CME 112- Programming Languages II

Week 8

Enum, Typedef and Struct

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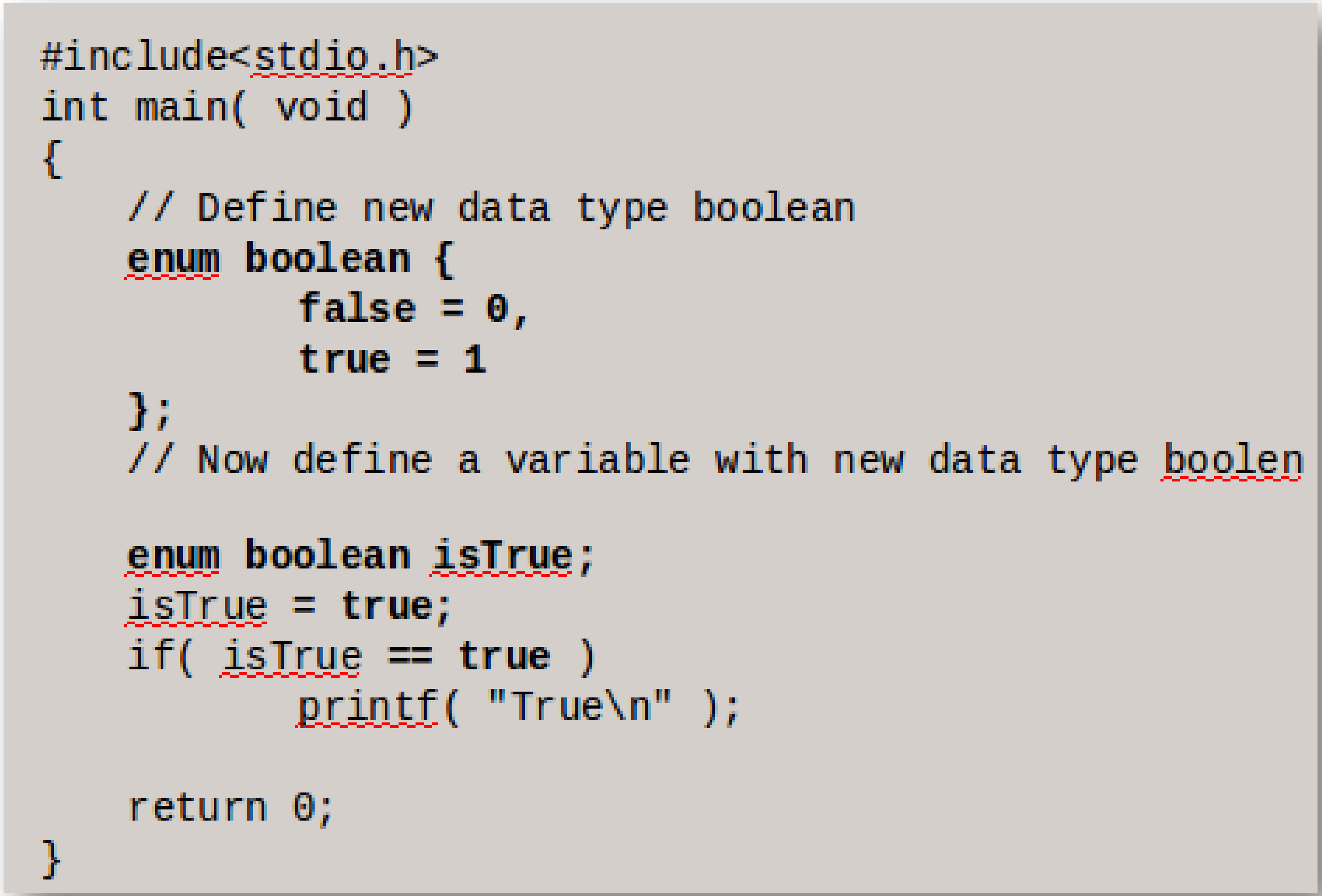
Science is trying to understand the language of nature. Those who understand the language are friendly to nature, and those who do not understand are enemies.

Enum

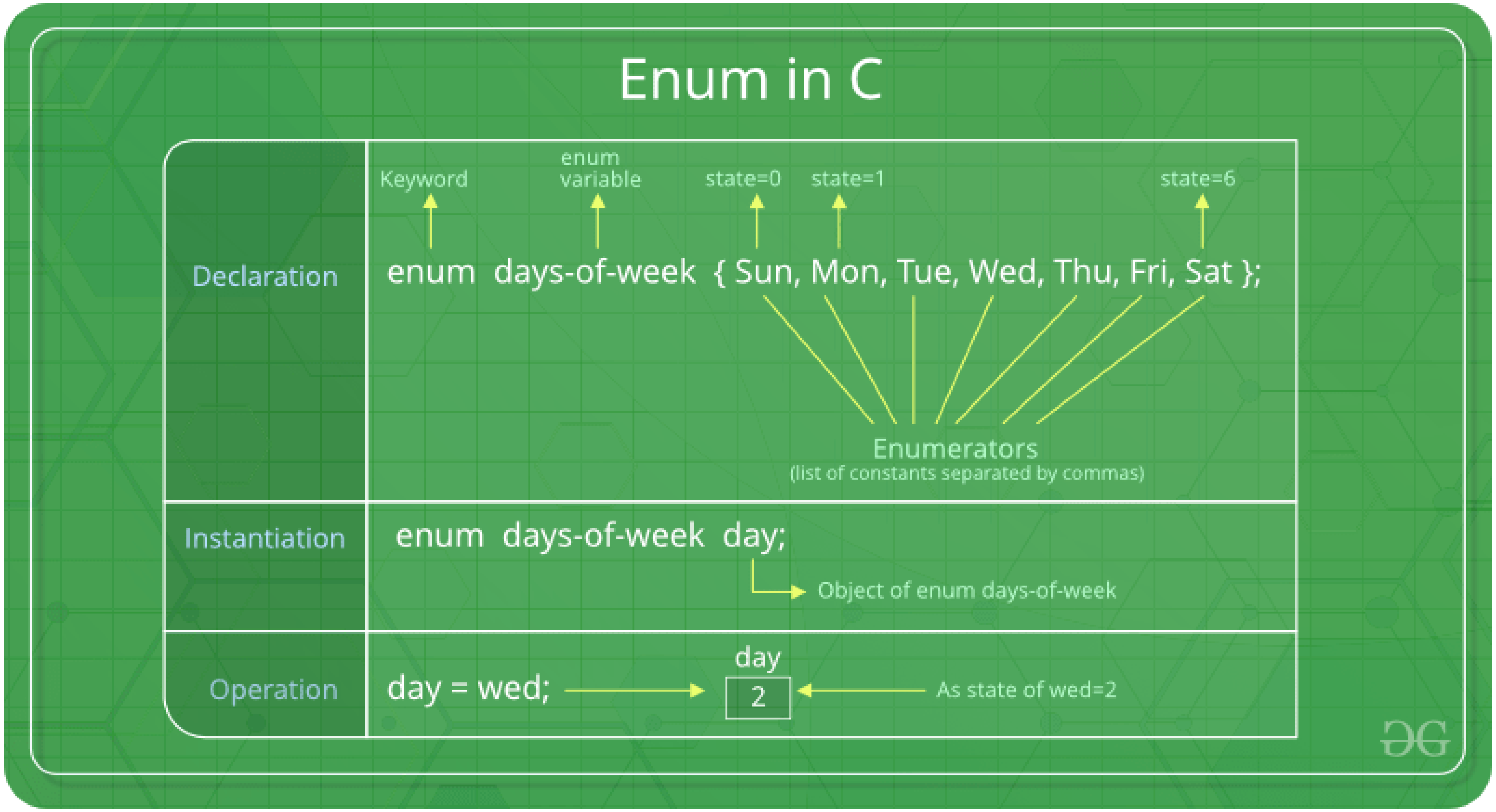
- An enumeration is a user-defined data type that consists of integral constants. To define an enumeration, keyword enum is used.
- Enumaration constants are like symbolic constants.
    - Enum values are set automatically
    - Values start at 0 and incremented by 1
    - Need unique constant names
- We can create our own data type by enum
- For example we can create a new boolean type in which 0 is false and 1 is true

