

Practical Workbook

**CT-175**

**PROGRAMMING  
FUNDAMENTALS**



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## EXERCISE Q# 01

**Declare a structure named employee that stores the employee id, name, salary and department.**

```
#include<stdio.h>
#include<string.h>
int main(){
    struct employee{
        int ID;
        char name[20];
        int salary;
        char department[100];
    };
    struct employee e1;
    e1.ID= 157;
    strcpy(e1.name,"Hamna Ali Khan");
    e1.salary= 50000;
    strcpy(e1.department,"Computer Science & IT");
    printf("Your ID is = %d\n", e1.ID);
    printf("Your name is = %s\n",e1.name);
    printf("Your salary is = %d\n",e1.salary);
    printf("Your department is = %s", e1.department);
    return 0;
}
```

### OUTPUT:

```
Your ID is = 157
Your name is = Hamna Ali Khan
Your salary is = 50000
Your department is = Computer Science & IT
```

## EXERCISE Q# 02

Take data input from user after declaring a variable of employee type and show the data in proper format on output screen.

```
#include<stdio.h>
#include<string.h>
int main(){
    struct employee{
        int ID;
        char name[20];
        int salary;
        char department[100];
    };
    struct employee e1;

    printf("Enter your ID = ");
    scanf("%d",&e1.ID);
    getchar();

    printf("Enter your name = ");
    fgets(e1.name,sizeof(e1.name),stdin);
    e1.name[strcspn(e1.name,"\n")]=0;

    printf("Enter your salary = ");
    scanf("%d",&e1.salary);
    getchar();

    printf("Enter your department = ");
    fgets(e1.department,sizeof(e1.department),stdin);
    e1.department[strcspn(e1.department,"\n")]=0;

    printf("\nEmployee Details:\n");
    printf("ID: %d\n", e1.ID);
    printf("Name: %s\n", e1.name);
    printf("Salary: %d\n", e1.salary);
    printf("Department: %s\n", e1.department);
    return 0;
}
```

OUTPUT:

```
Enter your ID = 157
Enter your name = Hamna Ali Khan
Enter your salary = 50000
Enter your department = BCIT
```

```
Employee Details:
ID: 157
Name: Hamna Ali Khan
Salary: 50000
Department: BCIT
```

## EXERCISE Q# 03

A phone number, such as (212) 767-8900, can be thought of as having three parts: e.g., the area code (212), the exchange (767), and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers.

The interchange might look like this:

Enter area code: 415

Enter exchange: 555

Enter number: 1212

Then display like below:

My number is (212) 767-8900

Your number is (415) 555-1212

```
#include <stdio.h>

struct phone {
    int areaCode;
    int exchange;
    int number;
};

int main() {
    struct phone myNum = {212, 767, 8900};
    struct phone yourNum;

    printf("Enter area code: ");
    scanf("%d", &yourNum.areaCode);

    printf("Enter exchange: ");
    scanf("%d", &yourNum.exchange);
```

```
printf("Enter number: ");
scanf("%d", &yourNum.number);

printf("\nMy number is (%d) %d-%d\n", myNum.areaCode, myNum.exchange,
myNum.number);
printf("Your number is (%d) %d-%d\n", yourNum.areaCode, yourNum.exchange,
yourNum.number);

return 0;
}
```

### OUTPUT:

```
Enter area code: 415
Enter exchange: 555
Enter number: 1212

My number is (212) 767-8900
Your number is (415) 555-1212
```

