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What is the purpose of the main() function in a C program? Explain its significance.

Every C program has the entry point as the main() function. On executing a program the operating system will always give control to the main() function originally therefore by default the program is executed by the main() function. This causes it to be the most crucial role of a C program since without it the compiler would not have the idea where to begin executing. A program may have more than one, but it must have one main() function and it is mandatory. The main() function normally returns an integer value to the operating system, in which a return 0; is a general indication that the program was successfully run. Therefore, main() function is the core aspect of the execution of the program, and it is what connects the program and the operating system.

Explain the difference between a variable declaration and a variable initialization in C.

Variable declaration and variable initialization are two similar and yet different concepts in C programming. The procedure of telling the compiler the name and the type of data in a variable is known as variable declaration. At this point the memory is already allocated, but the variable does not contain any useful value. e.g. int age; states an integer variable called age but does not give it a value. Conversely, variable initialization gives a starting value to the variable when it is being declared. As an example, int age = 20; declares the variable and sets the value of the variable to 20. Concisely, declaration occupies memory with the variable, and the initial value is set by the process of initializing.

What are the different data types available in C? Provide examples of each data type.

C defines a variety of data types to work with various types of values which can be generally separated into basic, derived and user-defined. Types of basic data are int, which are integers, float, which are single-precision decimal numbers, double, which are double-precision decimal numbers, and char which are used to store single characters. These types are used in example int num = 10;, float price = 99.5;, double pi = 3.14; and char grade = A;. Beyond these, ways to store and manipulate more complex types of data include derived data types, including arrays, pointers and functions. Another user-defined data type available in C is struct, union, enumeration and type-define whereby, a programmer is free to create customized data structures. These two combined can enable C to deal with a broad spectrum of information in applications.

1. **Basic Data Types**

```
int num = 10;

float price = 99.50;

char grade = 'A';
```

2. **Derived Data Types**

```
int marks[5] = {90, 80, 70, 85, 95};

int *ptr;
```

3. **User-Defined Data Types**

```
struct Student {
   int roll;
   char name[20];  };
```

Explain the concept of type conversions in C. Provide examples of implicit and explicit type conversions.

A conversion of one variable into another data type is termed as type conversion in C. It has two major forms, which are implicit and explicit conversions. Type promotion, also identified as implicit conversion, is an automatic compiler process. In this, the smaller types of data are changed into bigger compatible types to avoid loss of data. Indicatively, when an integer is assigned to a double variable, the compiler automatically casts the integer to a double. Explicit conversion, however, is through the programmer using the cast operator (type). This can be converted between one form to another. As an example, is 3.14 an integer or is it a double, (int) 3.14 will give you 3, not the decimal place value. Hence, both type conversion and compatibility between operations are provided as well as allowing the programmer to have control over the data. For example,

1. **Implicit Type Conversion**

   int a = 5;

   double b = a; //int automatically converted to double

2. **Explicit Type Conversion**

   double x = 9.8;

   int y = (int)x; //double explicitly converted to int (decimal part lost)

What is the role of the scanf() function in C? Provide an example of its usage.

The scanf() function in C is used to accept input from the user at runtime. It is defined in the <stdio.h> library and works with format specifiers such as %d for integers, %f for floats, %c

for characters, and %s for strings. The function requires the address of the variable using the & operator so that the input value can be stored in the correct memory location. This makes programs interactive and flexible since they can accept values directly from the user rather than using fixed values in the code. For example,

```
#include <stdio.h>

int main() {
    int age;
    float height;
    char grade;
    printf("Enter your age, height, and grade: ");
    scanf("%d %f %c", &age, &height, &grade);
    printf("Age: %d, Height: %.2f, Grade: %c\n", age, height, grade);
    return 0;
}
```