Enum



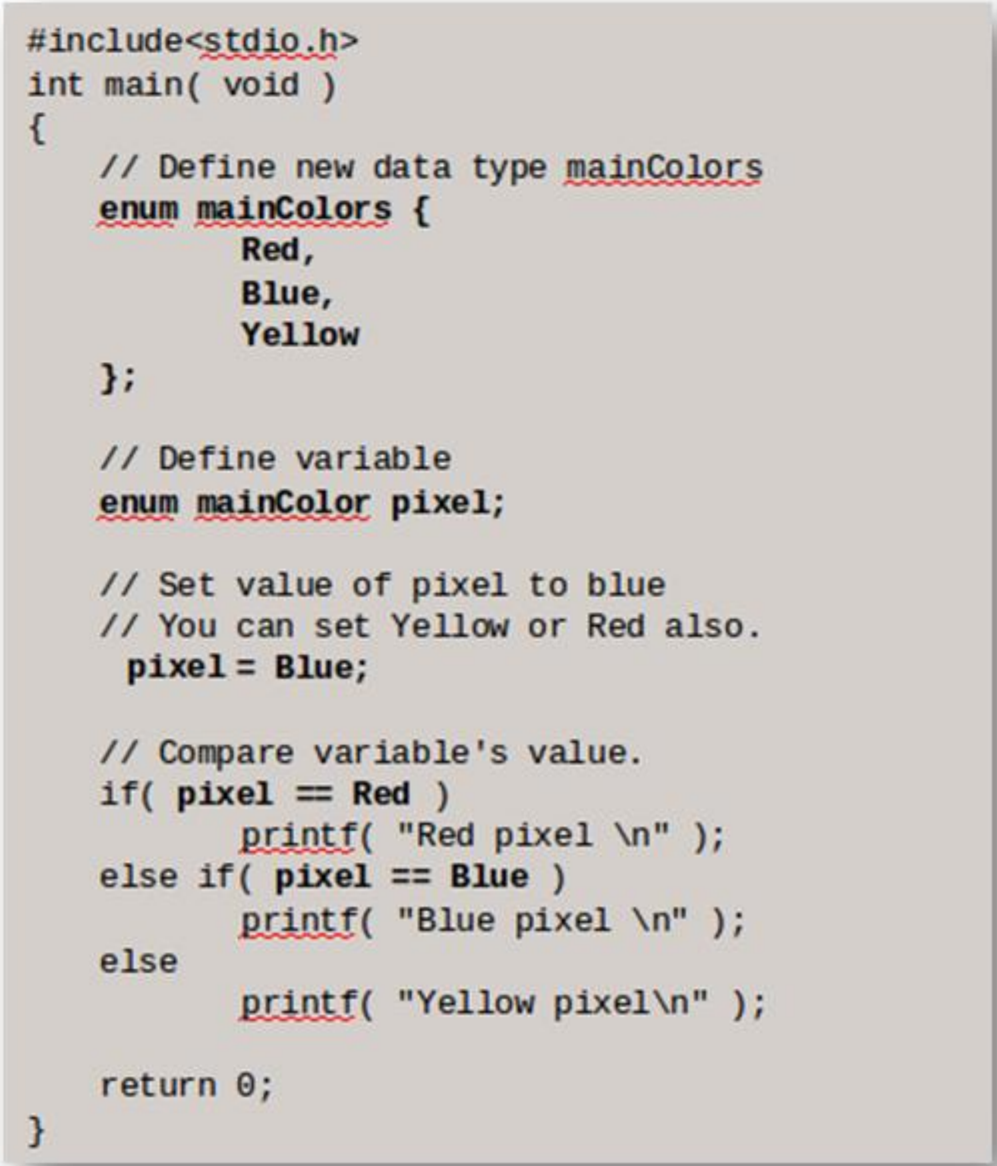
```
#include<stdio.h>
int main( void )
{
    // Define new data type boolean
    enum boolean {
            false = 0,
            true = 1
    };
    // Now define a variable with new data type boolen

    enum boolean isTrue;
    isTrue = true;
    if( isTrue == true )
            printf( "True\n" );

    return 0;
}
```

Enum



```
enum  days-of-week  { Sun, Mon, Tue, Wed, Thu, Fri, Sat };
enum  days-of-week  day;
day = wed;
```

Enum



```
#include<stdio.h>
int main( void )
{
    // Define new data type mainColors
    enum mainColors {
            Red,
            Blue,
            Yellow
    };

    // Define variable
    enum mainColor pixel;

    // Set value of pixel to blue
    // You can set Yellow or Red also.
     pixel = Blue;

    // Compare variable's value.
    if( pixel == Red )
            printf( "Red pixel \n" );
    else if( pixel == Blue )
            printf( "Blue pixel \n" );
    else
            printf( "Yellow pixel\n" );

    return 0;
}
```

Enum

```
// An example program to demonstrate working of enum in C
#include<stdio.h>

enum week{Mon, Tue, Wed, Thur, Fri, Sat, Sun};

int main()
{
        enum week day;
        day = Wed;
        printf("%d",day);
        return 0;
}
```

Enum

Two enum names can have same value. For example, in the following C program both ‘Failed’ and ‘Freezed’ have same value 0.

```
#include <stdio.h>
enum State {Working = 1, Failed = 0, Freezed = 0};

int main()
{
printf("%d, %d, %d", Working, Failed, Freezed);
return 0;
}
```

Enum

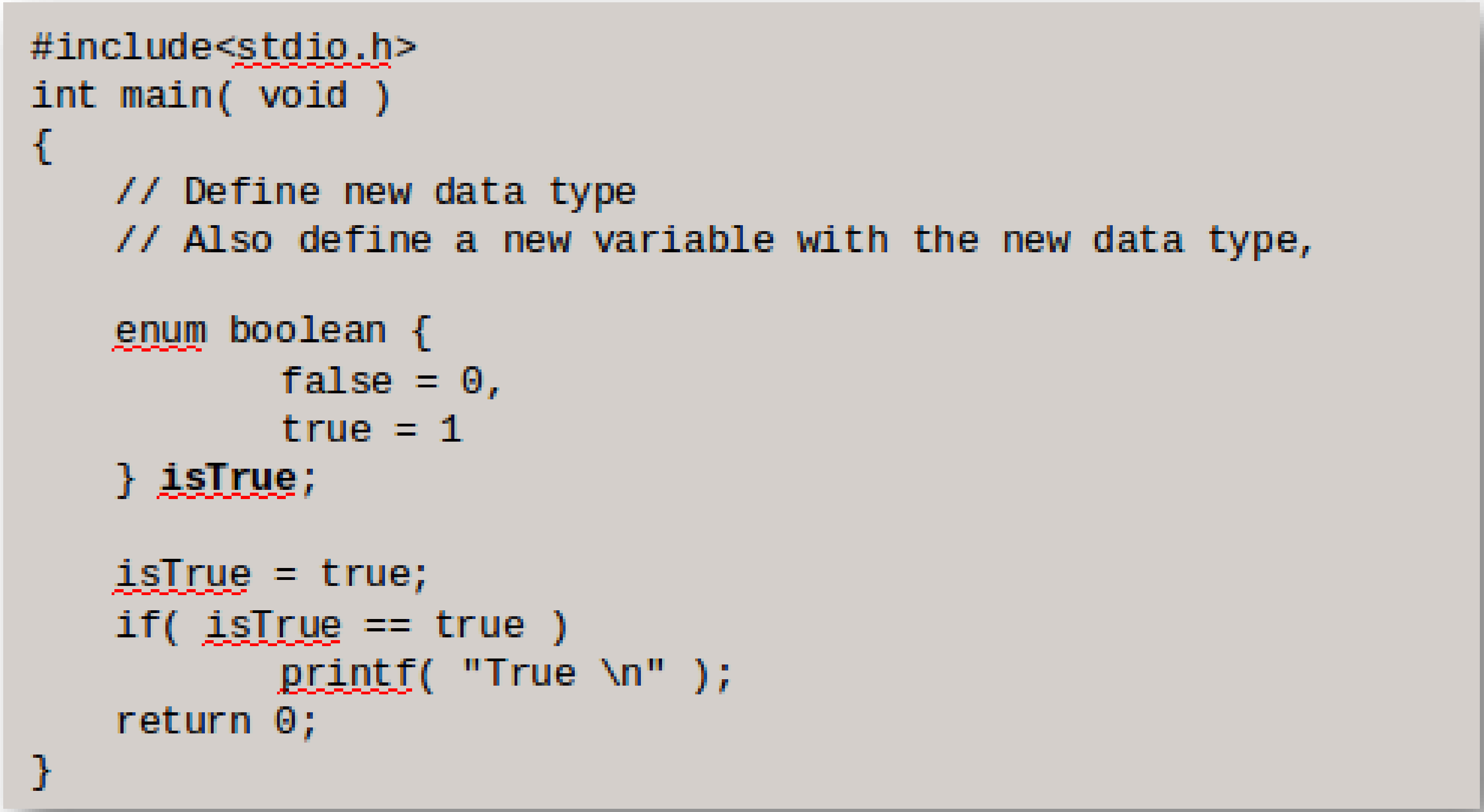
```
#include <stdio.h>
enum day {sunday = 1, monday, tuesday = 5,
          wednesday, thursday = 10, friday, saturday};

int main()
{
   printf("%d %d %d %d %d %d %d", sunday, monday, 
tuesday, wednesday, thursday, friday, saturday);
   return 0;
}
```

```
Output:   1 2 5 6 10 11 12
```

