Programming in C

Part 2

Data Types and Type Conversion in C

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Data Types

- **Data types** are declarations for memory locations or variables that determine the characteristics of the data that may be stored and the methods (operations) of processing that are permitted involving them..

Following are the examples of some very common data types used in C:

- **char:** The most basic data type in C. It stores a single character and requires a single byte of memory in almost all compilers.
- **int:** As the name suggests, an int variable is used to store an integer.
- **float:** It is used to store decimal numbers (numbers with floating point value) with single precision.
- **double:** It is used to store decimal numbers (numbers with floating point value) with double precision.

DATA TYPES

Type	Data types
Basic Data Type	int, char, float, double
Derived Data Type	array, pointer, structure, union
Enumeration Data Type	enum
Void Data Type	void

Integer Types

Type	Storage size	Value range
char	1 byte	-128 to 127 or 0 to 255
unsigned char	1 byte	0 to 255
signed char	1 byte	-128 to 127
int	2 or 4 bytes	-32,768 to 32,767 or -2,147,483,648 to 2,147,483,647
unsigned int	2 or 4 bytes	0 to 65,535 or 0 to 4,294,967,295
short	2 bytes	-32,768 to 32,767
unsigned short	2 bytes	0 to 65,535
long	4 bytes	-2,147,483,648 to 2,147,483,647
unsigned long	4 bytes	0 to 4,294,967,295

Floating-Point Types

Type	Storage size	Value range	Precision
float	4 byte	1.2E-38 to 3.4E+38	6 decimal places
double	8 byte	2.3E-308 to 1.7E+308	15 decimal places
long double	10 byte	3.4E-4932 to 1.1E+4932	19 decimal places

The void Type

- The void type specifies that no value is available. It is used in three kinds of situations –

Sr.No.	Types & Description
1	**Function returns as void** There are various functions in C which do not return any value or you can say they return void. A function with no return value has the return type as void. For example, **void exit (int status);**
2	**Function arguments as void** There are various functions in C which do not accept any parameter. A function with no parameter can accept a void. For example, **int rand(void);**
3	**Pointers to void** A pointer of type void * represents the address of an object, but not its type. For example, a memory allocation function **void *malloc(size_t size);** returns a pointer to void which can be casted to any data type.

Type Conversion

- **Type casting** is a way to convert a variable from one data type to another data type. For example, if you want to store a long value into a simple integer then you can typecast long to int.

Types of Type Conversion:

- Implicit Type Conversion
- Explicit Type Conversion

Implicit Type Conversion

- When the type conversion is performed automatically by the compiler, such type of conversion is known as implicit type conversion or type promotion.
- Implicit conversions do not require any operator for converted. They are automatically performed when a value is copied to a compatible type in the program.
- All the data types of the variables are upgraded to the data type of the variable with largest data type.

bool -> char -> short int -> int -> unsigned int -> long -> unsigned -> long long -> float -> double -> long double

Example (Conversion of Char to int)

```
#include <stdio.h>
void main()
{
   int i = 17;
   char c = 'c'; /* ascii value is 99 */
   int sum;
   sum = i + c;
   printf("Value of sum : %d\n", sum );
}
```

Explicit Type Conversion

- The type conversion performed by the programmer by posing the data type of the expression of specific type is known as explicit type conversion. The explicit type conversion is also known as type casting.
- Type casting in c is done in the following form:

(data_type)expression;

Example:

```
{
int x=7,
y=5;
float z;
 z = (float)x/(float)y;
}
```

Header Files

- A header file is a file with extension **.h** which contains C function declarations and macro definitions to be shared between several source files.
- **#include** is used to use these files in program and it is called as preprocessor directive.
- Including a header file produces the same results as copying the header file into each source file that needs it.
- The default header file that comes with the C compiler is the stdio.h.
- Examples: stdio.h, conio.h, math.h, string.h, graphics.h

LIST OF INBUILT C FUNCTIONS IN STDIO.H FILE:

- **printf()** This function is used to print the character, string, float, integer, octal and hexadecimal values onto the output screen
- **scanf()** This function is used to read a character, string, numeric data from keyboard.
- **getc()** It reads character from file
- **gets()** It reads line from keyboard
- **getchar()** It reads character from keyboard
- **puts()** It writes line to o/p screen
- **putchar()** It writes a character to screen

STRING.H

- This header file declares several string manipulation and memory manipulation routines. The functions contained in string.h are given in the following table:

String functions	Description
strcat ( )	Concatenates str2 at the end of str1
strncat ( )	Appends a portion of string to another
strcpy ( )	Copies str2 into str1
strncpy ( )	Copies given number of characters of one string to another
strlen ( )	Gives the length of str1
strcmp ( )	Returns 0 if str1 is same as str2. Returns <0 if strl < str2. Returns >0 if str1 > str2
strchr ( )	Returns pointer to first occurrence of char in str1
strrchr ( )	last occurrence of given character in a string is found
strstr ( )	Returns pointer to first occurrence of str2 in str1
strrstr ( )	Returns pointer to last occurrence of str2 in str1

FUNCTIONS IN MATH.H

- This header file declares prototypes for the math functions and math error handlers. The routines in math.h file perform mathematical calculations and conversion.

floor ( )	This function returns the nearest integer which is less than or equal to the argument passed to this function.
round ( )	This function returns the nearest integer value of the float/double/long double argument passed to this function. If decimal value is from ".1 to .5", it returns integer value less than the argument. If decimal value is from ".6 to .9", it returns the integer value greater than the argument.
sin ( )	This function is used to calculate sine value.
cos ( )	This function is used to calculate cosine.
tan ( )	This function is used to calculate tangent.
log ( )	This function is used to calculates natural logarithm.
sqrt ( )	This function is used to find square root of the argument passed to this function.
pow ( )	This is used to find the power of the given number.

FUNCTIONS IN CONIO.H

- clrscr
- getch
- getche
- gotoxy
- textcolor
- textbackground

COMMENTS IN C

- Comments in C language are used to provide information about lines of code. It is widely used for documenting code.
- All characters available inside any comment are ignored by C compiler.
- They are non executable.
- There are 2 types of comments in C language.
  - Single Line Comments (//printing information)
  - Multi Line Comments

(/*
code
to be commented
*/)

```
#include<stdio.h
int main(){
    //printing info
    printf("Hello C
```

REFERENCES

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- LET US C, YASHWANT KANETKAR
- Basics of C Programming, 2011, by J.B. Dixit