Structures

Refat Othman

Computer Science Department

Comp 133

Refat Othman

User-Defined Structure Types

- A database is a collection of information subdivided into records.
  - A record is a collection of information of one data object (e.g., ID, name, and age of a student).
- C allows us to define a new data type (called structure type) for each category of a structured data object.

User-Defined Structure Types

A Structure is a collection of related data items, possibly of different types.

A struct is heterogeneous in that it can be composed of data of different types.

Array is homogeneous since it can contain only data of the same type.

Declaring Structure Types

- Syntax

```
typedef struct{
   type1 id1;
   type2 id2;
   …
  } struct_type;
```

- Example

```
typedef struct{
        charname  [20];
        int age;
   } student_info;
```

Declaring Structure Types

- Declaration:

```
student_info student1,
             student2 = {"Yamen", 3};
```

- Accessing Members of a struct

```
student1.name
```
- is the name of student

```
student1.age
```
- is the age of student

The members of a struct type variable are accessed with the dot (.) operator

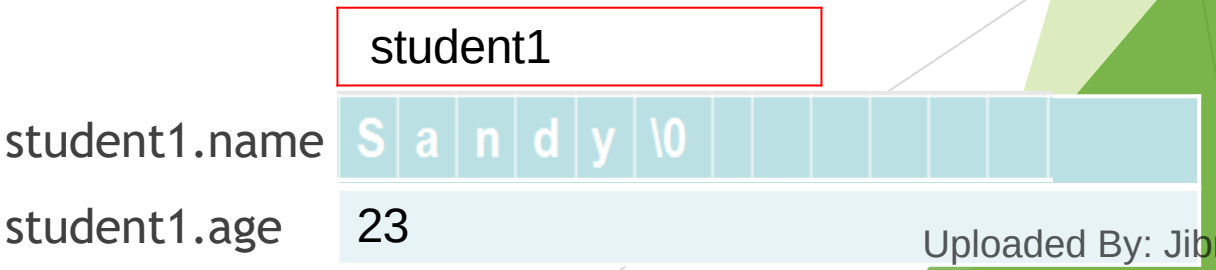
Example 1

```
typedef    struct{
            char name [20];
            int age;
        } student_info;
```

//Declare variable

```
student_info      student1;

strcpy(student1.name, "Sandy");
Student1.age=23;
```



Example 2

```
typedef  struct{
                    char name [20];
                    int age;
          } student_info;


//Declare variable

    student_info    student2;

//Assigning values to student2  (from  a user)

   scanf("%s%d", student2 .name,& student2.age);

//Printing the values of student2

   printf("%s%d", student2 .name,student2.age);
```

Array of structure

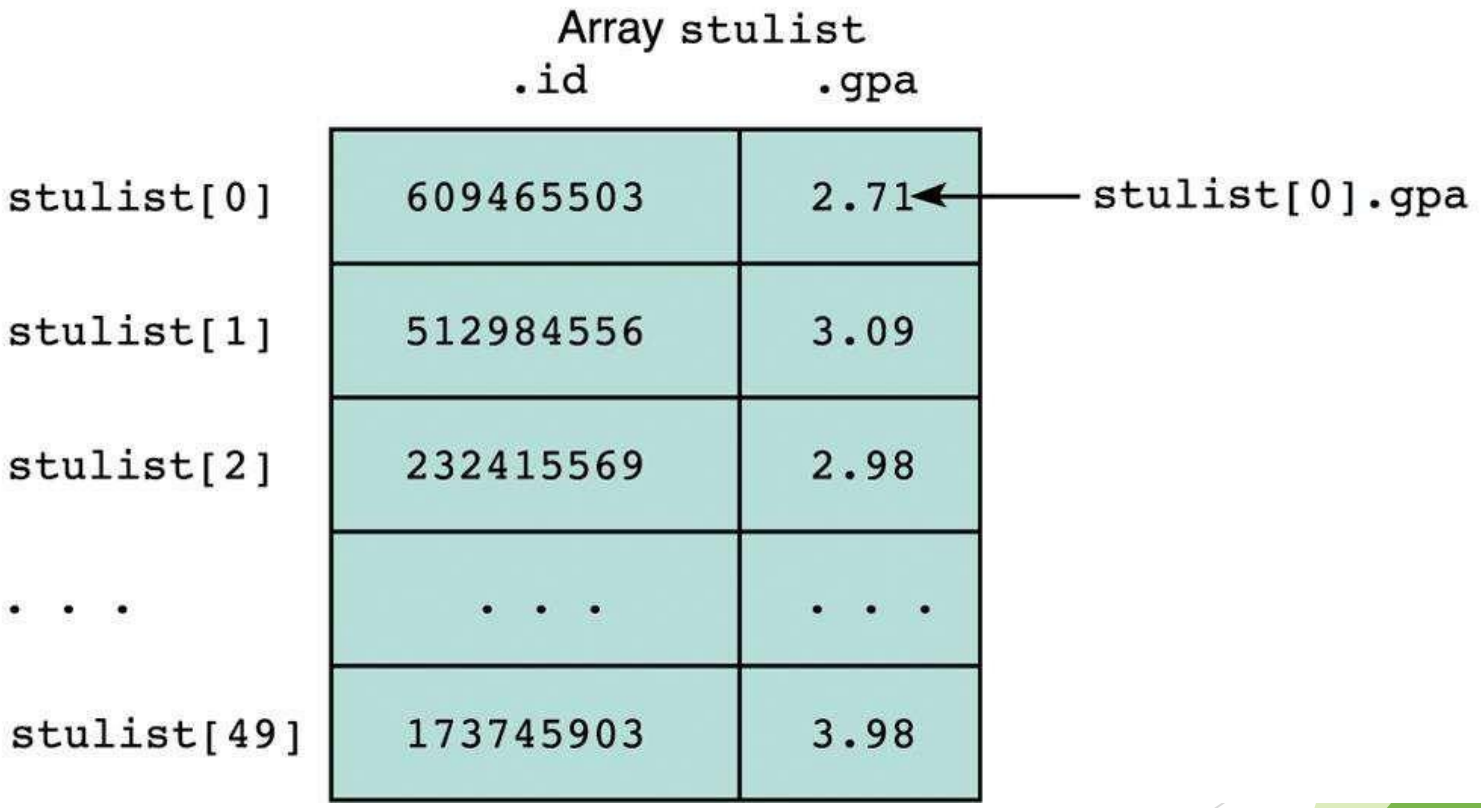
- We can declare an array of structures.

```
typedef struct{
   int id;
   double gpa;
} student_t;
```