Enum

- Enum is useful if you have some data to be grouped or arranged. Some examples:
  - enum education { primarySchool, secondarySchool, highSchool, graduate, master };
  - enum education student;
  - enum sex { male, female };
  - enum sex person;
- Notice that we use enum keyword for each variable definition.
- We have two alternative ways for not writing enum for each variable definition
  - Defining variable with enum definition
  - Using typedef

Enum

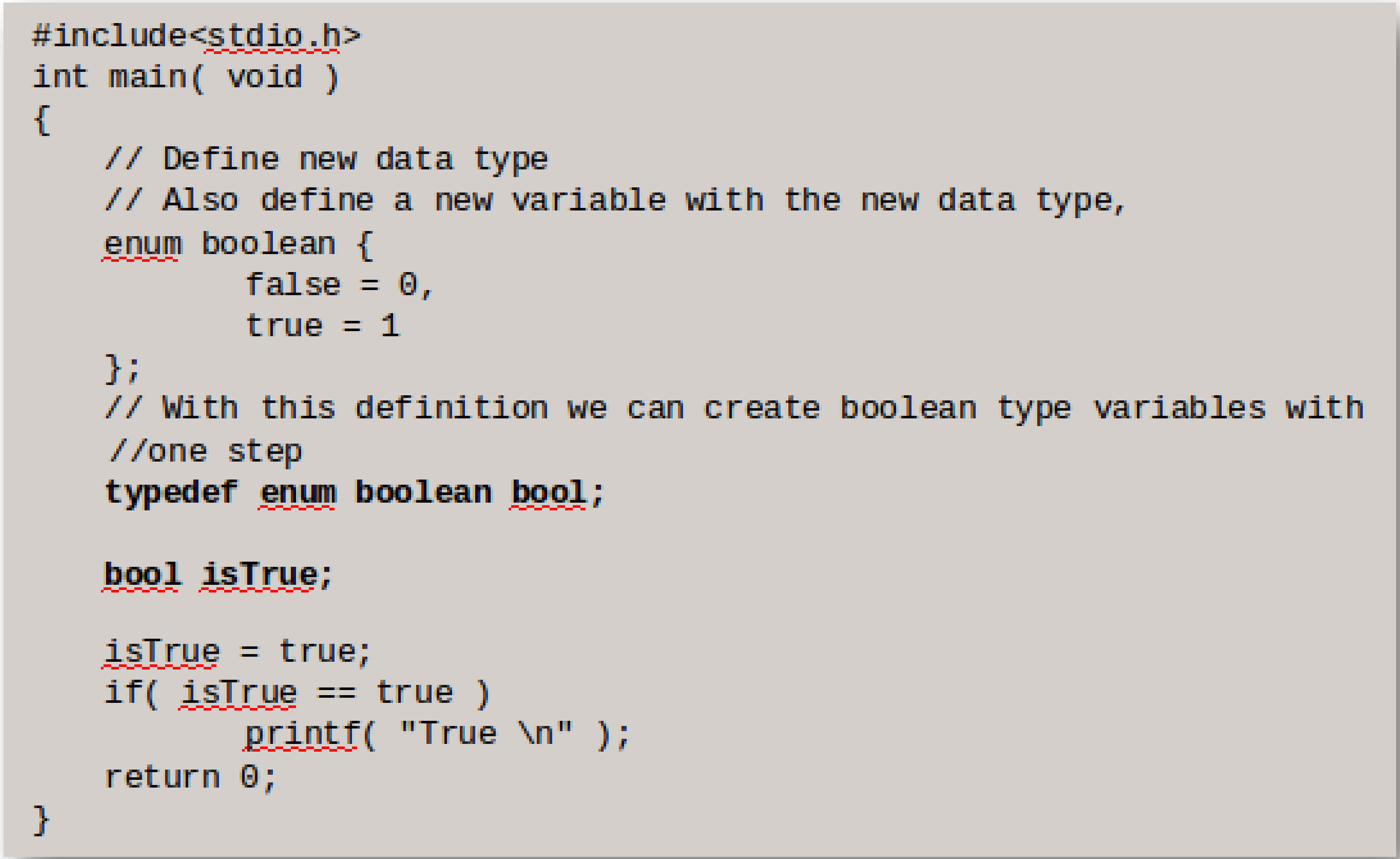


```
#include<stdio.h>
int main( void )
{
    // Define new data type
    // Also define a new variable with the new data type,

    enum boolean {
            false = 0,
            true = 1
    } isTrue;

    isTrue = true;
    if( isTrue == true )
            printf( "True \n" );
    return 0;
}
```

Typedef

- Used to name data types with other user defined names.
- Format of typedef:
  - typedef *old_datatype_name* *new_datatype_name*
  - typedef int tamsayi
    - defines int as tamsayi

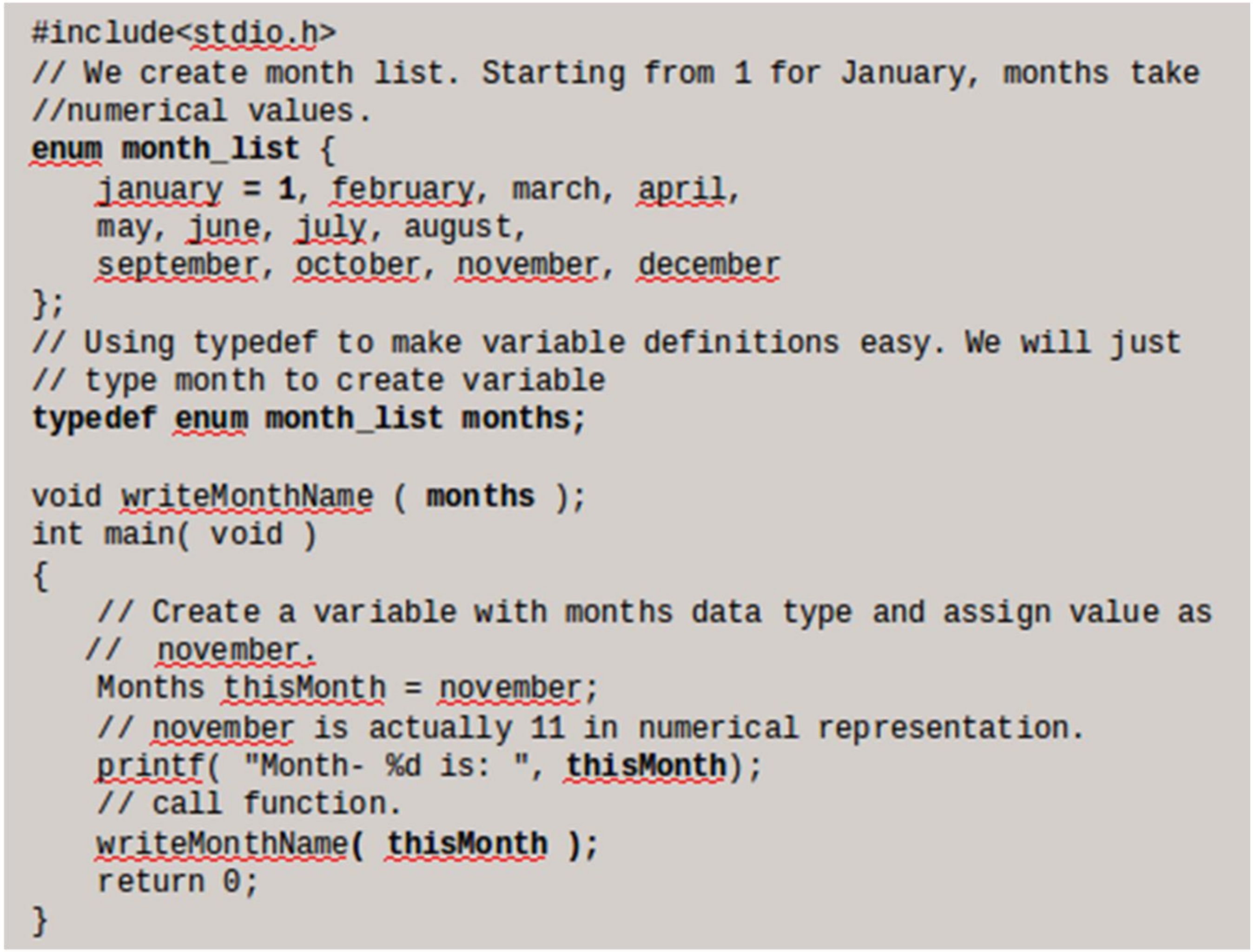
Typedef



```
#include<stdio.h>
int main( void )
{
    // Define new data type
    // Also define a new variable with the new data type,
    enum boolean {
            false = 0,
            true = 1
    };
    // With this definition we can create boolean type variables with
    //one step
    typedef enum boolean bool;

    bool isTrue;

    isTrue = true;
    if( isTrue == true )
            printf( "True \n" );
    return 0;
}
```

