Object oriented programming In C++ (ACE 1004)

Structure 1

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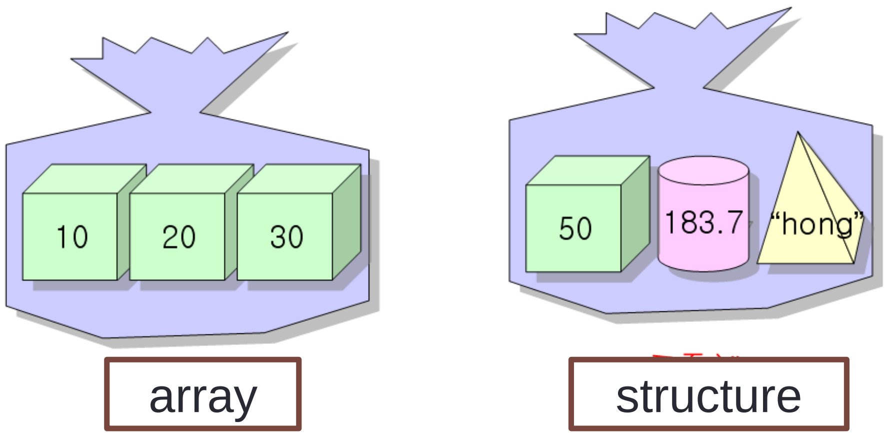
What is the Structure

- Arrays require that all elements be of the same data type
- Many times it is necessary to group information of different data types.
  - ✓ An example is a materials list for a product. The list typically includes a name for each item, a part number, dimensions, weight, and cost.

What is the Structure

Data types
- **fundamental** : char, int, float, double etc.
- **derived** : array, structure etc.

- ➢ Structure
  - ✓ Can store combinations of **deferent types of data**
  - ✓ A *struct* is a derived data type composed of members that are each **fundamental** or **derived data types**.

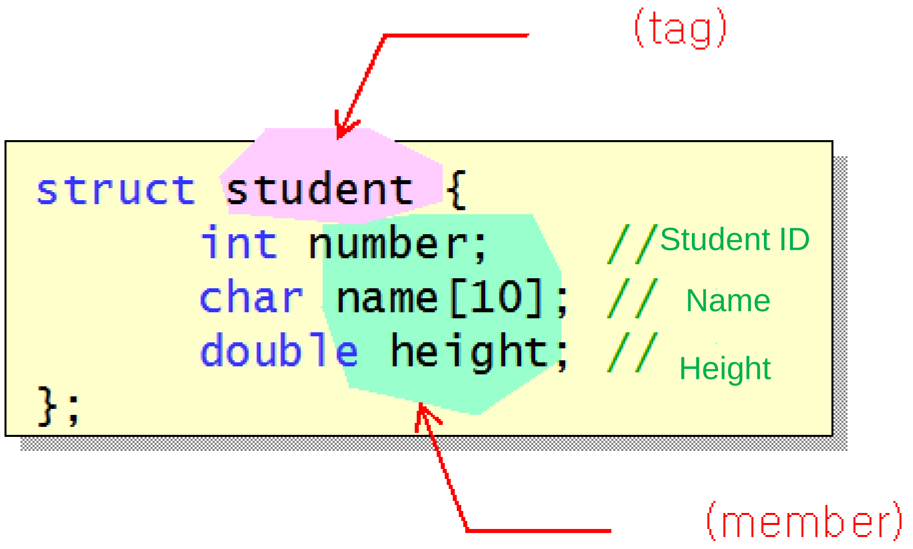


Definition of structure

- Definition form for structure

```
struct structure_tag_name {
    data type member_name;
    data type member_name;
    ...
};
```

Create the new data types



```
struct student {
        int number;        //Student ID
        char name[10];     // Name
        double height;     // Height
};
```

Definition of structure

```
// point A(x,y)
struct point {
        int x;                  // x axis
        int y;                  // y axis
};
```

```
// complex value
struct complex {
        double real;            // real
        double imag;            // imaginary
};
```

```
// date
struct date {
        int month;
        int day;
        int year;
};
```

```
// Rectangular
struct rect {
        int x;
        int y;
        int width;
        int height;
};
```

```
// employee
struct employee {
        char name[20];          // name
        int age;                // age
        int gender;             // gender
        int salary;             // salary
};
```

Definition of structure

```
// point A(x,y)
struct point {
        int x;              // x axis
        int y               // y axis
};
```

```
// complex value
struct complex {
        double real;        // real
        double imag;        // imaginary
}
```

