;

printf("%f %f", avgEven, avgOdd);

printf("%d %d", SumEven, SumOdd);

return 0;

4-

2

No: -----

Date: -----

$$T(0) = 0$$

$$T(1) = 1$$

$$T(2) = 2$$

} simple case

$$T(n) = 2 * T(n-1) + 3 * T(n-2)$$

} recursive case

```
int T(int n)
```

{

```
    if (n == 0 || n == 1 || n == 2)
```

```
        return n;
```

```
    else
```

```
        return 2 * T(n-1) + 3 * T(n-2);
```

{

```
int main( )  
{  
    int n;  
    printf("Enter n:");  
    scanf("%d", &n);  
  
    int res;  
    res = T(n);  
  
    printf("%d", res);  
  
    return 0;  
}
```



No. of Pages : Three
No. Of Questions : Four
Examiner : Dr. Emad Elsamahy
Dr. Ahmed Salem

CS143 Introduction to Problem Solving and Programming (Final Exam)

(40 Points)

Question One:

(5 Points)

Mark (✓) or (X) for each of the following sentences:

1. Plagiarism is the violation of copyright agreements by illegally copying software for use in another computer. () **F**
2. All types of loops in C can be implemented using for loop. () **F**
3. Finding errors tools, which is part of the IDE, can be used to detect syntax-errors in the C program. () **F**
4. In case of unsorted array of integers, only sequential search can be used. () **T**
5. The variable (i) can be decremented by (1), using the following commands:
i=i-1, i-=1, --i, and i--. () **F**
6. In C, the following statement can be considered as an example of the short circuit evaluation.
(div != 0 || num % div == 0) () **T**
7. In C, variable name can be any name (satisfying the rules) or a standard identifier. () **T**
8. The loop in the shown program will be repeated for 2 times. () **F**

```
#include <stdio.h>
void main()
{
    int j;
    for (j=0; j>1; j++)
        printf("Hello\n");
}
```

9. Recursion is used as a replacement of looping in C programs. () **T**
10. Multiprocessing and multithreading can be used by the Operating System to enhance the computer performance in the existence of only one processor/core. ()

Question Two:

(5 Points)

Choose the correct answer (a, b, c, or d):

1. The shaded range on the right can be described using:

a. $(X \geq 0 \parallel X \leq 100)$

c. $(X \leq 0 \parallel X \geq 100)$

b. $(X \leq 0 \&\& X \geq 100)$

d. $(X \geq 0 \&\& X \leq 100)$
2. The function prototype: `void PrintOutput(int sum, int avr), .....` function.

a. has input(s) and has no output

c. has input(s) and has an output

b. has no input(s) and has no output

d. has no input(s) and has an output
3. The function `CalAvr` is used to calculate the average using the call by reference variables, should have the following prototype:

a. `double CalAvr(int Sum, int Count);`

b. `void CalAvr(double &Avr, int Sum, int Count);`

c. `void CalAvr(double &Avr, int Sum, int Count);`

d. `double CalAvr(int sum, int Count);`
4. Using the method of indirect reference in C, supposing that (X) is a pointer to (Y), the following statement can be used to set the value of (Y):

a. `Y=5;`

c. `*X=5;`

b. `&X=5;`

d. `Y==5;`
5. After execution of `(status=scanf("%d %d", &a, &b);)`, and the user inputs (a) and (b) as 15 and 'c'. (status) should return the value of:

a. 0.

c. 2.

b. 1.

d. -1.

6. Any array element (e.g. element 9) can be incremented by (1) using the following statement:
- ☒ a. `X[8]++;`
 - b. `X[8]+1=X[8];`
 - c. `X[9]++=1;`
 - d. `X[9]++;`
7. A "stub" can be used in thetesting.
- a. Unit
 - b. Integration
 - c. System
 - d. Acceptance
8. To swap the contents of two variables, without the use of a third variable, the following C code can be used:
- a. `x=x*y;`
`x=x/y;`
`y=x/y;`
`y=x-y;`
`x=x-y;`
`y=x+y;`
 - ☒ b. `y=x+y;`
`x=y-x;`
`y=y-x;`
d. `tmp=x;`
`x=y;`
`y=tmp;`
9. To left justified a string (y) when printed to the screen using (printf), the following command can be used:
- ☒ a. `printf("%10s",y);`
 - b. `printf("%-10[^\n]s",y);`
 - c. `printf("%10[^\n]s",y);`
 - d. `printf("%-10s",y);`
10. For a string variable named (str[15]) which equals to "Ahmed Salem10", running the following C code will change (str) to the following value:
- ```
for (int i = 0; i < strlen(str); ++i)
 if (isalpha(str[i]))
 if (isupper(str[i]))
 str[i] += 32;
 else
 str[i] -= 32;
 else
 str[i] = '/';
```
- a. "aHMED sALEM10".
  - b. "aHMED sALEM//"
  - c. "Ahmed Salem//".
  - ☒ d. "aHMED/sALEM//".

### Question Three:

(15 Points)

Trace the following C programs.

1 (5 Points)

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

char *extract(char *x)
{
 char *y;

 if (x == '\0')
 printf("*****\n");
 else
 {
 y = strtok(x, " ");
 extract(strtok(NULL, " "));
 printf("** %s.\n", y);
 }
}

void main()
{
 char x[30];
 char *y;
 strcpy(x, "I Love Problem Solving");
 extract(x);
 printf("*****\n");
}
```

← Syntax Error

has no return

2 (5 Points)

```
#include <stdio.h>

void Calculate (int x, int y, int *z)
{
 y=y+x;
 y-=3;
 *z=y+5;
}

void main()
{
 int a[]={10,3,4,7,2,1};
 int i;

 for (i=0; i<4; i++)
 Calculate(a[i], a[i+1], &a[i+2])

 for (i=0; i<=5; i++)
 printf("%d\n", a[i]);
}
```

10  
3  
15  
20  
37  
59

2]

No:-----

Date:-----

1st Call

15  
10, 3, 4, 7, 2, 1  
x y \*z  
~~13~~  
10

2nd Call

20  
10, 3, 15, 7, 2, 1  
x y \*z  
~~18~~  
15

3rd Call

37  
10, 3, 15, 20, 2, 1  
x y \*z  
~~35~~  
32

4th Call

59  
10, 3, 15, 20, 37, 1  
x y \*z  
~~57~~  
54