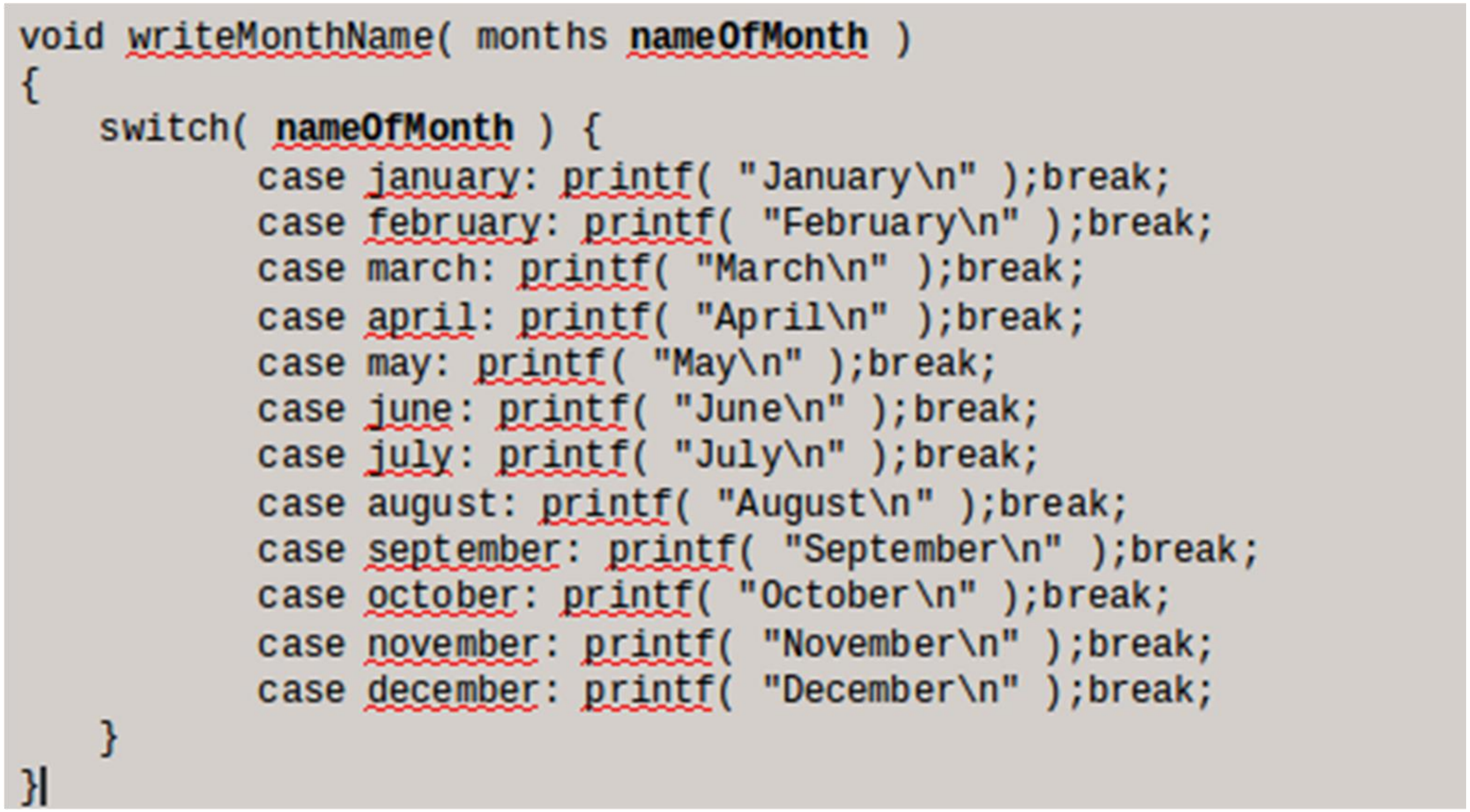
Enum

- If enum is defined globally it can be used as parameter to a function



```
#include<stdio.h>
// We create month list. Starting from 1 for January, months take
//numerical values.
enum month_list {
    january = 1, february, march, april,
    may, june, july, august,
    september, october, november, december
};
// Using typedef to make variable definitions easy. We will just
// type month to create variable
typedef enum month_list months;

void writeMonthName ( months );
int main( void )
{
    // Create a variable with months data type and assign value as
   //  november.
    Months thisMonth = november;
    // november is actually 11 in numerical representation.
    printf( "Month- %d is: ", thisMonth);
    // call function.
    writeMonthName( thisMonth );
    return 0;
}
```

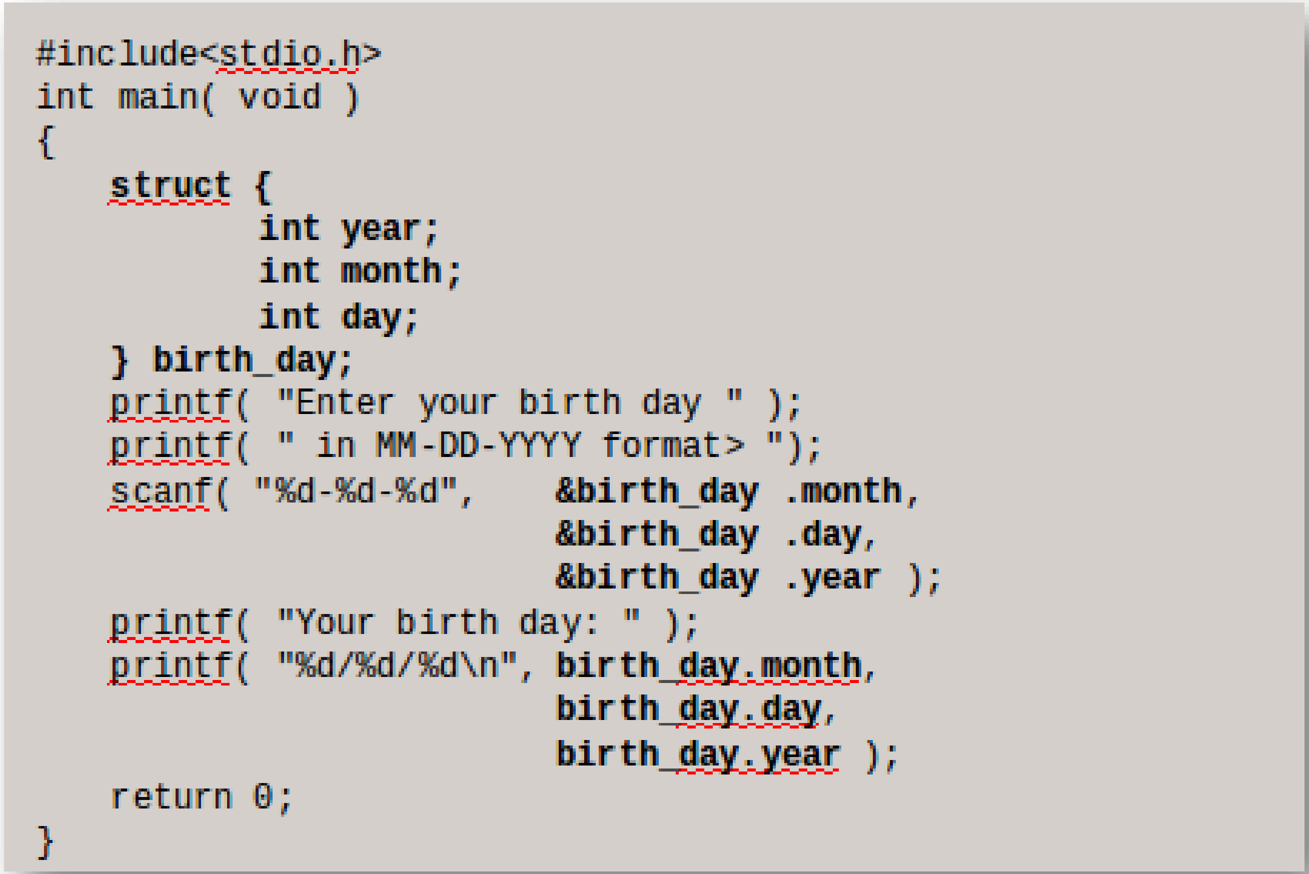
Enum



```
void writeMonthName( months nameOfMonth )
{
    switch( nameOfMonth ) {
            case january: printf( "January\n" );break;
            case february: printf( "February\n" );break;
            case march: printf( "March\n" );break;
            case april: printf( "April\n" );break;
            case may: printf( "May\n" );break;
            case june: printf( "June\n" );break;
            case july: printf( "July\n" );break;
            case august: printf( "August\n" );break;
            case september: printf( "September\n" );break;
            case october: printf( "October\n" );break;
            case november: printf( "November\n" );break;
            case december: printf( "December\n" );break;
    }
}
```

