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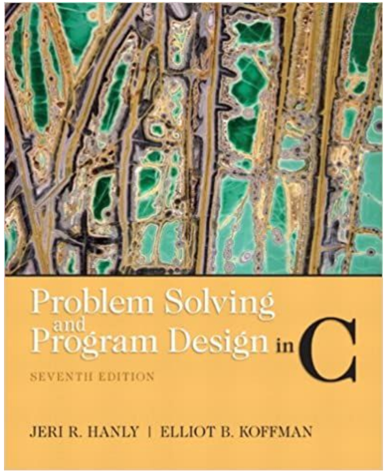

Problem Solving and Program Design in C
SEVENTH EDITION
JERI R. HANLY | ELLIOT B. KOFFMAN

# Faculty of Engineering and Technology
# Department of Computer Science

## Introduction to Computers and Programming (Comp 133)

References :
Book : Problem Solving and Program Design in C (7th Edition) 7th Edition
Slides : Dr. Radi Jarrar , Dr. Abdallah Karakra , Dr. Majdi Mafarja.

# Overview of C

# Chapter 2

# Programming language

- A programming language is a set of rules that provides a way of telling a computer what operations to perform.

- C a high-level programming language developed in 1972 by Dennis Ritchie at AT&T Bell Laboratories.

# Chapter 2

- Introduction

# Levels of Programming Languages

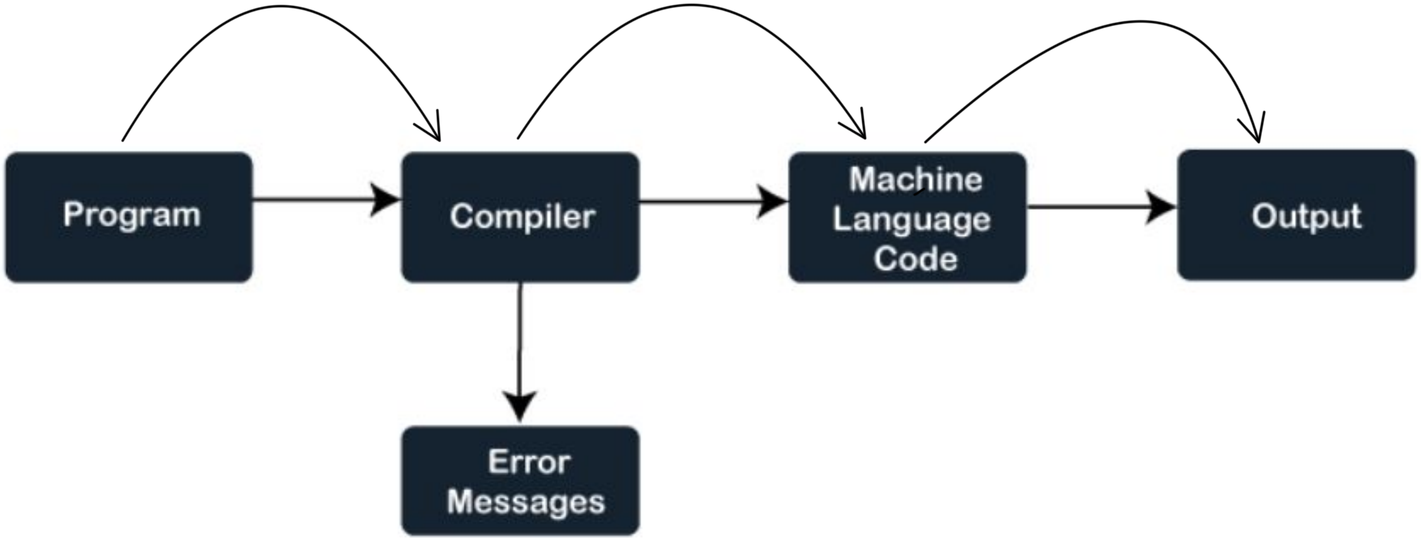
- Machine language
  - 0011001....011
- Assembly Language
  - mov ax, 0b00h
  - add ax, dx
- High Level Languages
- Fourth Generation Languages (4GL)
- Fifth Generation Languages (5GL

# High Level Languages

- Procedure-oriented languages
  - FORTRAN , COBOL , Pascal , C
- Object-oriented languages
  - C++, C#, Java
- Event-driven languages
  - Visual Basic
- Declarative languages
  - Functional ( Lisp, F#)

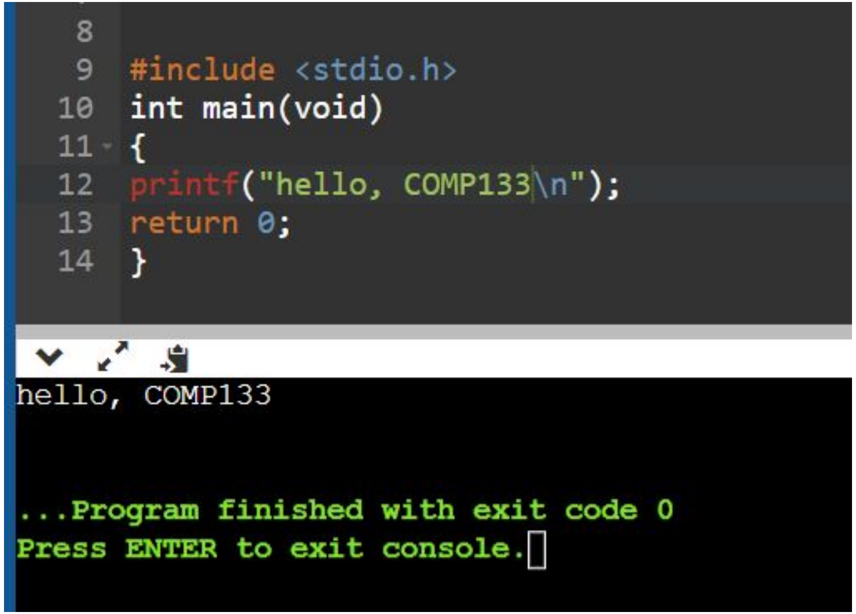
# Compiler

- Compiler is a software programs that convert a high-level language into a machine language (0's and 1's binary form) that a computer can understand and perform tasks as per the program's instructions



# C-program

```
#include <stdio.h>

int main(void)

{

printf("Hello, COMP 133\n");

return 0;

}
```



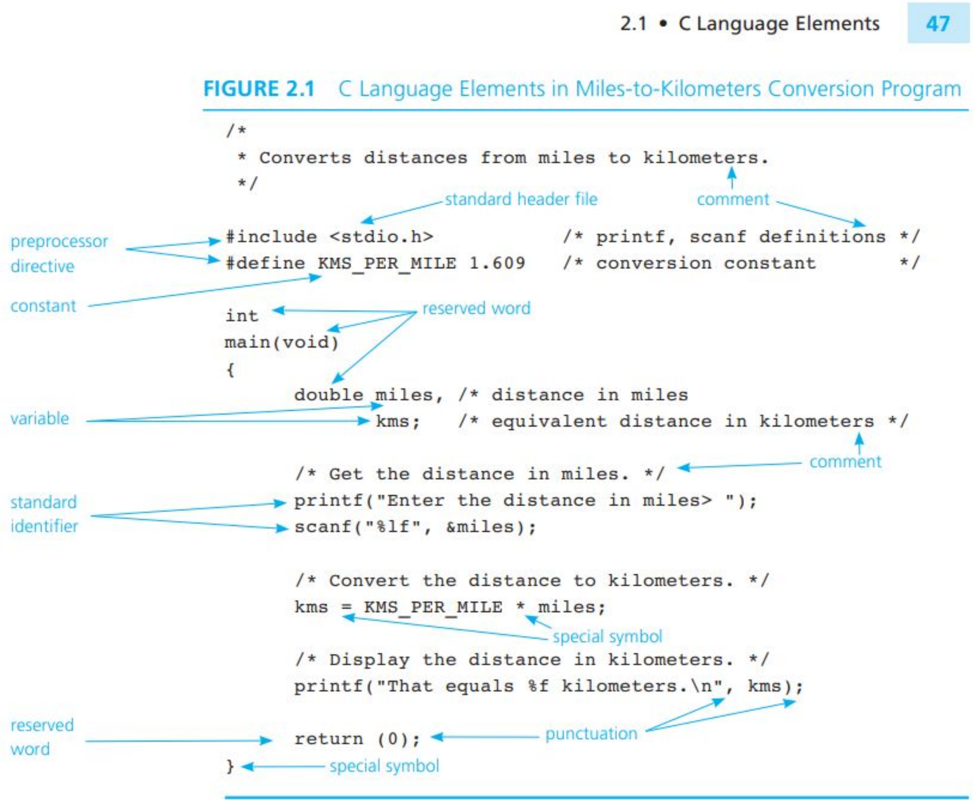
```c
#include <stdio.h>
int main(void)
{
printf("hello, COMP133\n");
return 0;
}
```

```
hello, COMP133


...Program finished with exit code 0
Press ENTER to exit console.
```

# Chapter 2

- C Language Elements

# Elements



2.1 • C Language Elements 47

FIGURE 2.1 C Language Elements in Miles-to-Kilometers Conversion Program

```
/*
 * Converts distances from miles to kilometers.
 */

#include <stdio.h>           /* printf, scanf definitions */
#define KMS_PER_MILE 1.609   /* conversion constant       */

int
main(void)
{
      double miles, /* distance in miles
             kms;   /* equivalent distance in kilometers */

      /* Get the distance in miles. */
      printf("Enter the distance in miles> ");
      scanf("%lf", &miles);

      /* Convert the distance to kilometers. */
      kms = KMS_PER_MILE * miles;

      /* Display the distance in kilometers. */
      printf("That equals %f kilometers.\n", kms);

      return (0);
}
```

```
//C program for area of circle    Comment
#include <stdio.h> // standard header file (contains printf and scanf )
#define PI  3.141   //we use define for creating constant
int main()            // int, float , and return   (reserved words)
{
    float r, a;   //  r, a are variables
   printf("Please enter the radius: ");  //standard identifier
   scanf("%f", &r);    //standard identifier
   a = PI * r * r;     //  = , *,{, }  special symbols
   printf("%f\n", a); // standard identifier
   return 0;
}
```

# Comments

- Each programing language has style for writing comments.
- In C-style comments :
  - /* comment */ -- More than one line
  - // comment
  - void main() {

    ```
    /* This is how comments are implemented in C
    to comment out a block of text */
    // or like this for a single line comment
    printf( "Hello World\n" ) ;
    }
    ```

# Preprocessor Directives

- **Preprocessor** a system program that modifies a C program prior to its compilation.
- **Library** a collection of useful functions and symbols that may be accessed by a program.
- #include
  - Gives a program access to a library
- <stdio.h>
  - Standard header file
  - Contains information about standard input and
  - Output functions such as scanf and printf

# Preprocessor Directives

- **Preprocessor directive** a C program line beginning with # that provides an instruction to the preprocessor.
- #include
  - Notify the preprocessor that some names used in the program are found in <stdio.h> (E.g. scanf, printf)
- #define
  - Using only data values that never change should be given names.
  - #define MAX_LENGTH 100
- Constant macro
  - #define **PI** 3.141593

***Constant value***

***Constant macro***

# Reserved Words

- **Reserved word** is a word that has a special meaning in C.

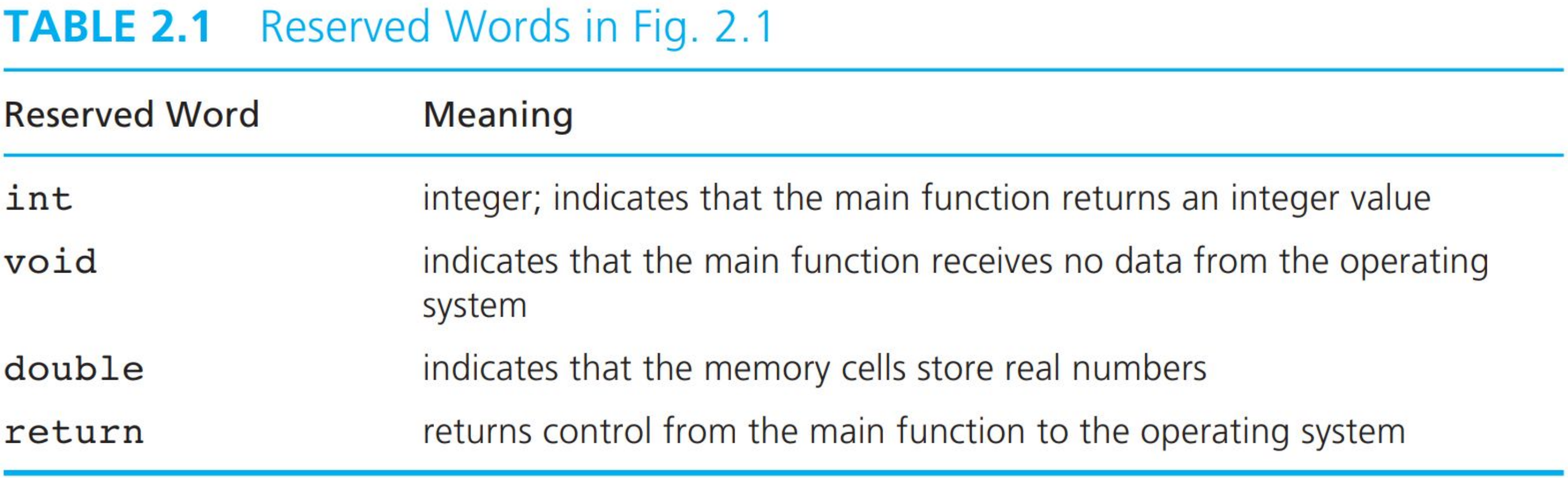


**TABLE 2.1** Reserved Words in Fig. 2.1

| Reserved Word | Meaning |
|---|---|
| `int` | integer; indicates that the main function returns an integer value |
| `void` | indicates that the main function receives no data from the operating system |
| `double` | indicates that the memory cells store real numbers |
| `return` | returns control from the main function to the operating system |

# Standard Identifiers & User-Defined Identifiers

- **Standard Identifiers :** Like reserved words, standard identifiers have special meaning in C.
- **User-Defined Identifiers :** Our own identifiers to name memory cells that will hold data.

