1. **Define a structure for student record and print details.**

IPO
Input: name, age
Process: Store values in a struct Student and print the fields
Output: Student ID, Name, and Age printed to the screen

Code:

```
#include <stdio.h>
struct Student {
    int id;
    char name[50];
    int age;
};
int main() {
    struct Student s = {1, "Alice", 20};


    printf("Student ID: %d\n", s.id);
    printf("Name: %s\n", s.name);
    printf("Age: %d\n", s.age);

    return 0;
}
```

Output:

Output

```
Student ID: 1
Name: Alice
Age: 20


=== Code Execution Successful ===
```

2. Write a program to store and display employee details using structures.

IPO

Input: Employee ID, Name, and Salary

Process: Store the input in a structure

Output: Print the employee's ID, Name, and Salary

Code:

```
#include <stdio.h>
struct Employee {
    int id;
    char name[50];
    float salary;
};
int main() {
    struct Employee e;

    printf("Enter Employee ID: ");
    scanf("%d", &e.id);
    printf("Enter Name: ");
    scanf("%s", e.name);
    printf("Enter Salary: ");
    scanf("%f", &e.salary);

    printf("\n--- Employee Details ---\n");
        printf("ID: %d\nName: %s\nSalary: %.2f\n", e.id, e.name, e.salary);

    return 0;
}
```

Output

```
Enter Employee ID: 1001
Enter Name: ak
Enter Salary: 500

--- Employee Details ---
ID: 1001
Name: ak
Salary: 500.00


=== Code Execution Successful ===
```

3. Write a program to pass a structure to a function.

IPO:

Input: id, name

Process: Pass structure to a function; function prints its values

Output: ID and Name printed by the function

Code:

```
#include <stdio.h>
struct Student {
    int id;
    char name[50];
};
void display(struct Student s) {
    printf("ID: %d\nName: %s\n", s.id, s.name);
}
int main() {
    struct Student s = {5,"beak"};
    display(s);
    return 0;
}
```

```
Output

ID: 5
Name: beak


=== Code Execution Successful ===
```

4. Write a program to store multiple student records using array of structures.
IPO:
Input: User enters ID and Name for 3 students
Process: Store each student's data in an array of structures
Output: Display all student IDs and Names

Code:

```
#include <stdio.h>
struct Student {
   int id;
   char name[50];
};
int main() {
   int i;
   struct Student s[3];

   for(i = 0; i < 3; i++) {
      printf("Enter ID and Name for student %d: ", i + 1);
      scanf("%d %s", &s[i].id, s[i].name);
   }

   printf("\n--- Student Records ---\n");
   for(i = 0; i < 3; i++) {
      printf("ID: %d, Name: %s\n", s[i].id, s[i].name);
   }

   return 0;
```

}

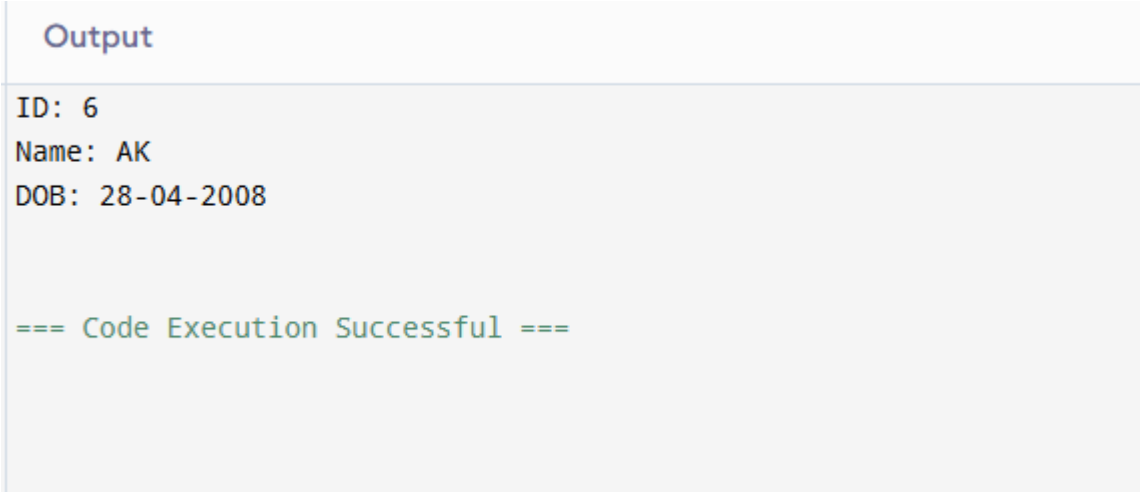
```
Output

Enter ID and Name for student 1: 1 ak
Enter ID and Name for student 2: 2 tv
Enter ID and Name for student 3: 3 str

--- Student Records ---
ID: 1, Name: ak
ID: 2, Name: tv
ID: 3, Name: str


=== Code Execution Successful ===
```

5. Write a program to demonstrate nested structures.
IPO:
Input: id , name , dob
Process: Store data in nested structures (struct Student containing struct Date)
Output: Display ID, Name, and Date of Birth in DD-MM-YYYY format

