
Tutorial - Week 6

Objectives: To practise with

- Struct , Union , and Enumeration
- User defined data types

1. What is the primary difference between a structure and an array? Which would you use to store the catalog description of a course? To store the names of students in the course?
2. Define a struct data type `date_t` and a function `displayDate`, that will output its date type parameter in the form `dd/mm/year`.

Example: Assuming that a variable `currentDate` is of type `date` and its contents is

day	month	year
9	5	2016

The function call `displaydate (currentDate)` will output `9/5/2016`

3. Considering the following C program segment

```
typedef struct
{
    char    name[20];
    int     id;
    float   mark[5];
}person_t;

person_t groupOne[10];
```

Indicate whether the following statements are valid or invalid

- a. `person_t.id =2907;`
- b. `groupOne[5].id = 2645;`
- c. `groupOne[0].mark[4]= 45.7;`
- d. `printf("%d\n", groupOne.id);`

4. a) Define a type named `long_lat_t` that would be appropriate for storing longitude or latitude values. The type comprises components named `degrees` (an integer), `minutes` (an integer), and `direction` (one of the characters 'N', 'S', 'E', or 'W').
b) The following is a type to represent a geographic location and a variable of this hierarchical structure type. We will assume that `STRSIZ` means 20.

```
typedef struct {
```

```

    char place[STRSZ];
    long_lat_t  longitude,
               latitude;
} location_t;

location_t resort;

```

Figure 1 gives the content of the variable `resort` in the memory

Variable `resort`, a structure of type `location_t`

<code>.place</code>	H a w a i i \0 ??...		
<code>.longitude</code>	158	0	W
<code>.latitude</code>	21	30	N

Figure 1

Complete the following table.

Reference	Data Type of Reference	Value
<code>resort.latitude</code>	<code>long_lat_t</code>	21 30 'N'
<code>resort.place</code>	_____	_____
<code>resort.longitude.direction</code>	_____	_____
_____	<code>int</code>	30
<code>resort.place[3]</code>	_____	_____

5. Write functions `multiply_complex` and `divide_complex` to implement the operations of multiplication and division of complex numbers defined as follows:

$$(a + bi) \times (c + di) = (ac - bd) + (ad + bc)i$$

$$\frac{(a + bi)}{(c + di)} = \frac{ac + bd}{c^2 + d^2} + \frac{bc - ad}{c^2 + d^2} i$$

Hint: Define a **struct** data type named `complex_t`, with two **double** components, **real** and **imag** to hold the real and imaginary part of the complex number, respectively.

6. Given the following definitions:

```

typedef struct {
    char fst_name[20],
          last_name[20];
    int score;
    char grade;
} student_t;
. . .
student_t stu1, stu2;

```

- a. Identify the following statements as possibly valid or definitely invalid. If invalid, explain why.

```
i. student_t stulist[30];
ii. printf("%s", stu1);
iii. printf("%d %c", stu1.score, stu1.grade);
iv. stu2 = stu1;
v. if (stu2.score == stu1.score)
    printf("Equal");
vi. if (stu2 == stu1)
    printf("Equal structures");
vii. scan_student(&stu1);
viii. stu2.last_name = "Martin";
```

- b. Identify the type of each of the following references:

```
i. stu1
ii. stu2.score
iii. stu2.fst_name[3]
iv. stu1.grade
```

- c. Write a statement that displays the initials of `stu1` (with periods).
- d. How many components does variable `stu2` have?
- e. Declare an array of 40 `student_t` structures, and write a code segment that displays on separate lines the names (*last name, first name*) of all the students in the list.
- f. Write functions `scan_student` and `print_student` for type `student_t` variables.

7. What output is produced by the following program?

```
typedef union      /* can store only one value at a time */
{
    char    var1;
    int     var2;
    double  var3;
} mixData_t;

int main(void)
{
    mixData_t myData;
    myData.var1 = 'A';
    myData.var2 = 35;
    if(myData.var1 == 'A')
        myData.var3 = 5.0;
    else myData.var3 = -1.5;
    printf ("%f", myData.var3); }
```

8. Electromagnetic spectrum is subdivided into several bands:

LF, MF, HF, VHF, UHF

Define a new data type `band_t` that can take only these values. Declare array `channels` of type `band_t` that can store 44 elements. Write a function `initChannels()` that initializes all elements of the array with the value `VHF` using a `for` loop.

9. Write a function `print_day` for enumerated type `day_t` that displays its argument as a string.

```
void print_day(day_t cur_day);
```

Hint: Use a `switch` statement to select the appropriate `printf` statement.