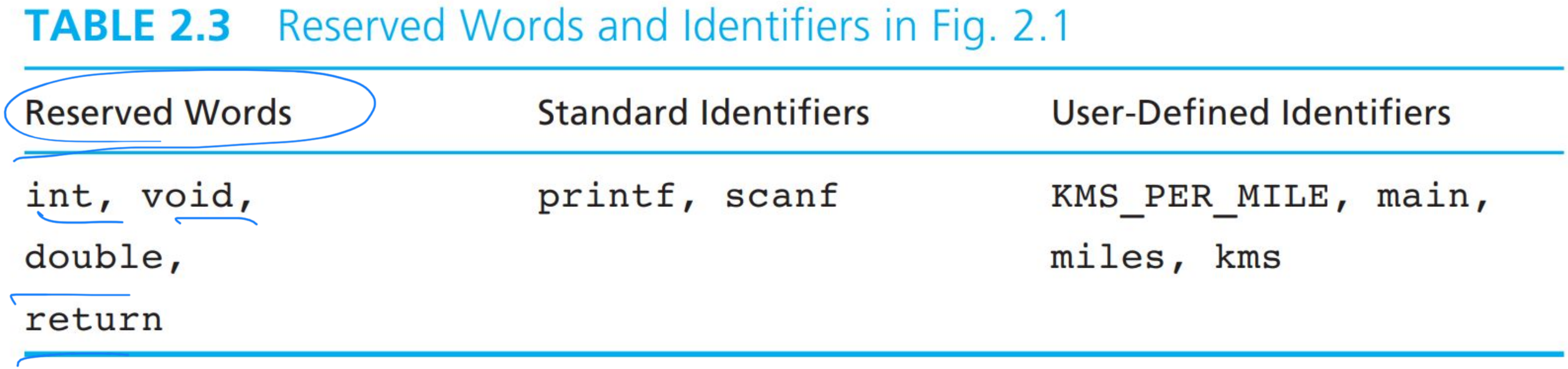


**TABLE 2.3** Reserved Words and Identifiers in Fig. 2.1

| Reserved Words | Standard Identifiers | User-Defined Identifiers |
|---|---|---|
| `int, void,`<br>`double,`<br>`return` | `printf, scanf` | `KMS_PER_MILE, main,`<br>`miles, kms` |

# Variable Declarations and Data Types

- **Variable** a name associated with a memory cell whose value can change.
- **Variable declarations** statements that communicate to the compiler the names of variables in the program and the kind of information stored in each variable.
    - Syntax: type variable_name (or variable-list);

int , double, char….

Miles, Name , sum ….

# Basic Data Types

- There are five basic data types char, int, float, double, and void. All other data types in C are based on these.

| | |
|---|---|
| **char** | 1 byte ( 8 bits ) with range -128 to 127 **( ‘a’, ‘6’, ‘*’, ……..)** |
| **int** | 4 bytes with range -2,147,483,648 to 2,147,483,647 |
| **float** | 4 bytes with range $10^{-38}$ to $10^{38}$ with 7 digits of precision |
| **double** | 8 bytes with range $10^{-308}$ to $10^{308}$ with 15 digits of precision |
| **void** | generic pointer, used to indicate no function parameters etc. |

```
int i ; // a memory cell is reserved to hold an integer value

char a, b, ch ; //three character variables are defined
```

# Basic Data Types

- Char : represent an individual character value • include a letter, adigit, a special symbol •E.g., ‘A’, ‘z’, ‘2’, ‘9’, ‘*’, ‘:’, ‘ ” ’, ‘   ‘
- A real number has an integral part and a fractional part that are separated by a decimal point

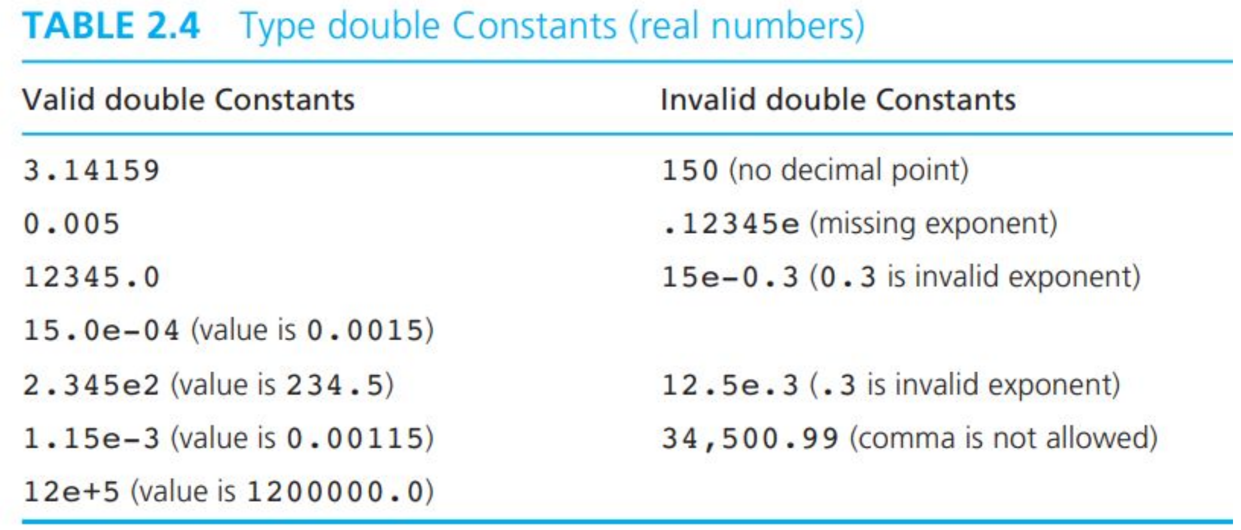


TABLE 2.4 Type double Constants (real numbers)

| Valid double Constants | Invalid double Constants |
|---|---|
| 3.14159 | 150 (no decimal point) |
| 0.005 | .12345e (missing exponent) |
| 12345.0 | 15e-0.3 (0.3 is invalid exponent) |
| 15.0e-04 (value is 0.0015) | |
| 2.345e2 (value is 234.5) | 12.5e.3 (.3 is invalid exponent) |
| 1.15e-3 (value is 0.00115) | 34,500.99 (comma is not allowed) |
| 12e+5 (value is 1200000.0) | |

# Integer Types in C

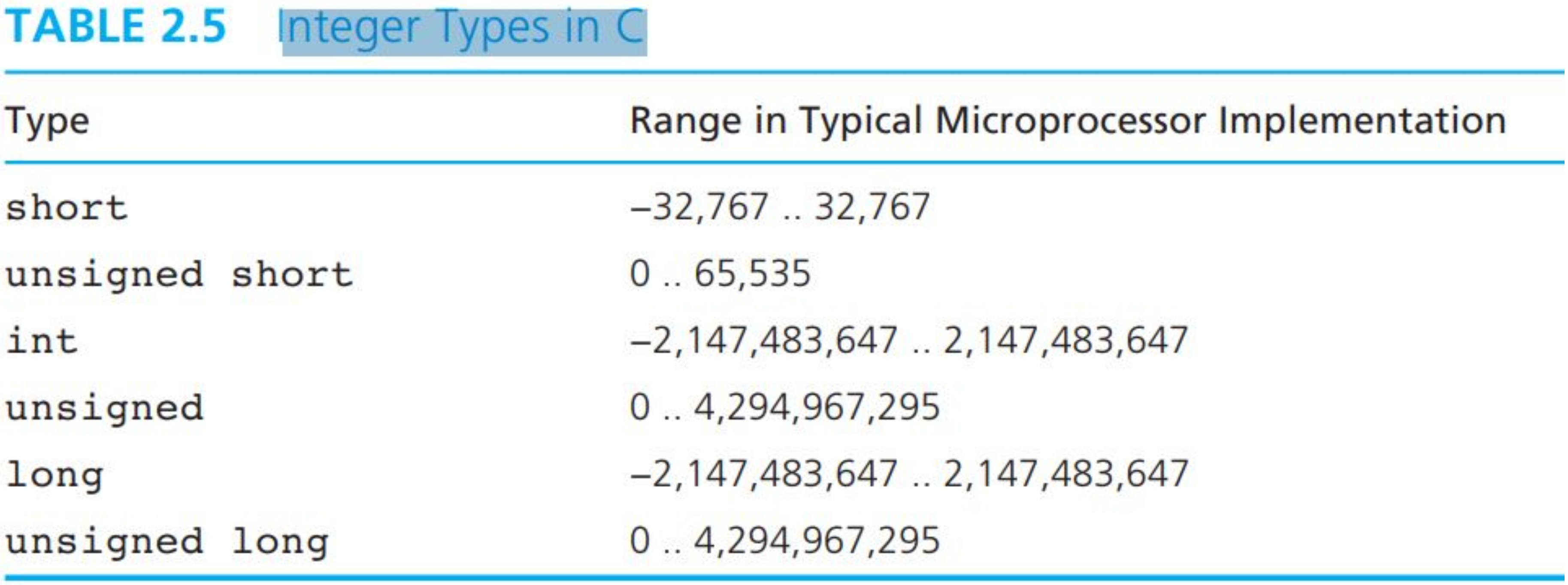


**TABLE 2.5** Integer Types in C

| Type | Range in Typical Microprocessor Implementation |
|---|---|
| `short` | –32,767 .. 32,767 |
| `unsigned short` | 0 .. 65,535 |
| `int` | –2,147,483,647 .. 2,147,483,647 |
| `unsigned` | 0 .. 4,294,967,295 |
| `long` | –2,147,483,647 .. 2,147,483,647 |
| `unsigned long` | 0 .. 4,294,967,295 |

# Floating-Point Types in C

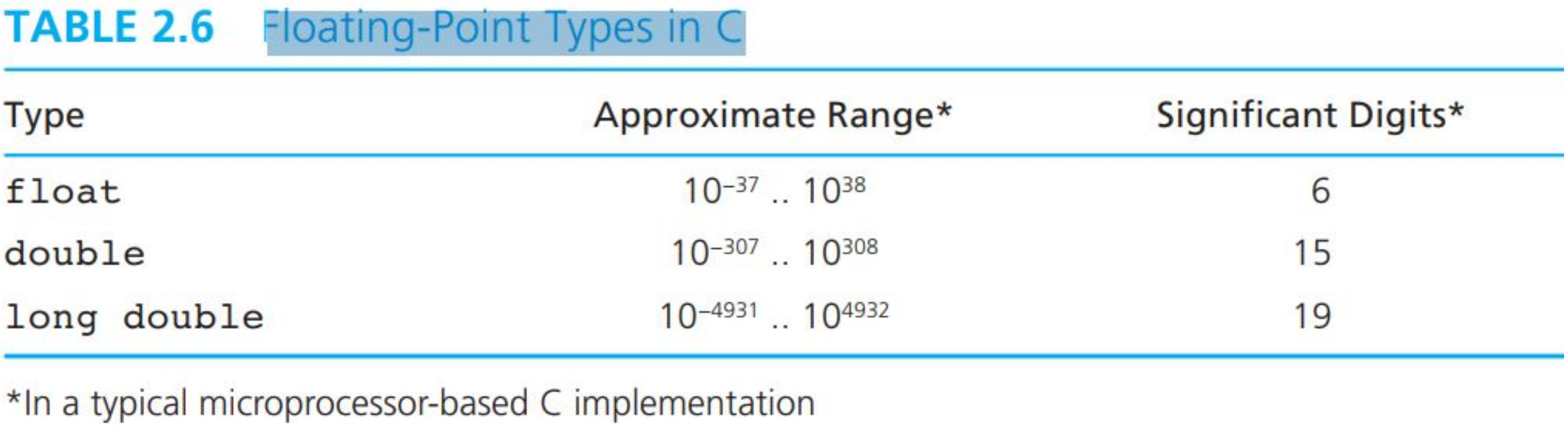


**TABLE 2.6** Floating-Point Types in C

| Type | Approximate Range* | Significant Digits* |
|---|---|---|
| `float` | $10^{-37}$ .. $10^{38}$ | 6 |
| `double` | $10^{-307}$ .. $10^{308}$ | 15 |
| `long double` | $10^{-4931}$ .. $10^{4932}$ | 19 |