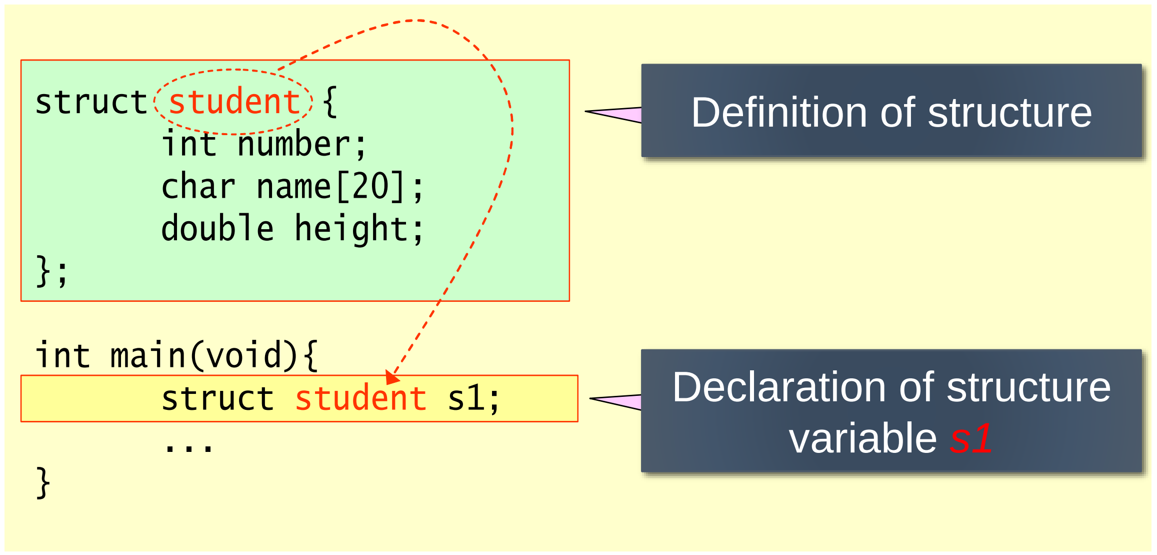
```
// date
union date {
        int month;
        int day;
        int year;
};
```

```
// Rectangular
struct rect {
        int x;
        int y;
        int width;
        int height;
};
```

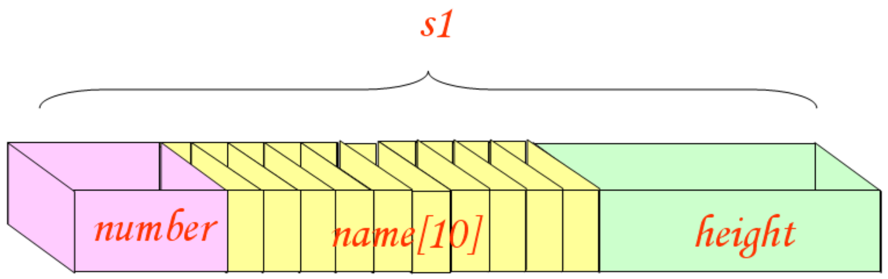
```
// employee
struct employee {
        char name[20];      // name
        int age;            // age
        int gender;         // gender
        int salary;         // salary
};
```

Declaration of structure

- The definition of structure and the declaration of structure variables are different.



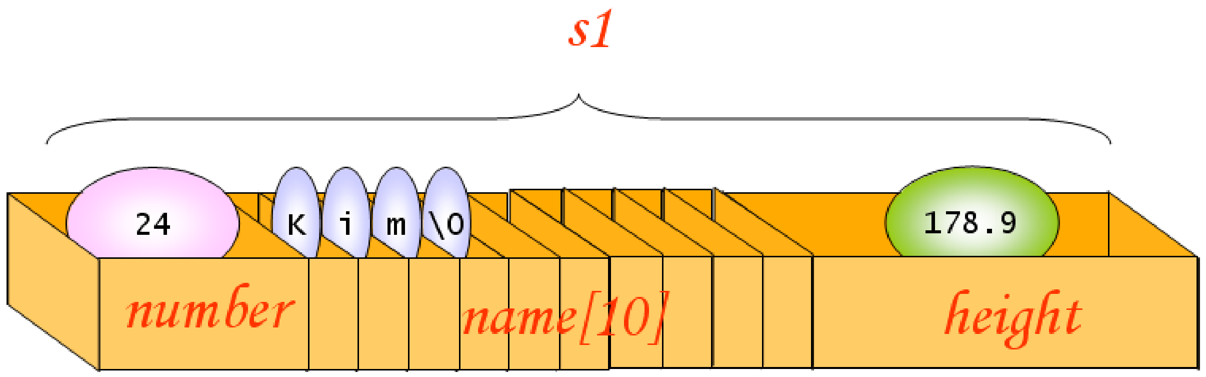
```
struct student {
        int number;
        char name[20];
        double height;
};

int main(void){
        struct student s1;
        ...
}
```