Struct

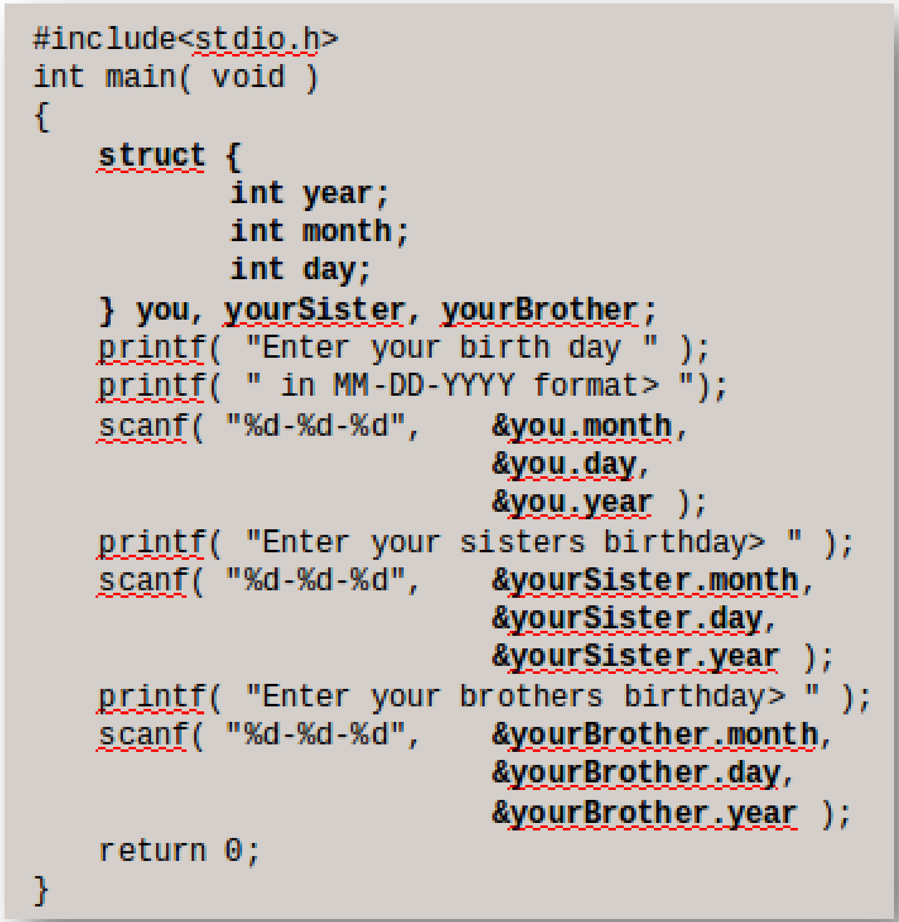
- Used to group different types of variables in one structure.
- Structures are important for object oriented programming



```
#include<stdio.h>
int main( void )
{
    struct {
            int year;
            int month;
            int day;
    } birth_day;
    printf( "Enter your birth day " );
    printf( " in MM-DD-YYYY format> ");
    scanf( "%d-%d-%d",     &birth_day .month,
                           &birth_day .day,
                           &birth_day .year );
    printf( "Your birth day: " );
    printf( "%d/%d/%d\n", birth_day.month,
                           birth_day.day,
                           birth_day.year );
    return 0;
}
```