*In a typical microprocessor-based C implementation

# ASCII Codes for Characters

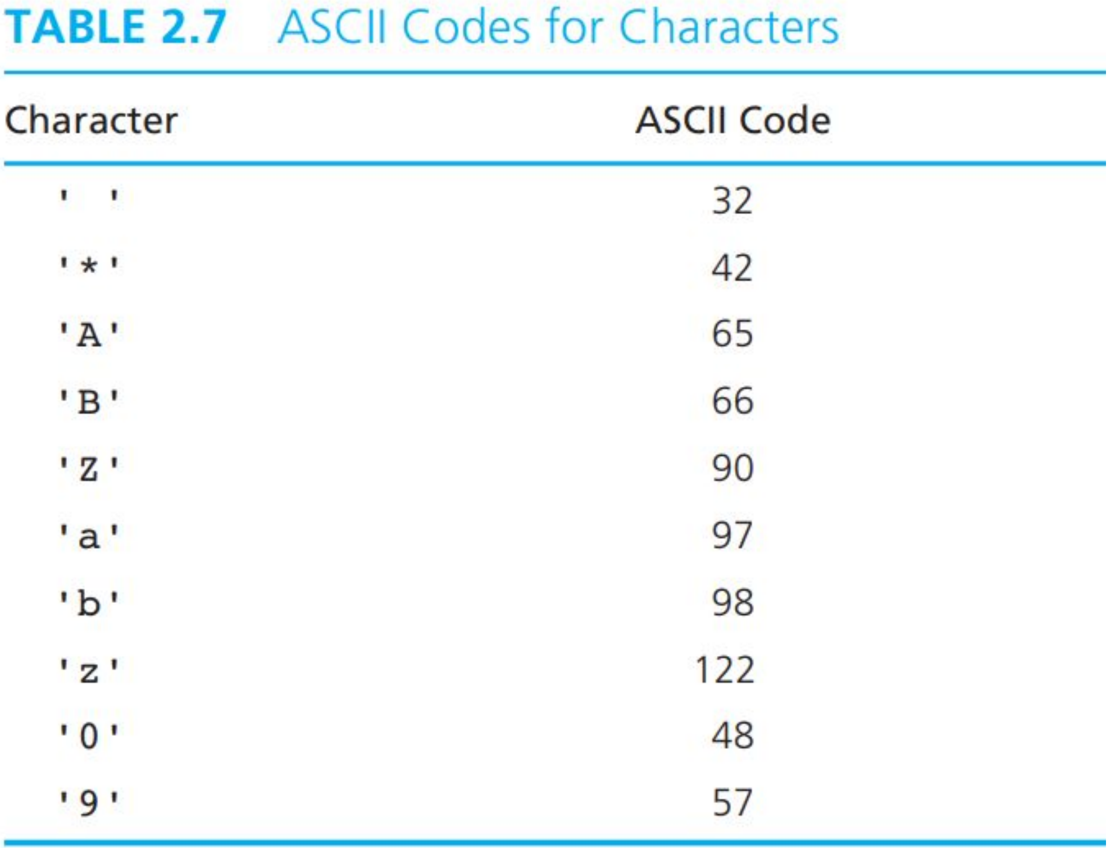


**TABLE 2.7** ASCII Codes for Characters

| Character | ASCII Code |
|---|---|
| `' '` | 32 |
| `'*'` | 42 |
| `'A'` | 65 |
| `'B'` | 66 |
| `'Z'` | 90 |
| `'a'` | 97 |
| `'b'` | 98 |
| `'z'` | 122 |
| `'0'` | 48 |
| `'9'` | 57 |

# Variable Names

Names of variables and functions in C are called identifiers and are **case sensitive**. Rules defining a variable :

1. An identifier must consist only of **letters**, **digits**, and **underscores** (NO special characters like: +*&^%#$@ … etc).
2. An identifier cannot begin with a digit.
3. A C reserved word cannot be used as an identifier.
4. An identifier defined in a C standard library should not be redefined.

**Reserved words** : A word that has special meaning in C. (int, float, double, char , return ,…, etc.)

# Variable Names

- letter_1, letter_2, inches, cent, CENT_PER_INCH, Hello, variable

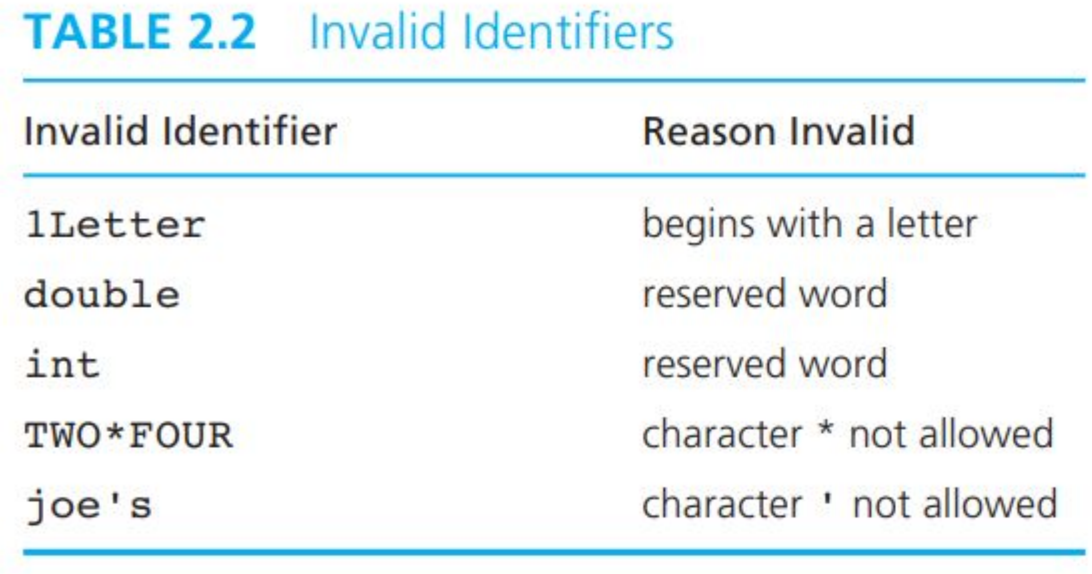


TABLE 2.2 Invalid Identifiers

| Invalid Identifier | Reason Invalid |
|---|---|
| `1Letter` | begins with a letter |
| `double` | reserved word |
| `int` | reserved word |
| `TWO*FOUR` | character `*` not allowed |
| `joe's` | character `'` not allowed |

# Initialising Variables

Varibales and functions

- The identifier is not initialised to zero or to any other value automatically and so will contain random values unless specifically initialised before use.
- *Syntax :- type var-name = constant ;*

- E.g. char ch = 'a'; // Character constants are normally represented between single quotes.

  double d = 12.2323 ;

  int i, j = 20 ; /* note in this case i is not initialised */

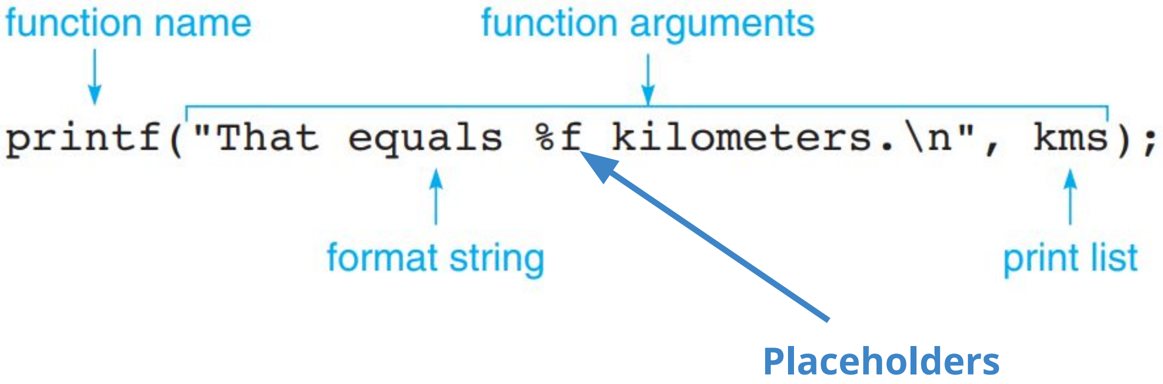
# Escape Sequences

- **Escape Sequences** special character constants preceded by the backslash character '\', and have special meanings in C.

- **\n** newline -> printf("Hello, COMP 133**\n**");
- **\t** tab
- **\b** backspace
- **\'** single quote
- **\"** double quote
- **\0** null character

# Input/Output Operations and Functions

- The *printf* Function



function name

function arguments

```
printf("That equals %f kilometers.\n", kms);
```

format string

print list

Placeholders

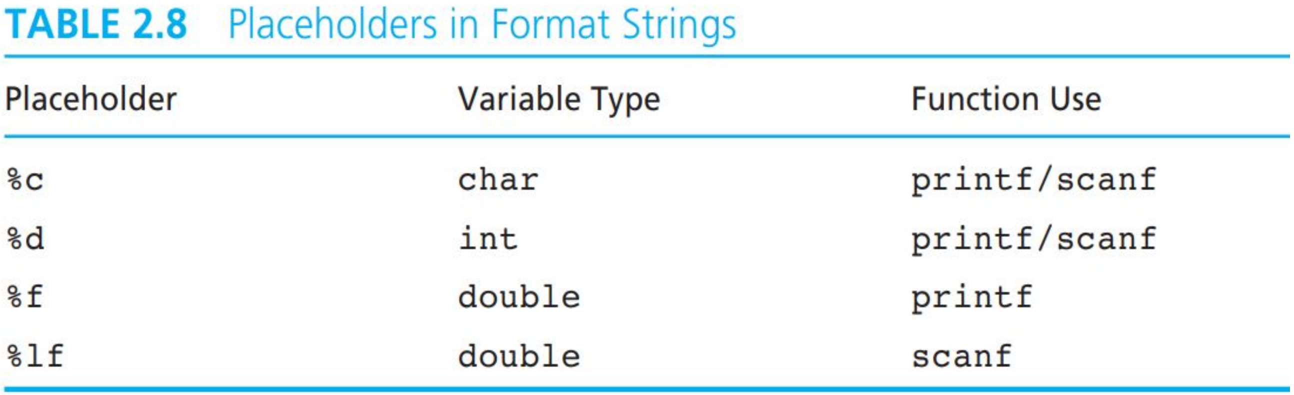


**TABLE 2.8** Placeholders in Format Strings

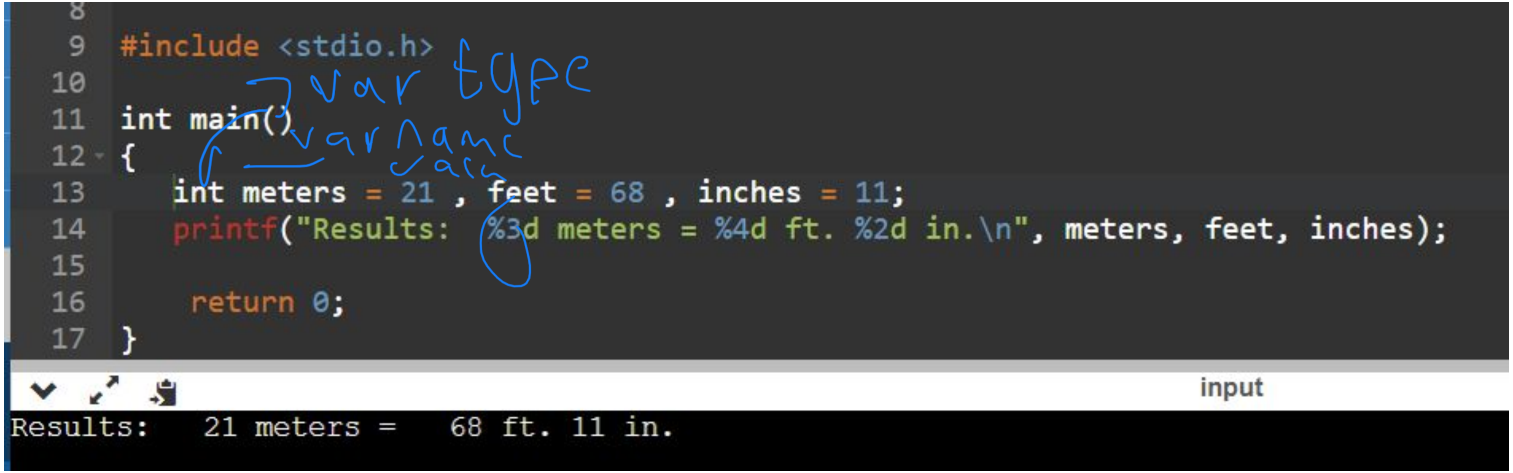
| Placeholder | Variable Type | Function Use |
|---|---|---|
| `%c` | `char` | `printf/scanf` |
| `%d` | `int` | `printf/scanf` |
| `%f` | `double` | `printf` |
| `%lf` | `double` | `scanf` |

# printf()

- printf (“The area is %f", a);
- scanf(“ %f ”,&r);
- printf (“the result is %d”, sum);
- scanf (“%lf”,& num);
- printf (“the number is %f”, num)
- printf( "%d + %d", i, j ) ;

# Field Width Specifiers & format output

- **Field width specifiers** are used in the control string to format output. The number of columns used to display a value.
- Syntax : % [total width printed] [.decimal places printed][ format specifier]
    - ○ [ ] is optional arguments.



```c
#include <stdio.h>

int main()
{
    int meters = 21 , feet = 68 , inches = 11;
    printf("Results:  %3d meters = %4d ft. %2d in.\n", meters, feet, inches);

     return 0;
}
```

```
Results:   21 meters =   68 ft. 11 in.
```

# Field Width Specifiers &  format output

```
int x= 4678,  y=3 ,  z=19
```

1. printf (“%d   %d   %d”, x,y,z)