Initialization of structure

```
struct student {
            int number;
            char name[10];
            double height;
};
struct student s1 = { 24, "Kim", 178.9 };
```

Using {…}



Access the structure member

- Access the structure member using “.”

```
s1.number = 26;
s1.name= "Kim";
s1.height = 183.2;
```

EX #1

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

struct student {
        int number;
        char name[10];
        double height;
};

int main(void)
{
        struct student s;

        s.number = 22072174;
        strcpy(s.name,"name");
        s.height = 170.2;

        printf("sid: %d\n", s.number);
        printf("name: %s\n", s.name);
        printf("height: %5.1f\n", s.height);

        return 0;
}
```

Declaration(definition)of structure

Declaration of structure variable

Access the structure member

```
sid: 22072174
name: name
height:  170.2
```

EX #2

```
#include<iostream>
struct  student {
   int korean;
   int english;
   int math;
};
int main() {
   student x, y;
   x.korean = 80;
   x.english = 90;
   x.math = 70;
   // print the data in x
   printf("%d %d %d₩n", x.korean, x.english, x.math);
   // read new data
   scanf_s("%d %d %d", &y.korean, &y.english, &y.math);
   // print the new data
   printf("%d %d %d₩n", y.korean, y.english, y.math);
   return 0;
}
```

Structure array

- Declaration of structure array

```
struct student {
        int number;
        char name[20];
        double height;
};
void main()
{
        struct student list[100];               // declaration of structure array

        list[2].number = 27;
        strcpy(list[2].name, “hong");
        list[2].height = 178.0;
}
```

- Initialization of structure array

```
struct student list[3] = {
        { 1, "Park", 172.8 },
        { 2, "Kim", 179.2 },
        { 3, "Lee", 180.3 }
};
```

EX#3 Structure array

```c
#define SIZE 3

struct student {
	int number;
	char name[20];
	double height;
};
int main(void)
{
	struct student list[SIZE];
	int i;

	for(i = 0; i < SIZE; i++)
	{
			printf(“Enter the student ID: ");
			scanf("%d", &list[i].number);
			printf(“Enter the name: ");
			scanf("%s", list[i].name);
			printf(“Enter the height (floating point): ");
			scanf("%lf", &list[i].height);
	}

	for(i = 0; i< SIZE; i++)
			printf(“SID: %d, Name: %s,  Height: %f\n", list[i].number, list[i].name, list[i].height);

	return 0;
}
```

```
Enter the student ID : 20070001
Enter the name : hong
Enter the height (floating point): 180.2
Enter the student ID : 20070002
Enter the name :  kim
Enter the height (floating point): 178.3
Enter the student ID : 20070003
Enter the name : lee
Enter the height (floating point): 176.3
SID: 20070001, Name: hong, Height: 180.200000
SID : 20070002, Name: kim, Height : 178.300000
SID : 20070003, Name: lee, Height : 176.300000
```

Structure and function

- If the input data type is the structure
  - ✓ Pass the structure copy
  - ✓ The larger size of the structure will take much time and memory

```
int equal(struct student s1, struct student s2)
{
        if( strcmp(s1.name, s2.name) == 0 )
                return 1;
        else
                return 0;
}
```

Return the structure

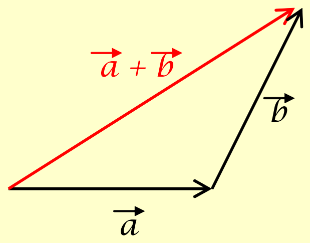
- Call by value

```
struct student make_student(void)
{
      struct student s;

      printf("age:");
      scanf("%d", &s.age);
      printf("Name:");
      scanf("%s", s.name);
      printf("Height:");
      scanf("%f", &s.height);

      return s;
}
```

Return the copy of the structure s

EX #4

```
#include <stdio.h>

struct vector {
	float x;
	float y;
};
struct vector get_vector_sum(struct vector a, struct vector b);

int main(void){
	struct vector a = { 2.0, 3.0 };
	struct vector b = { 5.0, 6.0 };
	struct vector sum;

	sum = get_vector_sum(a, b);
	printf("Vector Sum is  (%f, %f).\n", sum.x, sum.y);

	return 0;
}

struct vector get_vector_sum(struct vector a, struct vector b)
{
	struct vector result;

	result.x = a.x + b.x;
	result.y = a.y + b.y;

	return result;
}
```



```
Vector Sum is (7.000000, 9.000000).
```