## EXERCISE Q# 04

Define a structure to store the following student data: CGPA, courses (course name, GPA), address (consisting of street address, city, state, zip). Input 2 student records, compare and display which student have highest GPA in which course also Display which student has the highest CGPA . HINT: define another structure to hold the courses and address.

```
#include<stdio.h>
#include<string.h>
#define max_courses 5

typedef struct{
    char course_name[50];
    float GPA;
}course;
typedef struct{
    char street[40];
    char city[40];
    char state[40];
    int zip;
}address;
```

```
typedef struct{
    char name[50];
    float CGPA;
    course courses[max_courses];
    address add;
    int num_courses;
}student;

void comparecourses(student s1,student s2){
    for(int i=0;i<s1.num_courses&& i<s2.num_courses;i++){
        if(s1.courses[i].GPA>s2.courses[i].GPA){
            printf("In %s, %s has highest GPA: %.2f\n",
s1.courses[i].course_name,s1.name, s1.courses[i].GPA);
        }else if(s2.courses[i].GPA>s1.courses[i].GPA){
            printf("In %s, %s has highest GPA: %.2f\n",
s2.courses[i].course_name,s2.name, s2.courses[i].GPA);
        }else{
            printf("In %s, %s and %s have same GPA: %.2f\n",
s1.courses[i].course_name,s1.name,s2.name, s1.courses[i].GPA);
        }
    }
}

void compareCGPA(student s1, student s2) {
    if (s1.CGPA > s2.CGPA) {
        printf("%s has the higher CGPA: %.2f\n", s1.name, s1.CGPA);
    } else if (s1.CGPA < s2.CGPA) {
        printf("%s has the higher CGPA: %.2f\n", s2.name, s2.CGPA);
    } else {
        printf("Both have the same CGPA: %.2f\n", s1.CGPA);
    }
}

int main(){
    student s1,s2;

    printf("Enter details for Student 1:\n");
    printf("Name: ");
    fgets(s1.name,sizeof(s1.name),stdin);
    s1.name[strcspn(s1.name,"\n")]='\0';
    printf("CGPA: ");
    scanf("%f", &s1.CGPA);
    getchar();
    printf("Street Address: ");
    fgets(s1.add.street,sizeof(s1.add.street),stdin);
    s1.add.street[strcspn(s1.add.street,"\n")]='\0';
    printf("City: ");
    fgets(s1.add.city,sizeof(s1.add.city),stdin);
```

```

s1.add.city[strcspn(s1.add.city, "\n")] = '\0';
printf("State: ");
fgets(s1.add.state, sizeof(s1.add.state), stdin);
s1.add.state[strcspn(s1.add.state, "\n")] = '\0';
printf("Zip: ");
scanf("%d", &s1.add.zip);
getchar();
printf("Number of courses: ");
scanf("%d", &s1.num_courses);
getchar();
if (s1.num_courses > max_courses) {
    printf("Error: Number of courses cannot exceed %d.\n", max_courses);
    return 1;
}
for (int i = 0; i < s1.num_courses; i++) {
    printf("Course %d Name: ", i + 1);
    fgets(s1.courses[i].course_name, sizeof(s1.courses[i].course_name), stdin)
;
    s1.courses[i].course_name[strcspn(s1.courses[i].course_name, "\n")] = '\0';
    printf("GPA in %s: ", s1.courses[i].course_name);
    scanf("%f", &s1.courses[i].GPA);
    getchar();
}

printf("Enter details for Student :2\n");
printf("Name: ");
fgets(s2.name, sizeof(s2.name), stdin);
s2.name[strcspn(s2.name, "\n")] = '\0';
printf("CGPA: ");
scanf("%f", &s2.CGPA);
getchar();
printf("Street Address: ");
fgets(s2.add.street, sizeof(s2.add.street), stdin);
s2.add.street[strcspn(s2.add.street, "\n")] = '\0';
printf("City: ");
fgets(s2.add.city, sizeof(s2.add.city), stdin);
s2.add.city[strcspn(s2.add.city, "\n")] = '\0';
printf("State: ");
fgets(s2.add.state, sizeof(s2.add.state), stdin);
s2.add.state[strcspn(s2.add.state, "\n")] = '\0';
printf("Zip: ");
scanf("%d", &s2.add.zip);
getchar();
printf("Number of courses: ");