**Output**

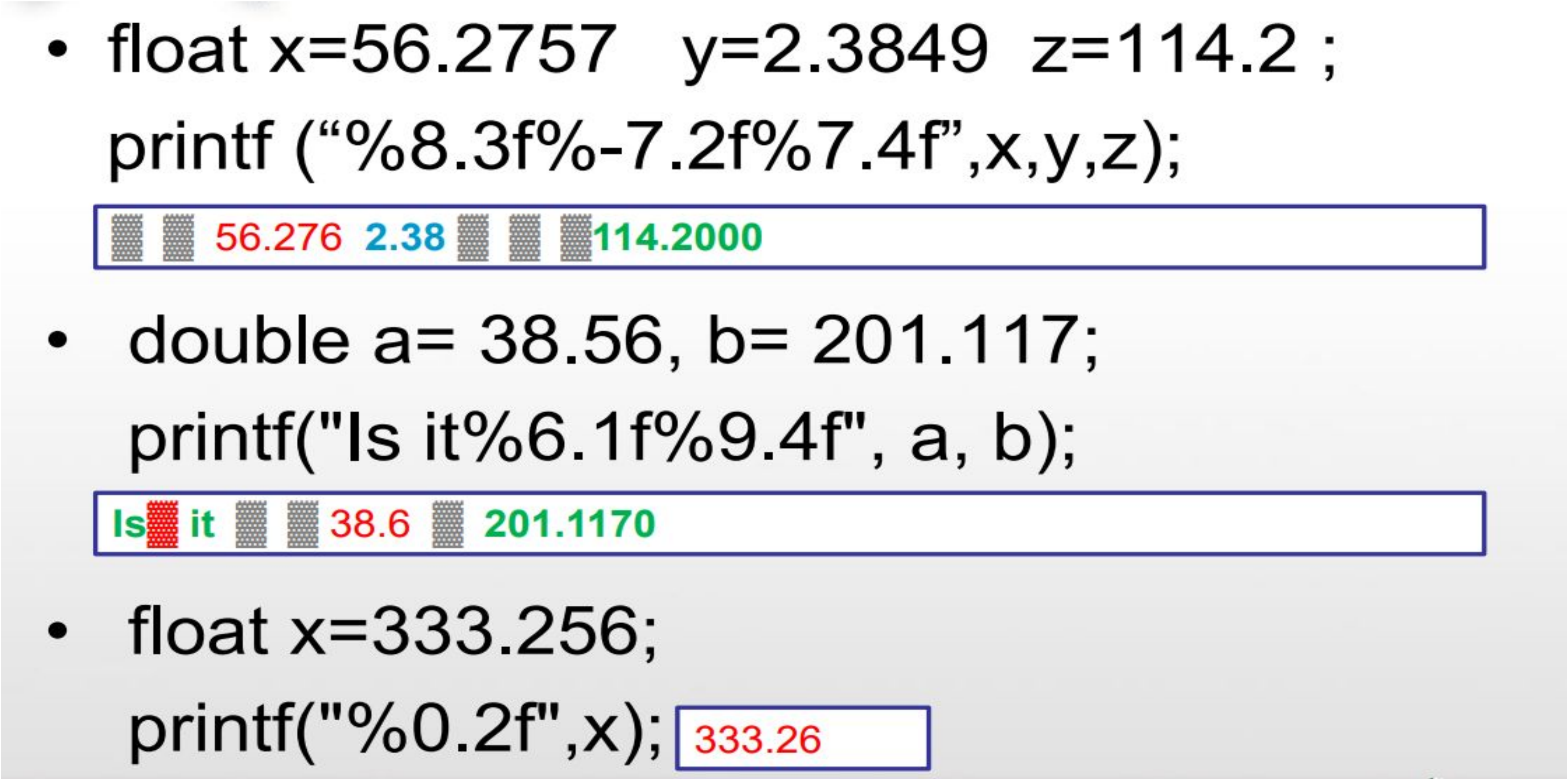
```
4678▨3▨ 19
```

2. printf (“%7d  %5d  %6d”, x,y,z)

**Output**

```
▨ ▨ ▨ 4678▨ ▨ ▨ ▨ ▨ 3 ▨ ▨ ▨ ▨ ▨   19
```

# Field Width Specifiers &  format output



- float x=56.2757   y=2.3849  z=114.2 ;

  printf (“%8.3f%-7.2f%7.4f”,x,y,z);

```
▒ ▒ 56.276 2.38▒ ▒ ▒114.2000
```

- double a= 38.56, b= 201.117;

  printf("Is it%6.1f%9.4f", a, b);

```
Is▒ it ▒ ▒ 38.6 ▒ 201.1170
```

- float x=333.256;

  printf("%0.2f",x);

```
333.26
```

# Field Width Specifiers & format output

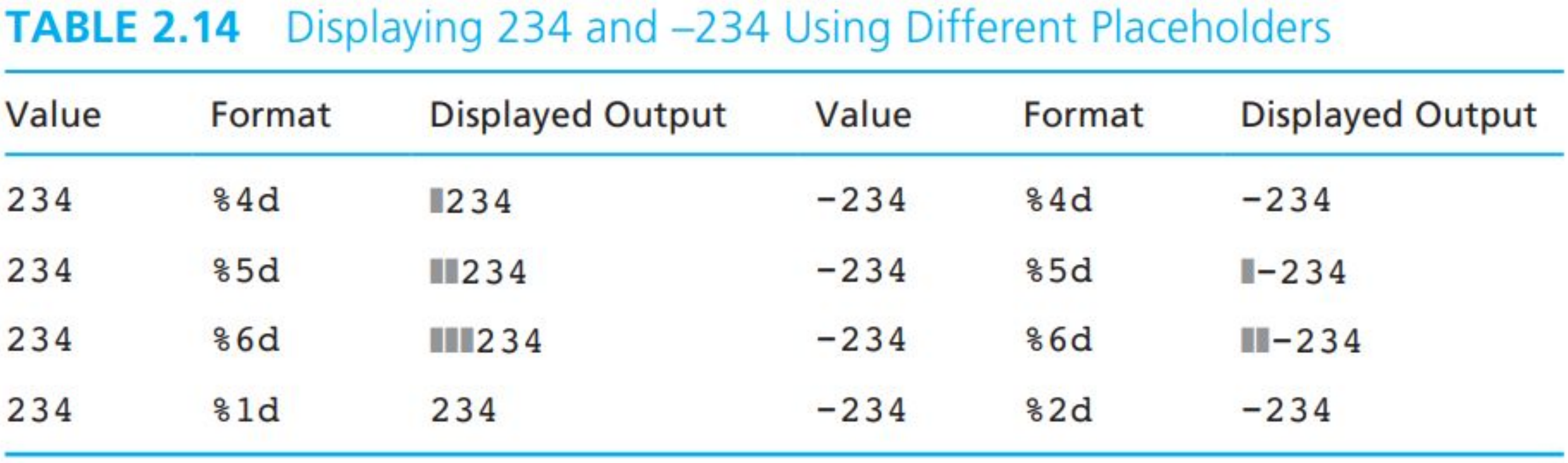


**TABLE 2.14** Displaying 234 and –234 Using Different Placeholders

| Value | Format | Displayed Output | Value | Format | Displayed Output |
|---|---|---|---|---|---|
| 234 | %4d | ▮234 | -234 | %4d | -234 |
| 234 | %5d | ▮▮234 | -234 | %5d | ▮-234 |
| 234 | %6d | ▮▮▮234 | -234 | %6d | ▮▮-234 |
| 234 | %1d | 234 | -234 | %2d | -234 |

# Field Width Specifiers & format output

char عدد - spaces لـ عدد

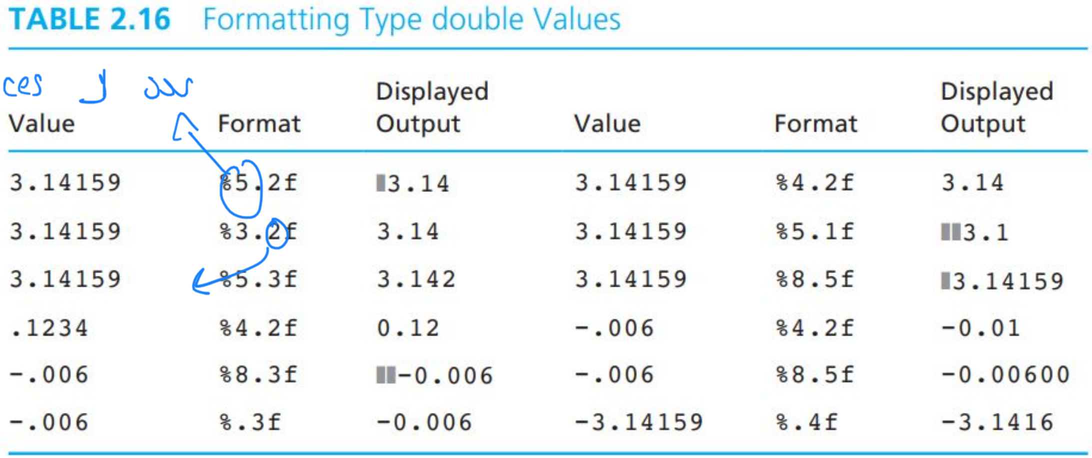


**TABLE 2.16** Formatting Type double Values

| Value | Format | Displayed Output | Value | Format | Displayed Output |
|---|---|---|---|---|---|
| 3.14159 | %5.2f | ▮3.14 | 3.14159 | %4.2f | 3.14 |
| 3.14159 | %3.2f | 3.14 | 3.14159 | %5.1f | ▮▮3.1 |
| 3.14159 | %5.3f | 3.142 | 3.14159 | %8.5f | ▮3.14159 |
| .1234 | %4.2f | 0.12 | -.006 | %4.2f | -0.01 |
| -.006 | %8.3f | ▮▮-0.006 | -.006 | %8.5f | -0.00600 |
| -.006 | %.3f | -0.006 | -3.14159 | %.4f | -3.1416 |

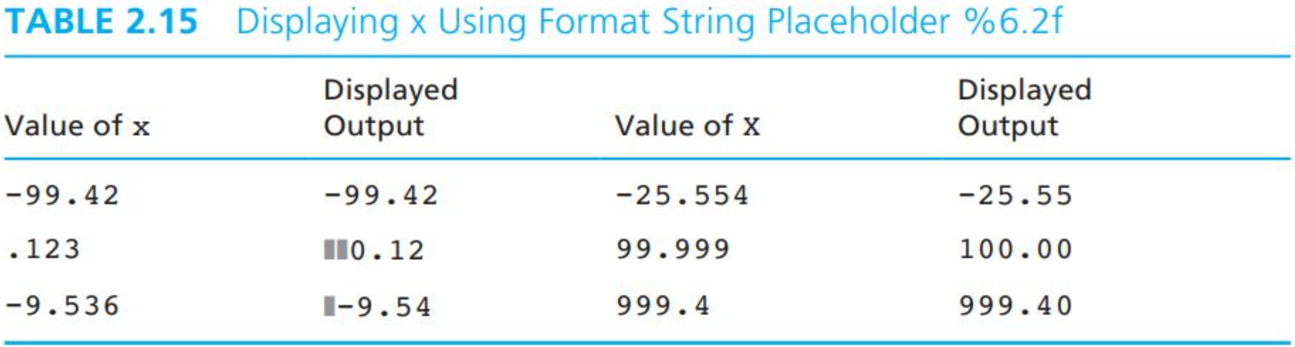
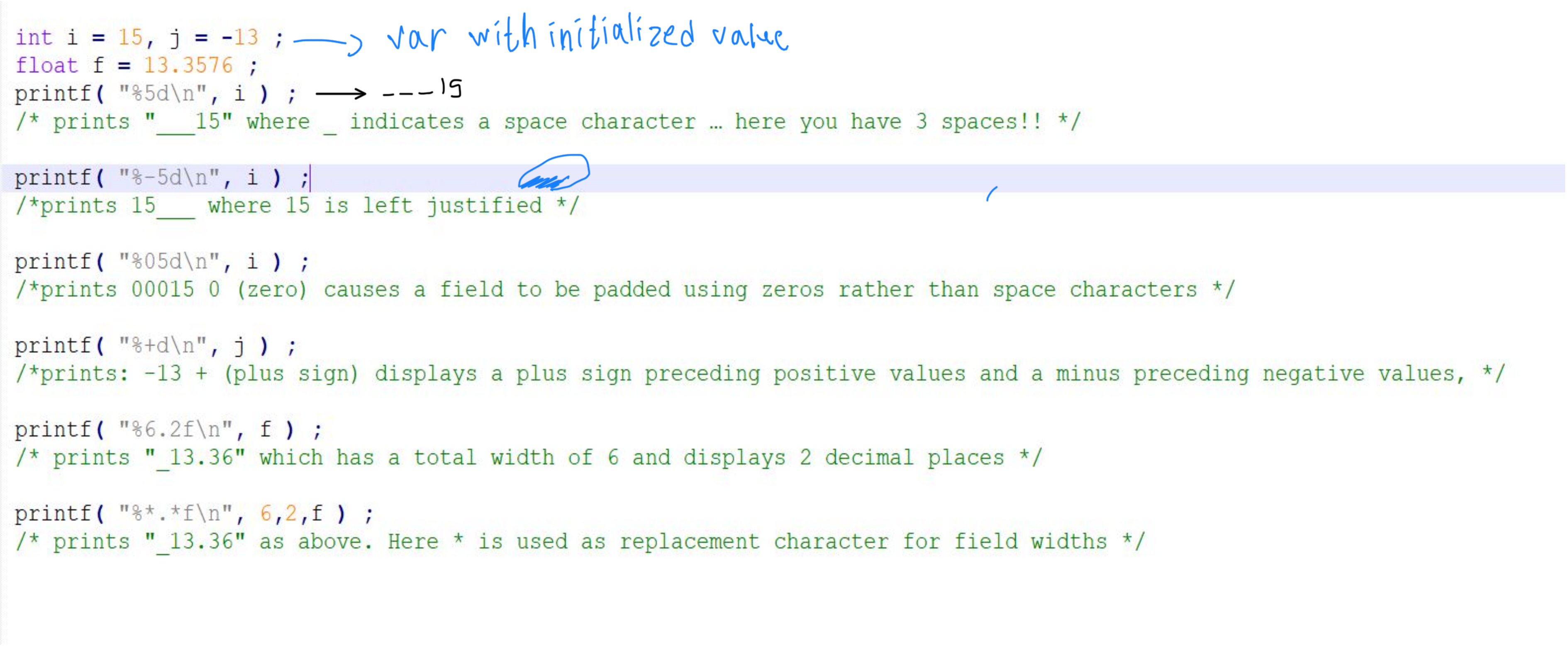