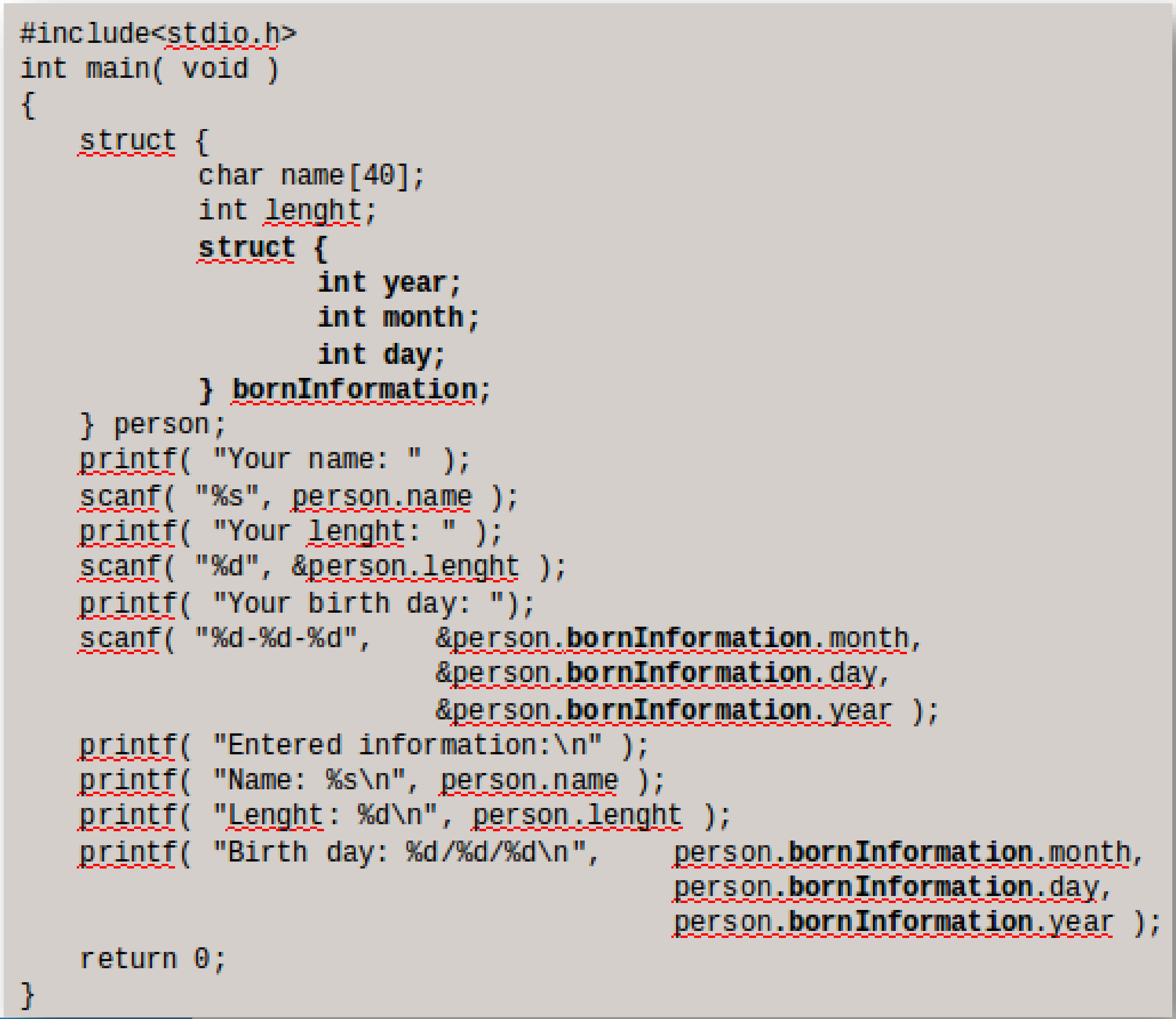
Struct

- If we did not use struct in this sample we would have to define 9 different variables.
- We make it with 3 variables.
- Think about a program that takes 20 information for a person.
- With 3 person you have to define 60 different variables.
- Another advantage of structures is to easily copy data from one variable to another.
- you = yourSister assignment copies your sister's data on to your data



```
#include<stdio.h>
int main( void )
{
    struct {
            int year;
            int month;
            int day;
    } you, yourSister, yourBrother;
    printf( "Enter your birth day " );
    printf( " in MM-DD-YYYY format> ");
    scanf( "%d-%d-%d",      &you.month,
                            &you.day,
                            &you.year );
    printf( "Enter your sisters birthday> " );
    scanf( "%d-%d-%d",      &yourSister.month,
                            &yourSister.day,
                            &yourSister.year );
    printf( "Enter your brothers birthday> " );
    scanf( "%d-%d-%d",      &yourBrother.month,
                            &yourBrother.day,
                            &yourBrother.year );

    return 0;
}
```

Nested Structures



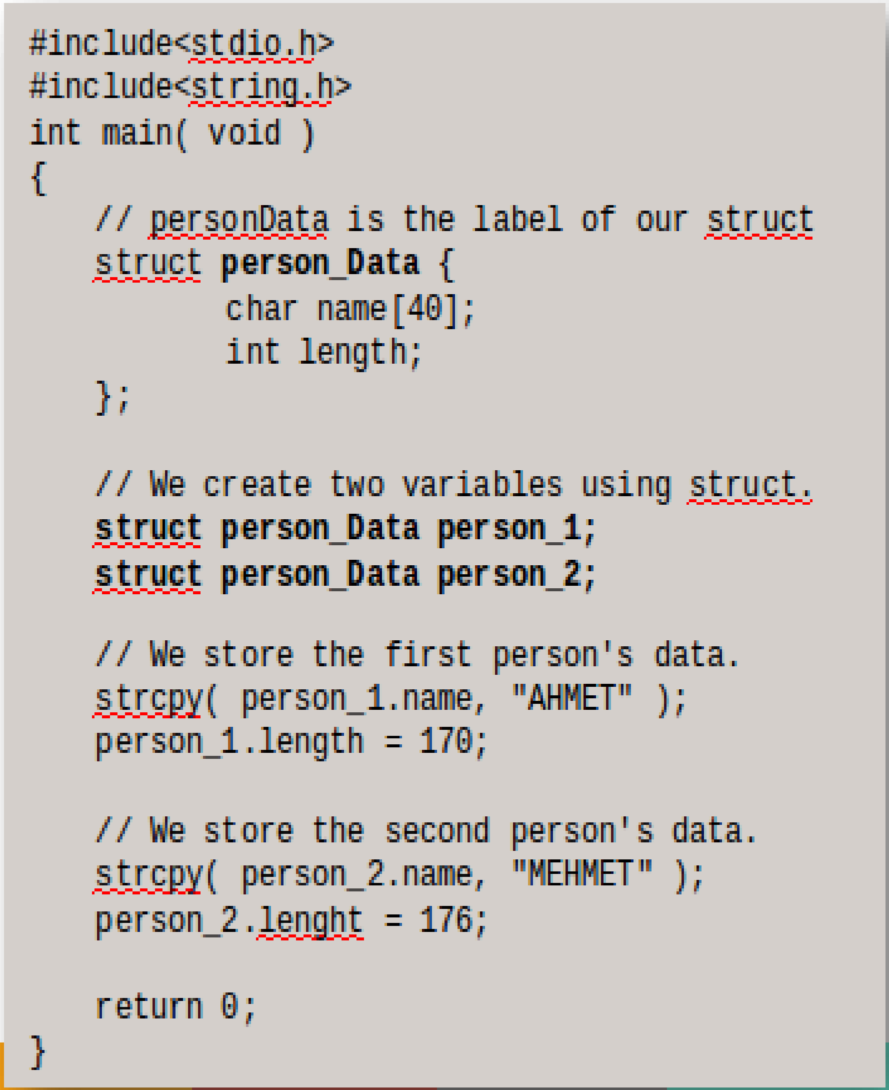
```
#include<stdio.h>
int main( void )
{
    struct {
            char name[40];
            int lenght;
            struct {
                    int year;
                    int month;
                    int day;
            } bornInformation;
    } person;
    printf( "Your name: " );
    scanf( "%s", person.name );
    printf( "Your lenght: " );
    scanf( "%d", &person.lenght );
    printf( "Your birth day: ");
    scanf( "%d-%d-%d",    &person.bornInformation.month,
                          &person.bornInformation.day,
                          &person.bornInformation.year );
    printf( "Entered information:\n" );
    printf( "Name: %s\n", person.name );
    printf( "Lenght: %d\n", person.lenght );
    printf( "Birth day: %d/%d/%d\n",     person.bornInformation.month,
                                         person.bornInformation.day,
                                         person.bornInformation.year );
    return 0;
}
```

Labeling Structures

- Labeling structures has many advantages.

- If labeling is not done, you have to define the variables when defining the structure.
- If you use labels you can define as many variables as you want from struct in any point of your program

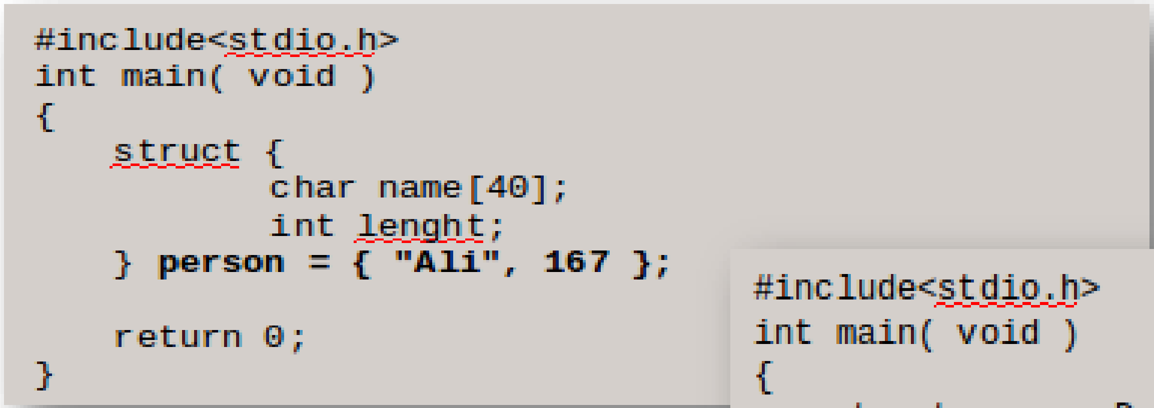
- In order to use the struct, we must create a variable with the label that we defined.