```

```
scanf("%d", &s2.num_courses);
getchar();
if (s2.num_courses > max_courses) {
    printf("Error: Number of courses cannot exceed %d.\n", max_courses);
    return 1;}
for (int i = 0; i < s2.num_courses; i++) {
    printf("Course %d Name: ", i + 1);
    fgets(s2.courses[i].course_name, sizeof(s2.courses[i].course_name), stdin)
;
    s2.courses[i].course_name[strcspn(s2.courses[i].course_name, "\n")] = '\0';
    printf("GPA in %s: ", s2.courses[i].course_name);
    scanf("%f", &s2.courses[i].GPA);
    getchar();
}
printf("\n---Comparison Results---\n");
comparecourses(s1, s2);
compareCGPA(s1, s2);

return 0;

}
```



**OUTPUT:**

```
Enter details for Student 1:
Name: Hamna Ali Khan
CGPA: 3.5
Street Address: 123 street
City: Karachi
State: Sindh
Zip: 3333
Number of courses: 2
Course 1 Name: Programming fundamentals
GPA in Programming fundamentals: 3.00
Course 2 Name: Applied Physics
GPA in Applied Physics: 3.8
Enter details for Student :2
Name: Yamna Ali Khan
CGPA: 3.8
Street Address: 355 street
City: Karachi
State: Sindh
Zip: 2333
Number of courses: 2
Course 1 Name: Programming fundamentals
GPA in Programming fundamentals: 3.8
Course 2 Name: Applied Physics
GPA in Applied Physics: 3.22

---Comparison Results---
In Programming fundamentals, Yamna Ali Khan has highest GPA: 3.80
In Applied Physics, Hamna Ali Khan has highest GPA: 3.80
Yamna Ali Khan has the higher CGPA: 3.80
```

## EXERCISE Q# 05

Write a C program that uses functions to perform the following operations:

- i) Reading a complex number
  - ii) Writing a complex number
  - iii) Addition of two complex numbers
  - iv) Multiplication of two complex numbers
- (Note: represent complex numbers using a structure.)

```
#include <stdio.h>
typedef struct {
    float real;
    float imag;
} complex;
complex readComplex() {
    complex c;
    printf("Enter the real part: ");
    scanf("%f", &c.real);
    printf("Enter the imaginary part: ");
    scanf("%f", &c.imag);
    return c;
}

void writeComplex(complex c) {
    if (c.imag >= 0)
        printf("%.2f + %.2fi\n", c.real, c.imag);
    else
        printf("%.2f - %.2fi\n", c.real, -c.imag);
}

complex addComplex(complex c1, complex c2) {
    complex result;
    result.real = c1.real + c2.real;
    result.imag = c1.imag + c2.imag;
    return result;
}

complex multiplyComplex(complex c1, complex c2) {
    complex result;
    result.real = c1.real * c2.real - c1.imag * c2.imag; //(ac-bd)
    result.imag = c1.real * c2.imag + c1.imag * c2.real; //(ad+bc)
    return result;
}
```

```
int main() {
    complex c1, c2, sum, product;

    printf("Enter the first complex number:\n");
    c1 = readComplex();

    printf("Enter the second complex number:\n");
    c2 = readComplex();

    printf("\nThe first complex number is: ");
    writeComplex(c1);

    printf("The second complex number is: ");
    writeComplex(c2);

    sum = addComplex(c1, c2);
    printf("\nThe sum of the two complex numbers is: ");
    writeComplex(sum);

    product = multiplyComplex(c1, c2);
    printf("The product of the two complex numbers is: ");
    writeComplex(product);

    return 0;
}
```

### OUTPUT:

```
Enter the first complex number:
Enter the real part: 2
Enter the imaginary part: 3
Enter the second complex number:
Enter the real part: 4
Enter the imaginary part: 5

The first complex number is: 2.00 + 3.00i
The second complex number is: 4.00 + 5.00i

The sum of the two complex numbers is: 6.00 + 8.00i
The product of the two complex numbers is: -7.00 + 22.00i
```