**TABLE 2.15** Displaying x Using Format String Placeholder %6.2f

| Value of x | Displayed Output | Value of x | Displayed Output |
|---|---|---|---|
| -99.42 | -99.42 | -25.554 | -25.55 |
| .123 | ▮▮0.12 | 99.999 | 100.00 |
| -9.536 | ▮-9.54 | 999.4 | 999.40 |

# Field Width Specifiers &  format output



```
int i = 15, j = -13 ;
float f = 13.3576 ;
printf( "%5d\n", i ) ;
/* prints "___15" where _ indicates a space character … here you have 3 spaces!! */

printf( "%-5d\n", i ) ;
/*prints 15___ where 15 is left justified */

printf( "%05d\n", i ) ;
/*prints 00015 0 (zero) causes a field to be padded using zeros rather than space characters */

printf( "%+d\n", j ) ;
/*prints: -13 + (plus sign) displays a plus sign preceding positive values and a minus preceding negative values, */

printf( "%6.2f\n", f ) ;
/* prints "_13.36" which has a total width of 6 and displays 2 decimal places */

printf( "%*.*f\n", 6,2,f ) ;
/* prints "_13.36" as above. Here * is used as replacement character for field widths */
```

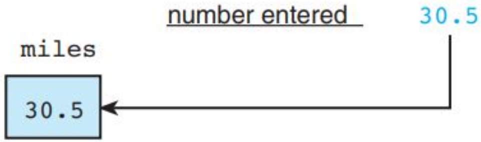
→ var with initialized value

→ ---15

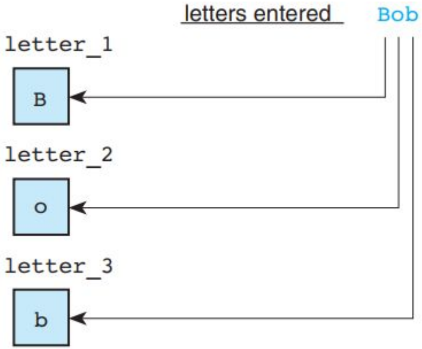
# scanf()

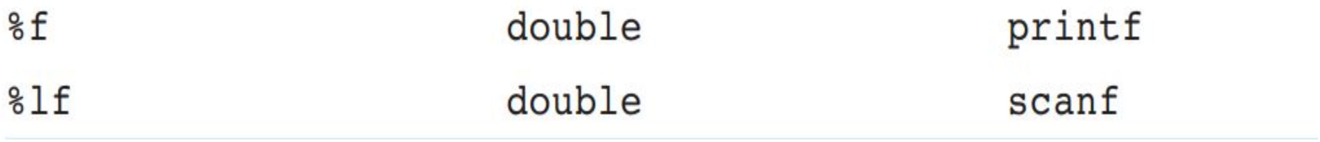
scanf("%lf",&

- ***scanf*** function get the data from standard input device, and stores it in the variable, in most cases the standard input device is the keyboard.
- scanf("%lf", &miles);



- scanf("%c%c%c", &letter_1, &letter_2, &letter_3);





| | | |
|---|---|---|
| %f | double | printf |
| %lf | double | scanf |

# Arithmetic Operations

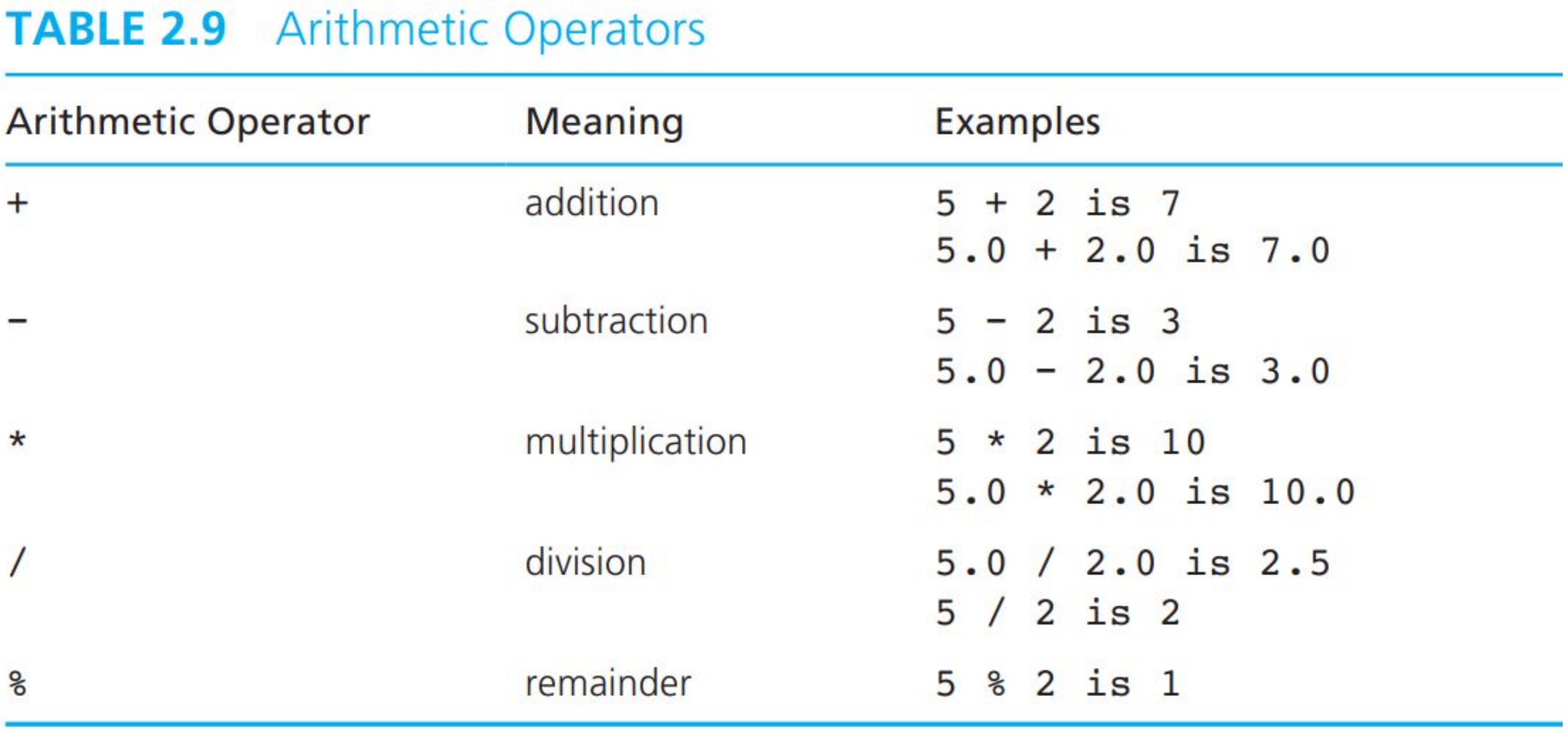


TABLE 2.9 Arithmetic Operators

| Arithmetic Operator | Meaning | Examples |
|---|---|---|
| + | addition | `5 + 2 is 7`<br>`5.0 + 2.0 is 7.0` |
| - | subtraction | `5 - 2 is 3`<br>`5.0 - 2.0 is 3.0` |
| * | multiplication | `5 * 2 is 10`<br>`5.0 * 2.0 is 10.0` |
| / | division | `5.0 / 2.0 is 2.5`<br>`5 / 2 is 2` |
| % | remainder | `5 % 2 is 1` |

# Arithmetic Operations

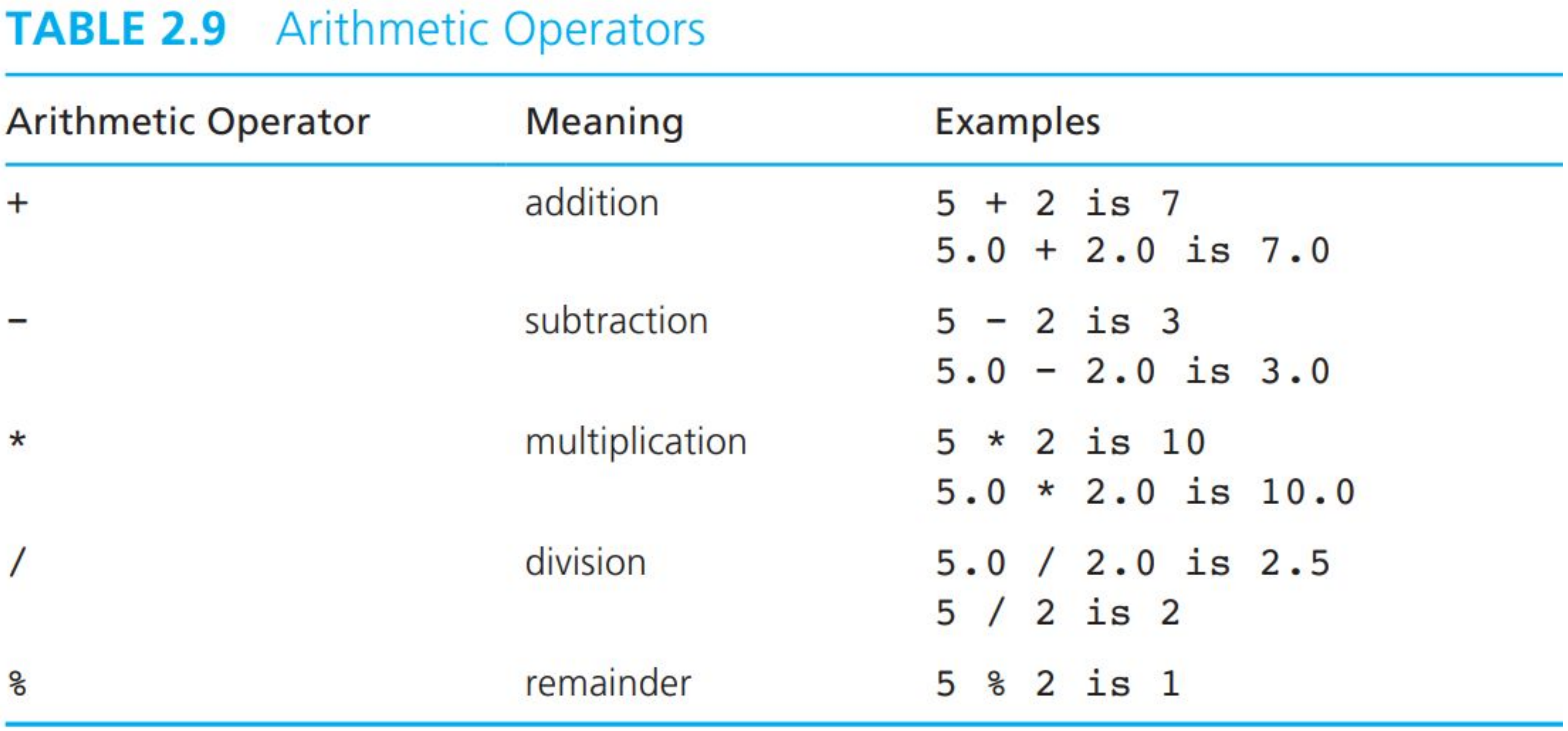


**TABLE 2.9** Arithmetic Operators

| Arithmetic Operator | Meaning | Examples |
|---|---|---|
| `+` | addition | `5 + 2 is 7`<br>`5.0 + 2.0 is 7.0` |
| `-` | subtraction | `5 - 2 is 3`<br>`5.0 - 2.0 is 3.0` |
| `*` | multiplication | `5 * 2 is 10`<br>`5.0 * 2.0 is 10.0` |
| `/` | division | `5.0 / 2.0 is 2.5`<br>`5 / 2 is 2` |
| `%` | remainder | `5 % 2 is 1` |

# Operators / and %

If the **/ and %** operators is used with a negative and a positive integer, the result may vary from one C implementation to another.