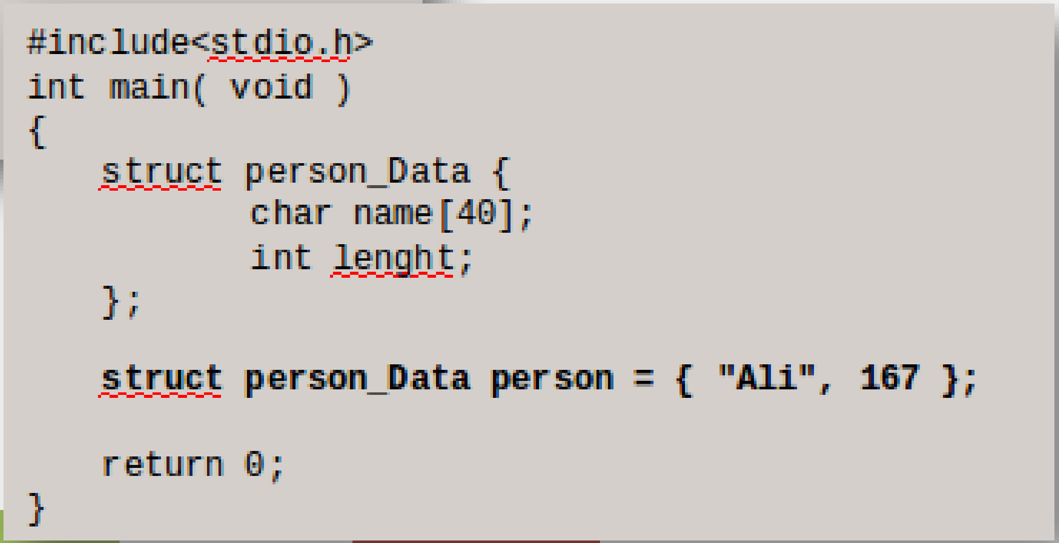
```
#include<stdio.h>
#include<string.h>
int main( void )
{
    // personData is the label of our struct
    struct person_Data {
            char name[40];
            int length;
    };

    // We create two variables using struct.
    struct person_Data person_1;
    struct person_Data person_2;

    // We store the first person's data.
    strcpy( person_1.name, "AHMET" );
    person_1.length = 170;

    // We store the second person's data.
    strcpy( person_2.name, "MEHMET" );
    person_2.lenght = 176;

    return 0;
}
```

Initial Values for Structures

- Structures can be defined with initial values of its variables.
- Order of the values must fit to the struct's order.
- You can give initial values for structs defined with or without label.

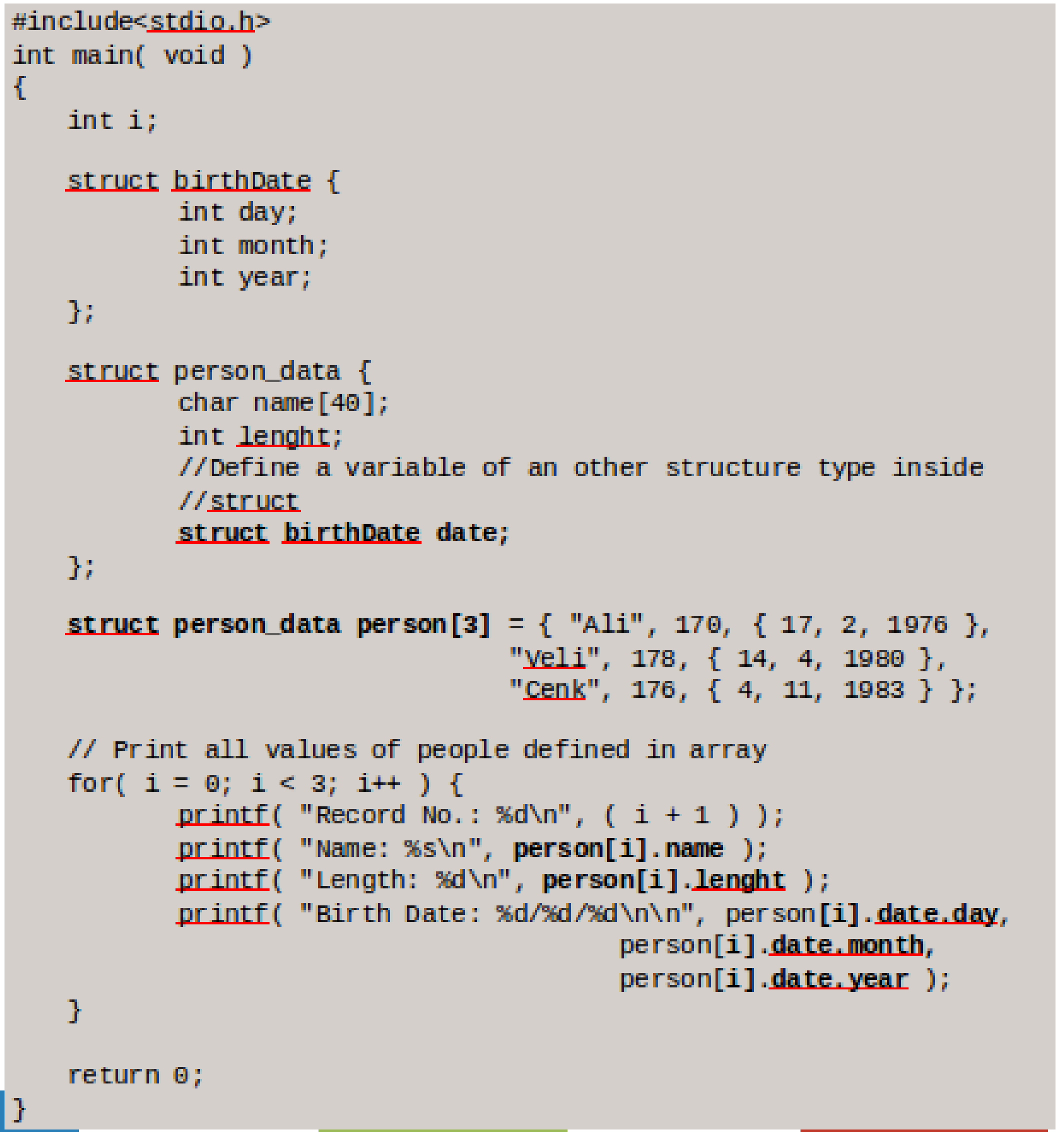


```
#include<stdio.h>
int main( void )
{
    struct {
            char name[40];
            int lenght;
    } person = { "Ali", 167 };

    return 0;
}
```



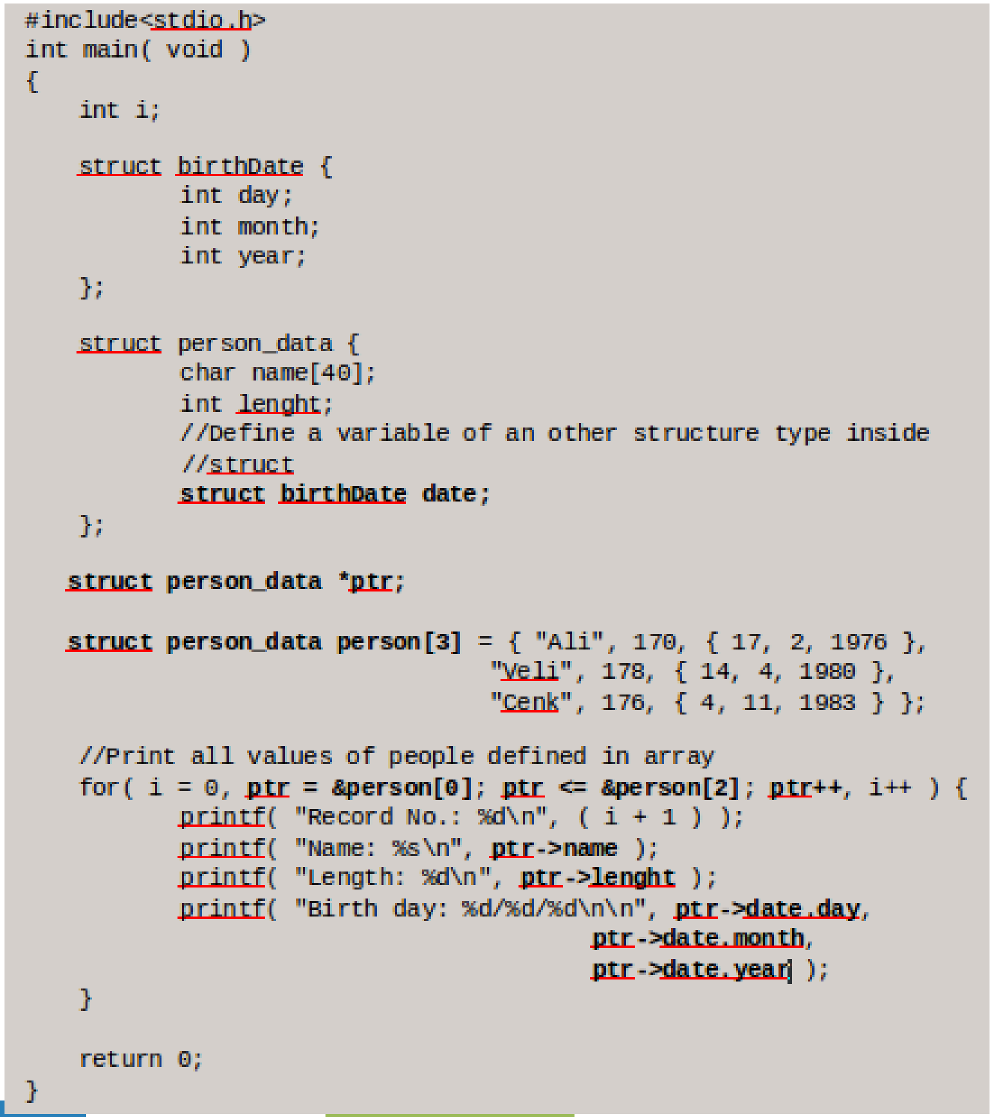
```
#include<stdio.h>
int main( void )
{
    struct person_Data {
            char name[40];
            int lenght;
    };

    struct person_Data person = { "Ali", 167 };

    return 0;
}
```