Code:

```
#include <stdio.h>
struct Date {
    int day, month, year;
};

struct Student {
    int id;
    char name[50];
    struct Date dob;
```

```
};

int main() {
   struct Student s = {6,"AK", {28,4,2008}};

      printf("ID: %d\nName: %s\nDOB: %02d-%02d-%04d\n", s.id, s.name, s.dob.day, s.dob.month, s.dob.year);

   return 0;
}
```



6. Write a program to calculate total and average marks using structures.

IPO:

Input: User enters Name and 3 subject Marks

Process: Calculate total and average marks

Output: Display total marks and average

Code:

```
#include <stdio.h>
struct Student
{
   char name[50];
   int marks[3];
```

```
};

int main()
 {
   struct Student s;
   int total = 0;

   printf("Enter student name: ");
   scanf("%s", s.name);

   printf("Enter marks in 3 subjects: ");
   for(int i = 0; i < 3; i++)
{
      scanf("%d", &s.marks[i]);
      total += s.marks[i];
 }

   float average = total / 3.0;

   printf("Total: %d\nAverage: %.2f\n", total, average);
   return 0;
}
```

Output

```
Enter student name: jinwoo
Enter marks in 3 subjects: 86 97 96
Total: 279
Average: 93.00


=== Code Execution Successful ===
```

7. write a program to find the highest marks among students.

IPO
Input: User enters Name and Marks for 3 students
Process: Find the student with the highest marks
Output: Display the name and marks of the topper

Code:

```
#include <stdio.h>
struct Student
{
   char name[50];
   int marks[3];
};
int main()
{
   struct Student s;
   int total = 0;
   printf("Enter student name: ");
   scanf("%s", s.name);
   printf("Enter marks in 3 subjects: ");
   for(int i = 0; i < 3; i++)
   {
      scanf("%d", &s.marks[i]);
      total += s.marks[i];
   }
   float average = total / 3.0;
   printf("Total: %d\nAverage: %.2f\n", total, average);
   return 0;
}
```

```
Enter marks in 3 subjects: 40 50 65
Total: 155
Average: 51.67


=== Code Execution Successful ===
```

8. Write a program to sort student records by name using structure.
IPO
Input: User enters ID and Name for 3 students
Process: Sort the array of structures alphabetically by Name using bubble sort
Output: Display sorted student records by Name

Code:

```
#include <stdio.h>
#include <string.h>
struct Student
{
   char name[50];
   int id;
};
int main()
{
   struct Student s[3], temp;
   int i, j;
   for(i = 0; i < 3; i++)
   {
      printf("Enter ID and Name of student %d: ", i + 1);
      scanf("%d %s", &s[i].id, s[i].name);
   }
   for(i = 0; i < 2; i++)
   {
      for(j = i + 1; j < 3; j++)
      {
         if(strcmp(s[i].name, s[j].name) > 0)
         {
            temp = s[i];
            s[i] = s[j];
            s[j] = temp;
         }
      }
```

```
    }
    printf("\nSorted by Name:\n");
    for(i = 0; i < 3; i++)
    {
        printf("ID: %d, Name: %s\n", s[i].id, s[i].name);
    }
}
```

```
Output

Enter ID and Name of student 1: 1 sung
Enter ID and Name of student 2: 2 beak
Enter ID and Name of student 3: 3 jinhoo

Sorted by Name:
ID: 2, Name: beak
ID: 3, Name: jinhoo
ID: 1, Name: sung


=== Code Execution Successful ===
```

9. Write a program using union to store data of different types.
IPO
Input: i, f ,str
Process: Assign different data types to union and print each
Output: Print each union member value

Code:

```
#include <stdio.h>
#include <string.h>
union Data
{
    int i;
    float f;
```

```
    char str[20];
};
int main()
{
    union Data data;
    data.i = 35;
    printf("Integer: %d\n", data.i);
    data.f = 235.55;
    printf("Float: %.2f\n", data.f);
    strcpy(data.str, "welcome");
    printf("String: %s\n", data.str);
    return 0;
}
```

10. Compare and contrast structure vs union with a sample program.

IPO

Input:

- **Structure: id, marks, name**
- **Union: id, marks, name**

Process: Display how data is stored and overwritten in structure vs union

Output:

- **All structure fields are retained and printed**
- **In union, only the last assigned value is printed**

Code:

```
#include <stdio.h>
#include <string.h>
struct StudentStruct
{
   int id;
   float marks;
   char name[20];
};
union StudentUnion
{
   int id;
   float marks;
   char name[20];
};
int main()
{
   struct StudentStruct s1 = {1, 98.5, "sung"};
   union StudentUnion u1;
   printf("--- Structure ---\n");
      printf("ID:  %d\nMarks:  %.2f\nName:  %s\n",  s1.id,  s1.marks,
s1.name);
   printf("\n--- Union (Only last assigned is valid) ---\n");
   u1.id = 2;
   printf("ID: %d\n", u1.id);
   u1.marks = 89.2;
   printf("Marks: %.2f\n", u1.marks);
   strcpy(u1.name, "beak");
   printf("Name: %s\n", u1.name);
   return 0;
}
```

Output

```
--- Structure ---
ID: 1
Marks: 98.50
Name: sung

--- Union (Only last assigned is valid) ---
ID: 2
Marks: 89.20
Name: beak


=== Code Execution Successful ===
```