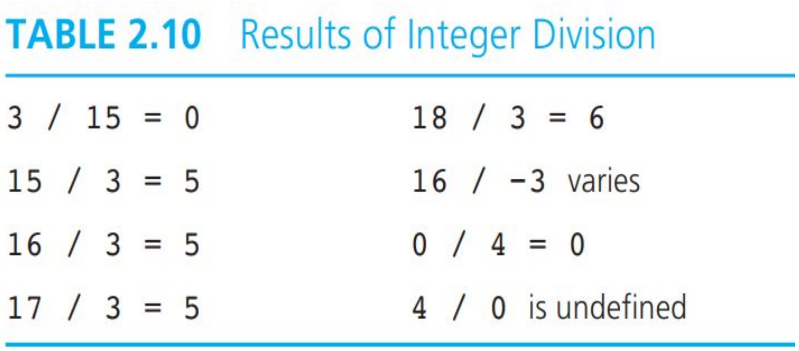


**TABLE 2.10** Results of Integer Division

| | |
|---|---|
| 3 / 15 = 0 | 18 / 3 = 6 |
| 15 / 3 = 5 | 16 / -3 varies |
| 16 / 3 = 5 | 0 / 4 = 0 |
| 17 / 3 = 5 | 4 / 0 is undefined |

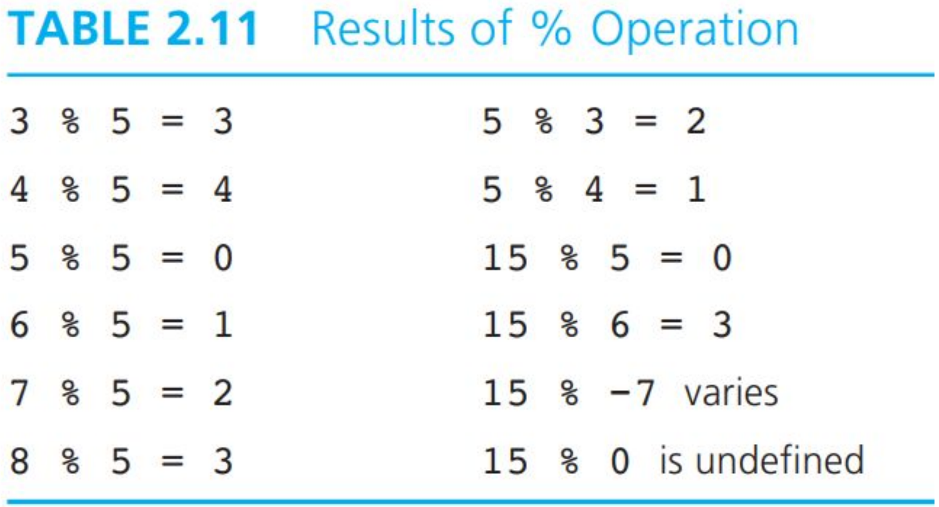


**TABLE 2.11** Results of % Operation

| | |
|---|---|
| 3 % 5 = 3 | 5 % 3 = 2 |
| 4 % 5 = 4 | 5 % 4 = 1 |
| 5 % 5 = 0 | 15 % 5 = 0 |
| 6 % 5 = 1 | 15 % 6 = 3 |
| 7 % 5 = 2 | 15 % -7 varies |
| 8 % 5 = 3 | 15 % 0 is undefined |

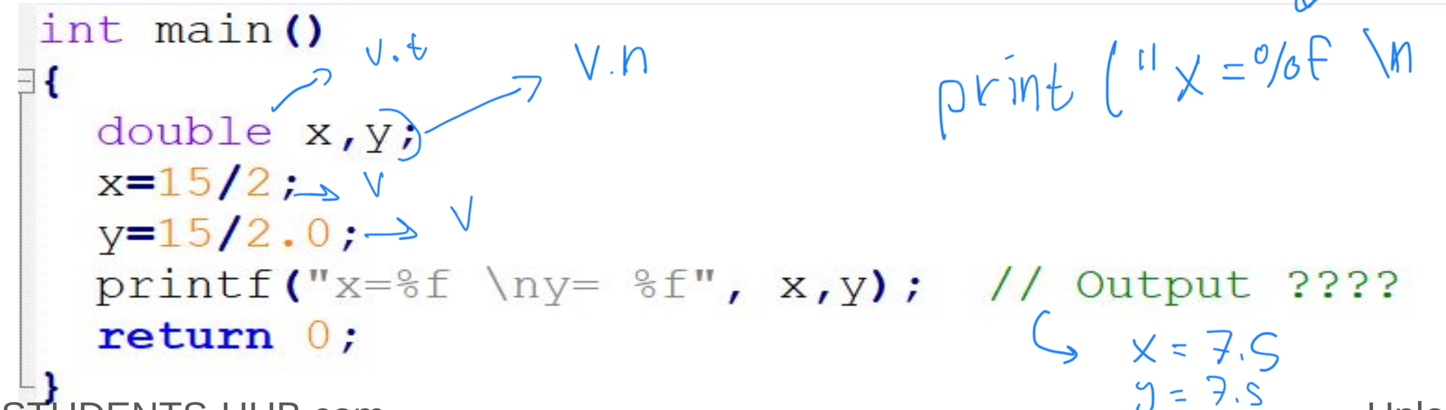
# Operators / and %

V.t = var type

V.n = var name

V = value

- **int / int = int .     E.g :   12/3= 4 , 9/8=1**
- **Int / float = float.  E.g : 9/8.0=1.125000**
- **Float / int = float.   E.g :  9.0/8=1.125000**
- **Float / float = float E.g : 9.0/8.0=1.125000**
- **Undefined** : when divide by zero  **18/0 , 16%0**



```
int main()
{
    double x,y;
    x=15/2;
    y=15/2.0;
    printf("x=%f \ny= %f", x,y);  // Output ????
    return 0;
}
```

v.t

V.n

V

V

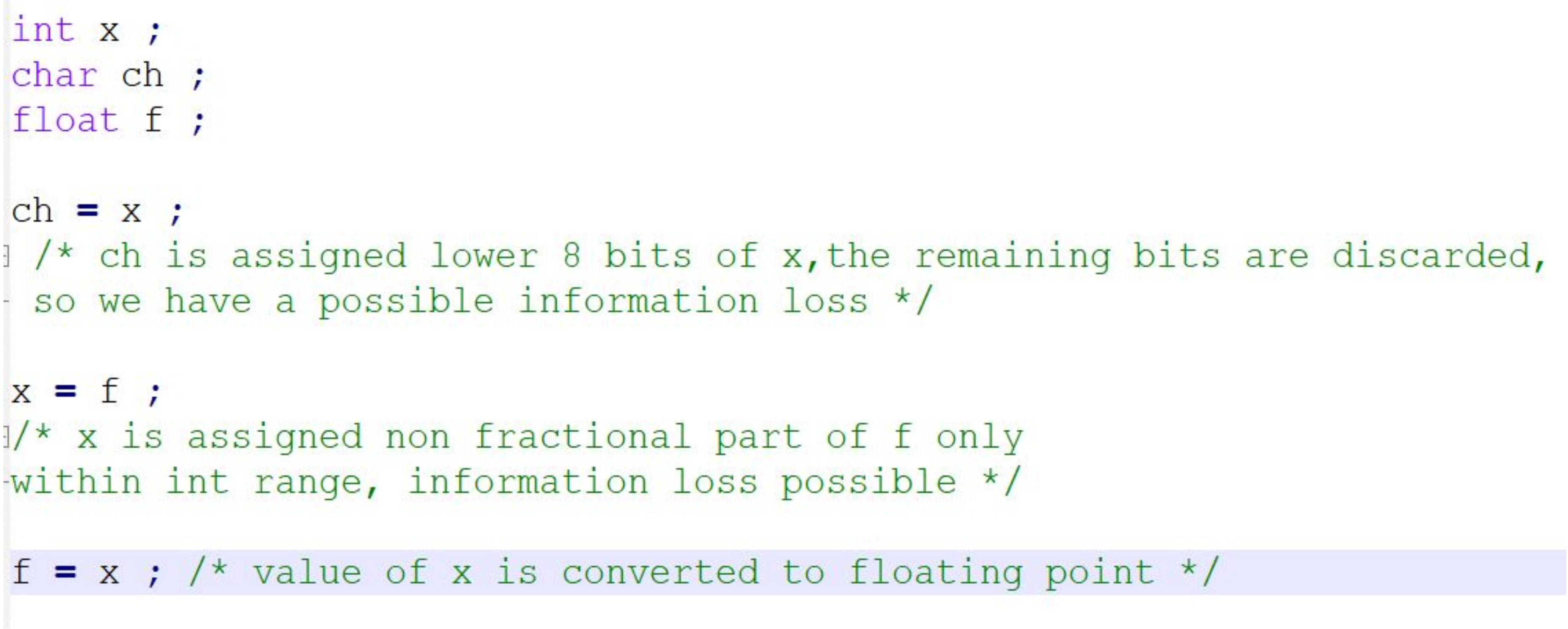
print ("x=%f \n y=%f", x,y

x = 7.5
y = 7.5

# Assignment Operator

- int x ;    x = 20 ;  int y;   y= 30;    x=y ;  (x and y same data type).
- **Multiple assignments :** x = y = z = 100 ;
- **Type Conversions** : the value of the right-value of an assignment is converted to the type of the left-value. This may sometimes yield compiler warnings if information is lost in the conversion.
  - **Int x;    double y=2.345;**
  - **x=y ; ?**

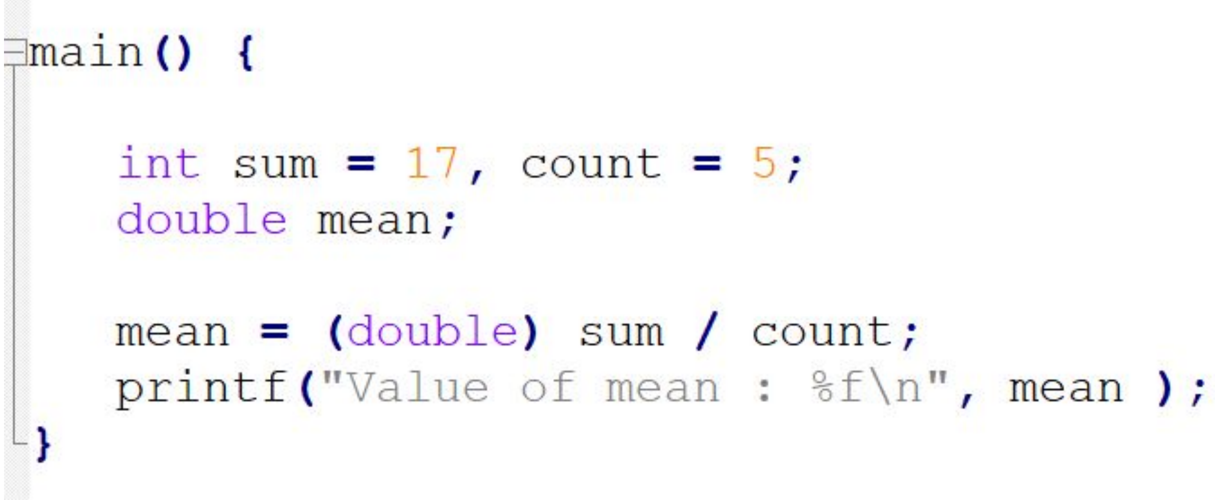
# Type Conversions



```
int x ;
char ch ;
float f ;

ch = x ;
 /* ch is assigned lower 8 bits of x,the remaining bits are discarded,
 so we have a possible information loss */

x = f ;
/* x is assigned non fractional part of f only
within int range, information loss possible */

f = x ; /* value of x is converted to floating point */
```

# Type conversion through casts

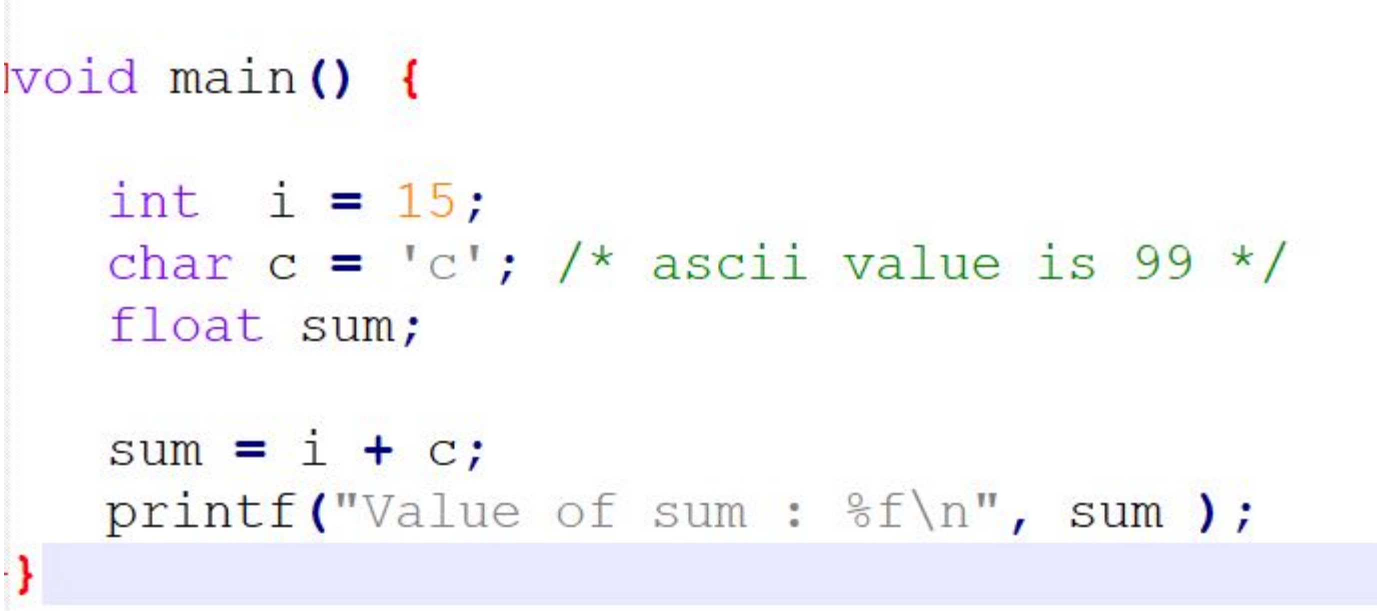
- **Type cast** : converting an expression to a different type by writing the desired type in parentheses in front of the expression.
  - n = **(int)**(9 * 0.5);
  - The value of n is 4



```
main() {

    int sum = 17, count = 5;
    double mean;

    mean = (double) sum / count;
    printf("Value of mean : %f\n", mean );
}
```