- Usage:

```
student_t stulist[50];
stulist[3].id = 92922023;
stulist[3].gpa = 3.0;
```

Array of structure



Example 3: Array of structure

C Program to Store Information(name, id and grade) of a Student Using Structure

```c
#include <stdlib.h>
typedef struct {
 char names[20];
 int id;
 int grade;

} Student_t;
int main()
{    int i;
     Student_t info[5]; //array of students
     printf ("Please enter student information: name,id and grade: \n");
     //Fill array
     for (i=0;i<5;i++)
          scanf ("%s %d %d",info[i].names,&info[i].id,&info[i].grade);

     // Print array
     for (i=0;i<5;i++)
          printf ("\n%s %d %d",info[i].names,info[i].id,info[i].grade);
     return 0;
}
```

Example 3 Cont.

C Program to Store Information(name, id and grade) of a Student Using Structure

```
Please enter student information: name,id and grade:
Yamen 100228   99
Sandy 101000   98
Amer  107342   90
Amera 100982   93
lina  100988   95

Yamen 100228 99
Sandy 101000 98
Amer 107342 90
Amera 100982 93
lina 100988 95
```

Example 4

C Program to Store Information(name, roll and marks) of a Student Using Structure

```c
#include <stdio.h>
typedef struct {
    char name[50];
    int roll;
    float marks;
} student_t;
int main(){
    student_t s;
    printf("Enter information of students:\n\n");
    printf("Enter name: ");
    scanf("%s",s.name);
    printf("Enter roll number: ");
    scanf("%d",&s.roll);
    printf("Enter marks: ");
    scanf("%f",&s.marks);
    printf("\nDisplaying Information\n");
    printf("Name: %s\n",s.name);
    printf("Roll: %d\n",s.roll);
    printf("Marks: %.2f\n",s.marks);
    return 0;
}
```

Example 4 Cont.

Output

```
Enter information of students:

Enter name: Adele
Enter roll number: 21
Enter marks: 334.5

Displaying Information
name: Adele
Roll: 21
Marks: 334.50
```

Example 5:Passing structure to a function

Case Study: Complex Numbers

A complex number is a number of a real part and an imaginary part. a+bi

Example 5:Passing structure to a function

C Program to Add Two Complex Numbers by Passing Structure to a Function

```c
#include <stdio.h>
typedef struct{
    float real;
    float imag;
}complex_t;
complex_t add(complex_t n1,complex_t n2);
int main(){
    complex_t n1,n2,temp;
    printf("For 1st complex number \n");
    printf("Enter real and imaginary respectively:\n");
    scanf("%f%f",&n1.real,&n1.imag);
    printf("\nFor 2nd complex number \n");
    printf("Enter real and imaginary respectively:\n");
    scanf("%f%f",&n2.real,&n2.imag);
    temp=add(n1,n2);
    printf("Sum=%.1f+%.1fi",temp.real,temp.imag);
    return 0;
}
complex_t add(complex_t n1,complex_t n2){
       complex_t temp;
       temp.real=n1.real+n2.real;
       temp.imag=n1.imag+n2.imag;
       return(temp);
}
```

Function call

Example 5 Cont.

Output

```
For 1st complex number
Enter real and imaginary respectively: 2.3
4.5

For 2st complex number
Enter real and imaginary respectively: 3.4
5
Sum=5.7+9.5i
```

Example 6

```c
#include <stdio.h>
typedef struct{
 char name[20];
 int age;
}student_t;

void fillStruct(student_t*);
int main()
{
    student_t s1,s3;
    student_t *s2;
    s2=&s1;

    fillStruct(s2); //fillStruct(&s1);
    s3=s1;
    printf("%s %d",s3.name,s3.age);
    return 0;
}
void fillStruct(student_t*ptr)
{
    scanf("%s%d",(*ptr).name,&ptr->age);// (*ptr).name same as ptr->name

}
```