Arrays of Structures



```
#include<stdio.h>
int main( void )
{
    int i;

    struct birthDate {
            int day;
            int month;
            int year;
    };

    struct person_data {
            char name[40];
            int lenght;
            //Define a variable of an other structure type inside
            //struct
            struct birthDate date;
    };

    struct person_data person[3] = { "Ali", 170, { 17, 2, 1976 },
                                    "Veli", 178, { 14, 4, 1980 },
                                    "Cenk", 176, { 4, 11, 1983 } };

    // Print all values of people defined in array
    for( i = 0; i < 3; i++ ) {
            printf( "Record No.: %d\n", ( i + 1 ) );
            printf( "Name: %s\n", person[i].name );
            printf( "Length: %d\n", person[i].lenght );
            printf( "Birth Date: %d/%d/%d\n\n", person[i].date.day,
                                            person[i].date.month,
                                            person[i].date.year );
    }

    return 0;
}
```

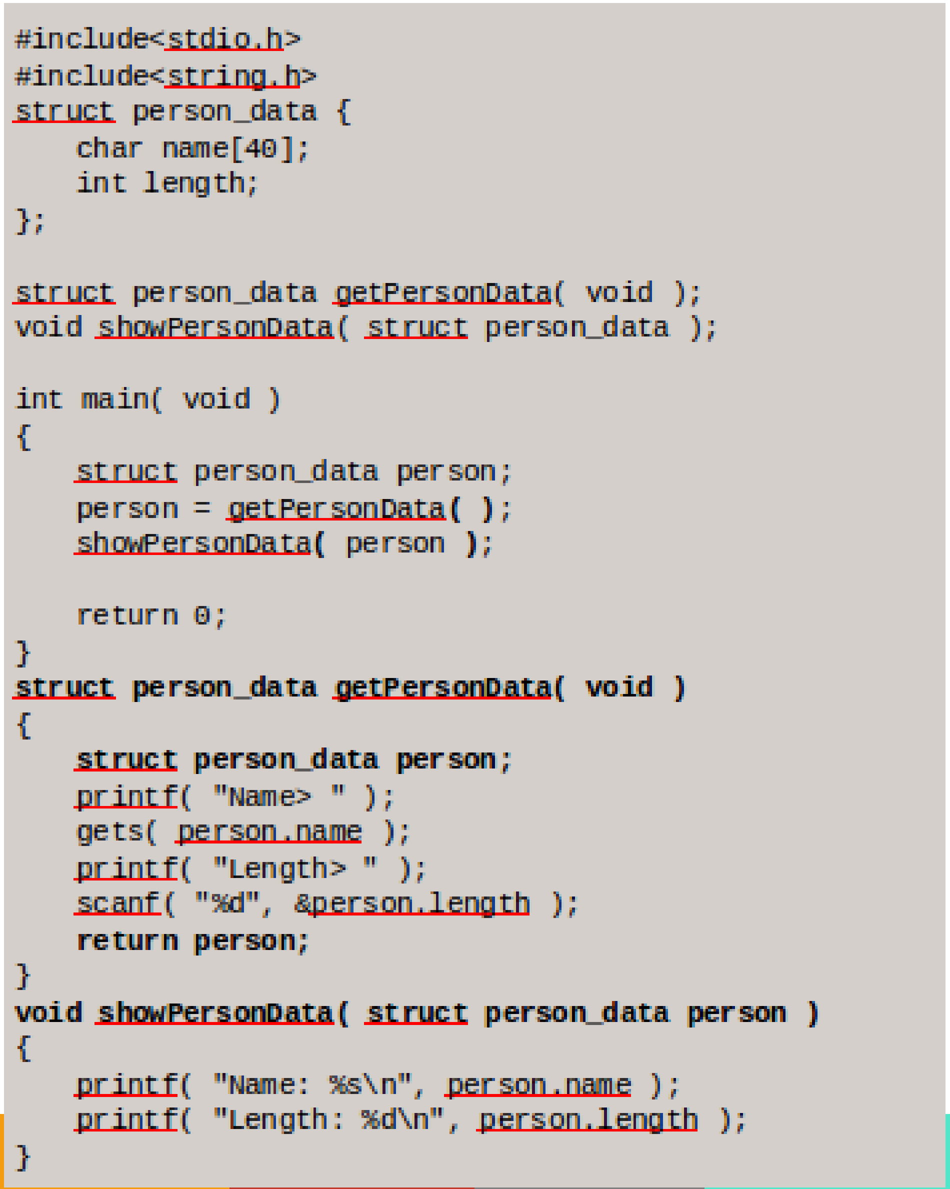
Accessing Structures with Pointers



```
#include<stdio.h>
int main( void )
{
    int i;

    struct birthDate {
           int day;
           int month;
           int year;
    };

    struct person_data {
           char name[40];
           int lenght;
           //Define a variable of an other structure type inside
           //struct
           struct birthDate date;
    };

   struct person_data *ptr;

   struct person_data person[3] = { "Ali", 170, { 17, 2, 1976 },
                              "Veli", 178, { 14, 4, 1980 },
                              "Cenk", 176, { 4, 11, 1983 } };

    //Print all values of people defined in array
    for( i = 0, ptr = &person[0]; ptr <= &person[2]; ptr++, i++ ) {
           printf( "Record No.: %d\n", ( i + 1 ) );
           printf( "Name: %s\n", ptr->name );
           printf( "Length: %d\n", ptr->lenght );
           printf( "Birth day: %d/%d/%d\n\n", ptr->date.day,
                                        ptr->date.month,
                                        ptr->date.year );
    }

    return 0;
}
```

Passing Structs as Parameters to Functions

➢ Define structure globally and pass to function.



```
#include<stdio.h>
#include<string.h>
struct person_data {
    char name[40];
    int length;
};

struct person_data getPersonData( void );
void showPersonData( struct person_data );

int main( void )
{
    struct person_data person;
    person = getPersonData( );
    showPersonData( person );

    return 0;
}
struct person_data getPersonData( void )
{
    struct person_data person;
    printf( "Name> " );
    gets( person.name );
    printf( "Length> " );
    scanf( "%d", &person.length );
    return person;
}
void showPersonData( struct person_data person )
{
    printf( "Name: %s\n", person.name );
    printf( "Length: %d\n", person.length );
}
```

Next Week

- Singly Linked Linear Lists

References

- Doç. Dr. Fahri Vatansever, “Algoritma Geliştirme ve Programlamaya Giriş”, Seçkin Yayıncılık, 12. Baskı, 2015.
- Kaan Aslan, “A’dan Z’ye C Klavuzu 8. Basım”, Pusula Yayıncılık, 2002.
- Paul J. Deitel, “C How to Program”, Harvey Deitel.
- “A book on C”, All Kelley, İra Pohl

Any Questions?

Thanks for listening

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Footnote..

I address the Republic of Turkey, especially today's youth and growing children: the West is very distant from the Turks. It was like that in the sense, idea and history. If today's western superiority shows you, the Turkish Child, that misfortune is not yours but a result of the unforgivable neglect of those before you. **Let me also say that, you're so clever!.. This is obvious. But forget the intelligence!.. Always be hard working...**

Ghazi Mustafa Kemal ATATURK