Value of mean : 3.400000

# Type conversion through casts



```
void main() {

    int  i = 15;
    char c = 'c'; /* ascii value is 99 */
    float sum;

    sum = i + c;
    printf("Value of sum : %f\n", sum );
}
```

Value of sum:
114.000000

# Chapter 2

- Arithmetic Expressions

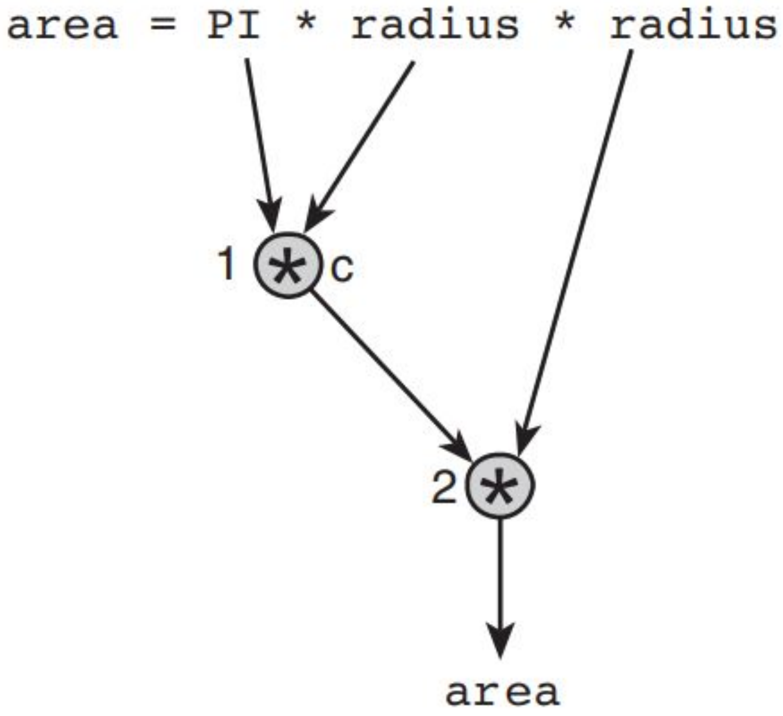
# Arithmetic Expressions

- Precedence Rules:

| | |
|---|---|
| 1 | () |
| 2 | * / % |
| 3 | + - |

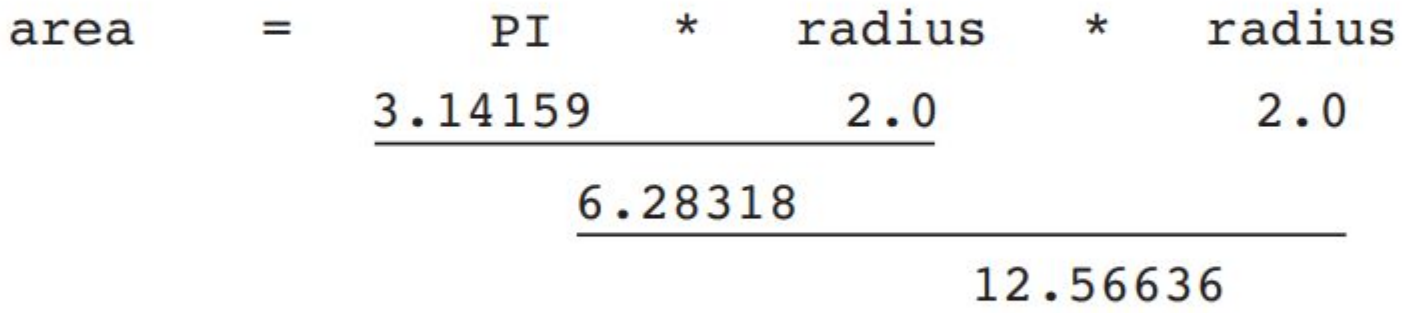
# Arithmetic Expressions

- Evaluation Tree for **area = PI * radius * radius;**



# Arithmetic Expressions

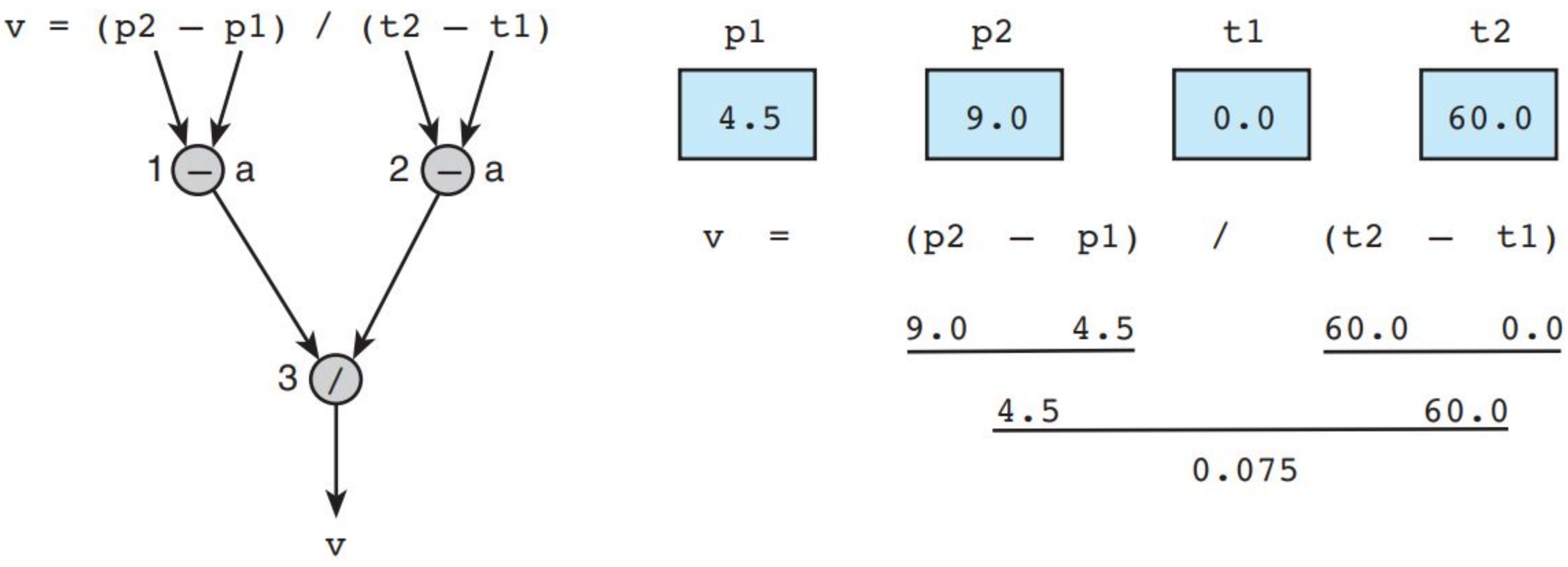
- Step-by-Step Expression Evaluation . **PI= 3.14159 , radius=2.0**



```
area   =      PI      *    radius    *    radius
          3.14159            2.0            2.0
          ________________________
                6.28318
                ______________________________
                            12.56636
```

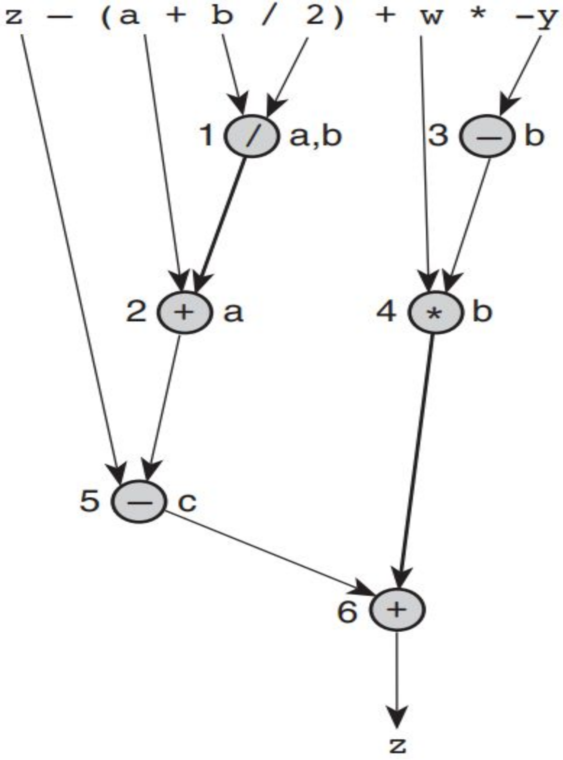
# Arithmetic Expressions

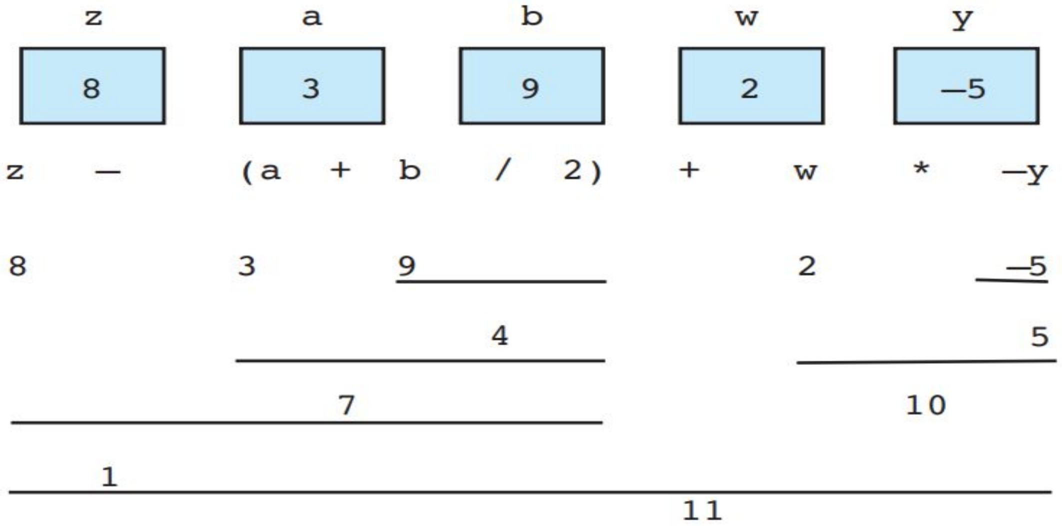
- Evaluation Tree and Evaluation for v = (p2 − p1) / (t2 − t1);



# Arithmetic Expressions

- Evaluation Tree and Evaluation for z − (a + b / 2) + w * −y





# Arithmetic Expressions

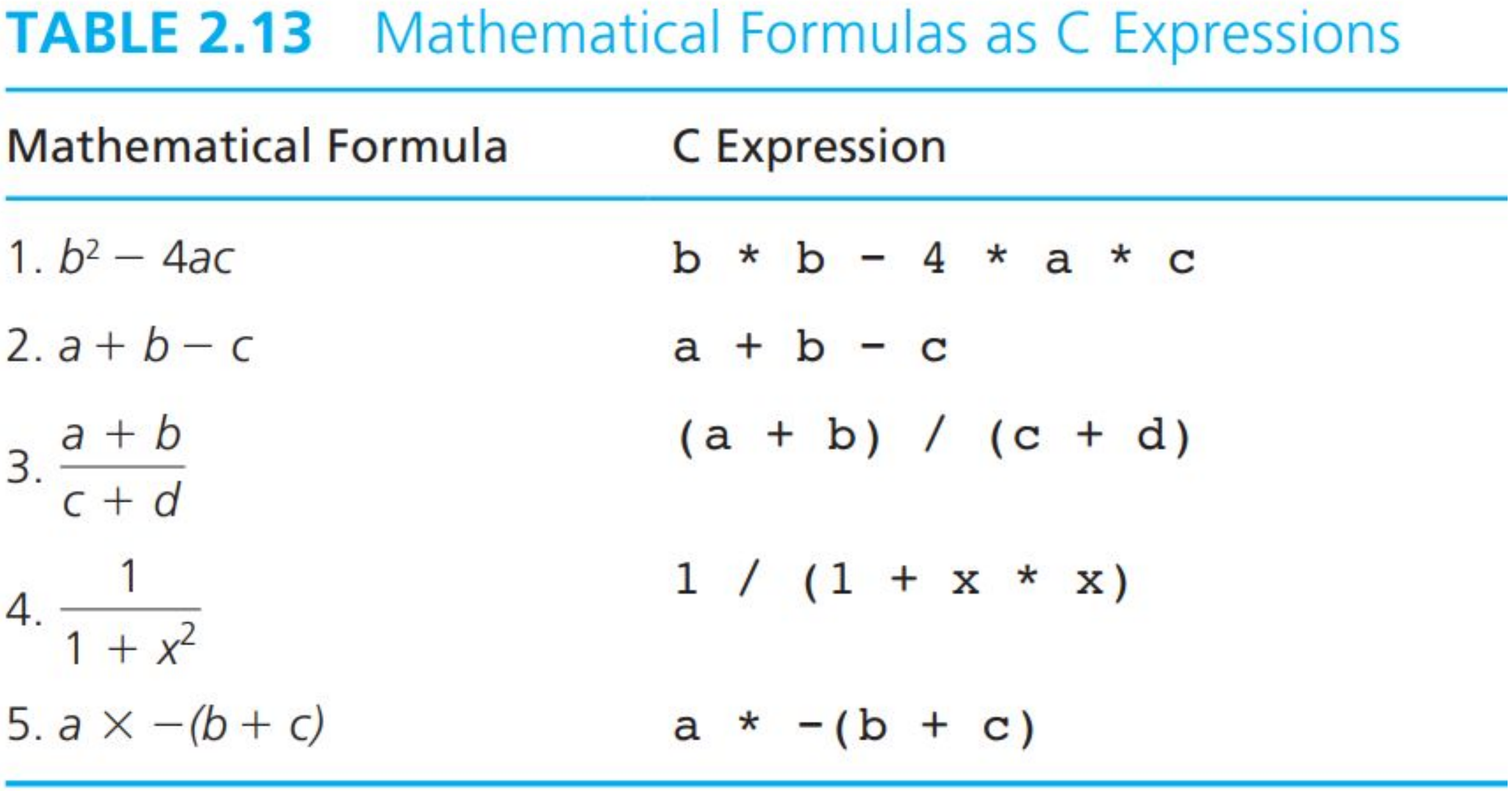
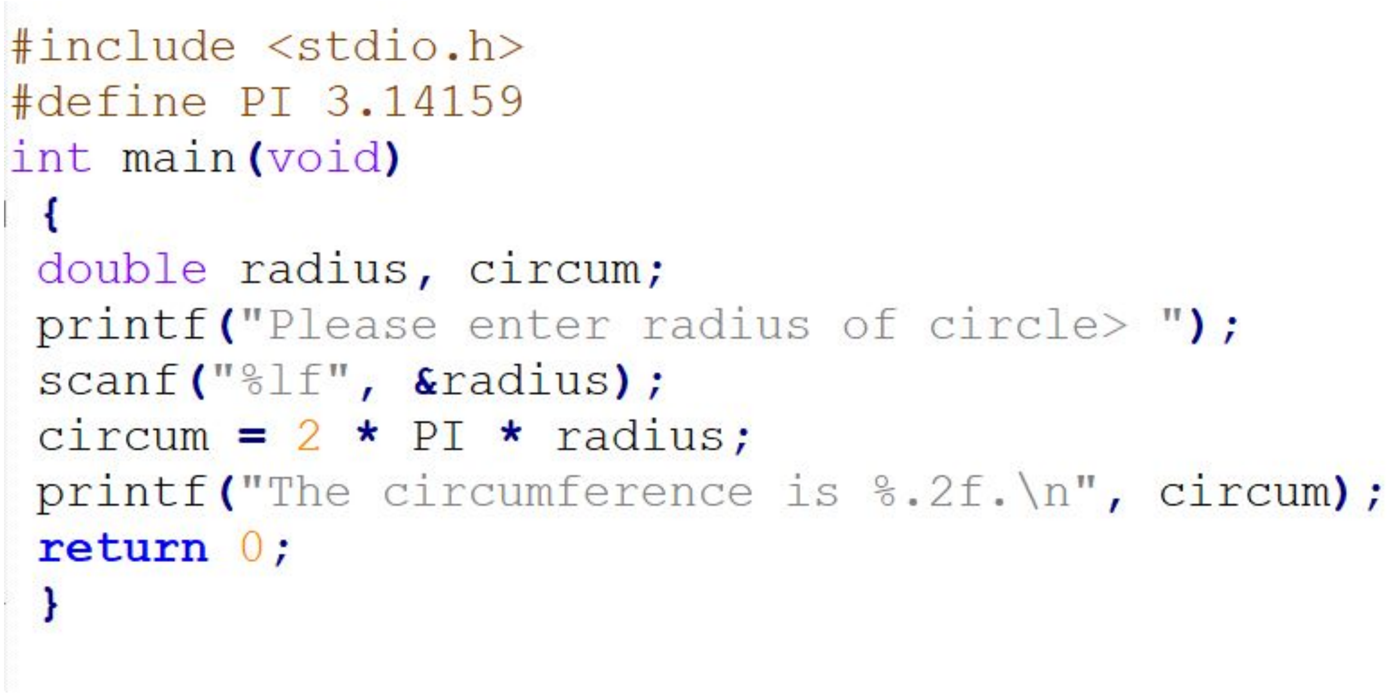


**TABLE 2.13** Mathematical Formulas as C Expressions

| Mathematical Formula | C Expression |
|---|---|
| 1. $b^2 - 4ac$ | `b * b - 4 * a * c` |
| 2. $a + b - c$ | `a + b - c` |
| 3. $\dfrac{a + b}{c + d}$ | `(a + b) / (c + d)` |
| 4. $\dfrac{1}{1 + x^2}$ | `1 / (1 + x * x)` |
| 5. $a \times -(b + c)$ | `a * -(b + c)` |

# Arithmetic Expressions

- Write a complete C program that prompts the user to enter the radius of a circle and displays the circumference. Circumference=2 πr



```
#include <stdio.h>
#define PI 3.14159
int main(void)
 {
 double radius, circum;
 printf("Please enter radius of circle> ");
 scanf("%lf", &radius);
 circum = 2 * PI * radius;
 printf("The circumference is %.2f.\n", circum);
 return 0;
 }
```

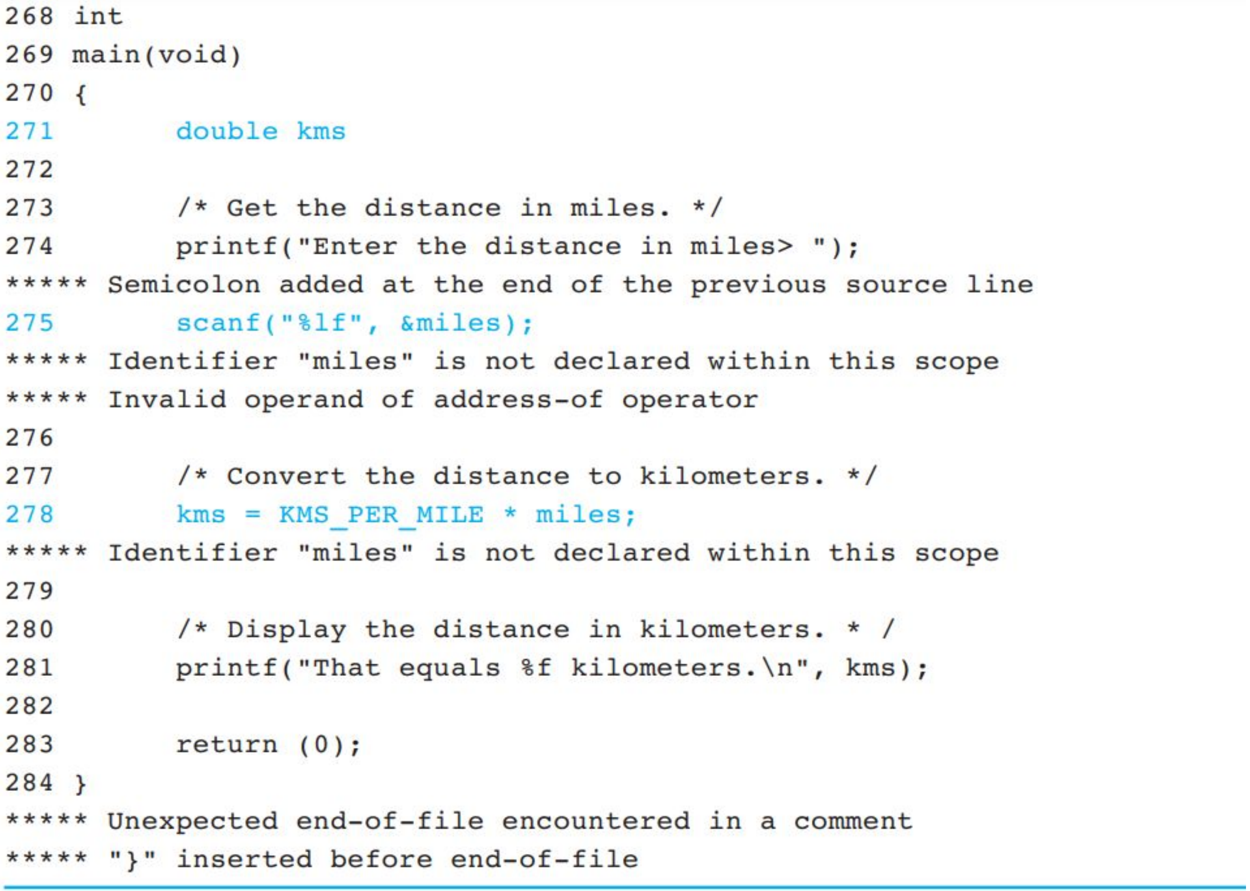
# Chapter 2

- Common programming errors

# Common programming errors

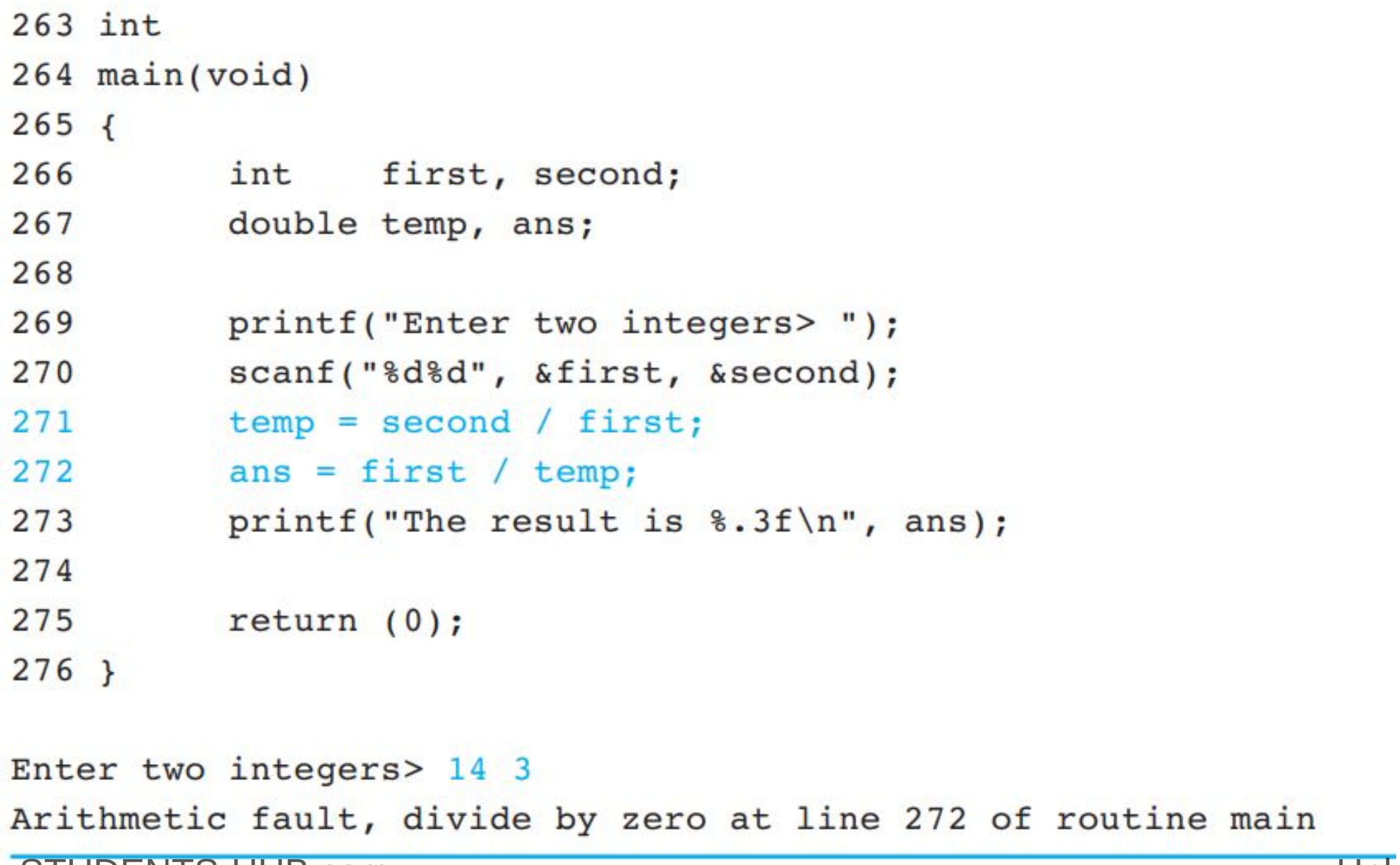
- **Syntax Errors** - a violation of the C grammar rules, detected during program translation (compilation)
  - Missing semicolon
  - Undeclared variable
  - Last comment is not closed because of blank in */ close-comment sequence
- **Logic Errors** - an error caused by following an incorrect algorithm
  - Sum = x-y (minus instead of plus)
- **Run-Time Errors** – an attempt to perform an invalid operation, detected during program execution.
  - Result= x / 0 (undefined)
- **Debugging :** removing errors from a program.

# Syntax Errors example



```
268 int
269 main(void)
270 {
271         double kms
272
273         /* Get the distance in miles. */
274         printf("Enter the distance in miles> ");
***** Semicolon added at the end of the previous source line
275         scanf("%lf", &miles);
***** Identifier "miles" is not declared within this scope
***** Invalid operand of address-of operator
276
277         /* Convert the distance to kilometers. */
278         kms = KMS_PER_MILE * miles;
***** Identifier "miles" is not declared within this scope
279
280         /* Display the distance in kilometers. * /
281         printf("That equals %f kilometers.\n", kms);
282
283         return (0);
284 }
***** Unexpected end-of-file encountered in a comment
***** "}" inserted before end-of-file
```

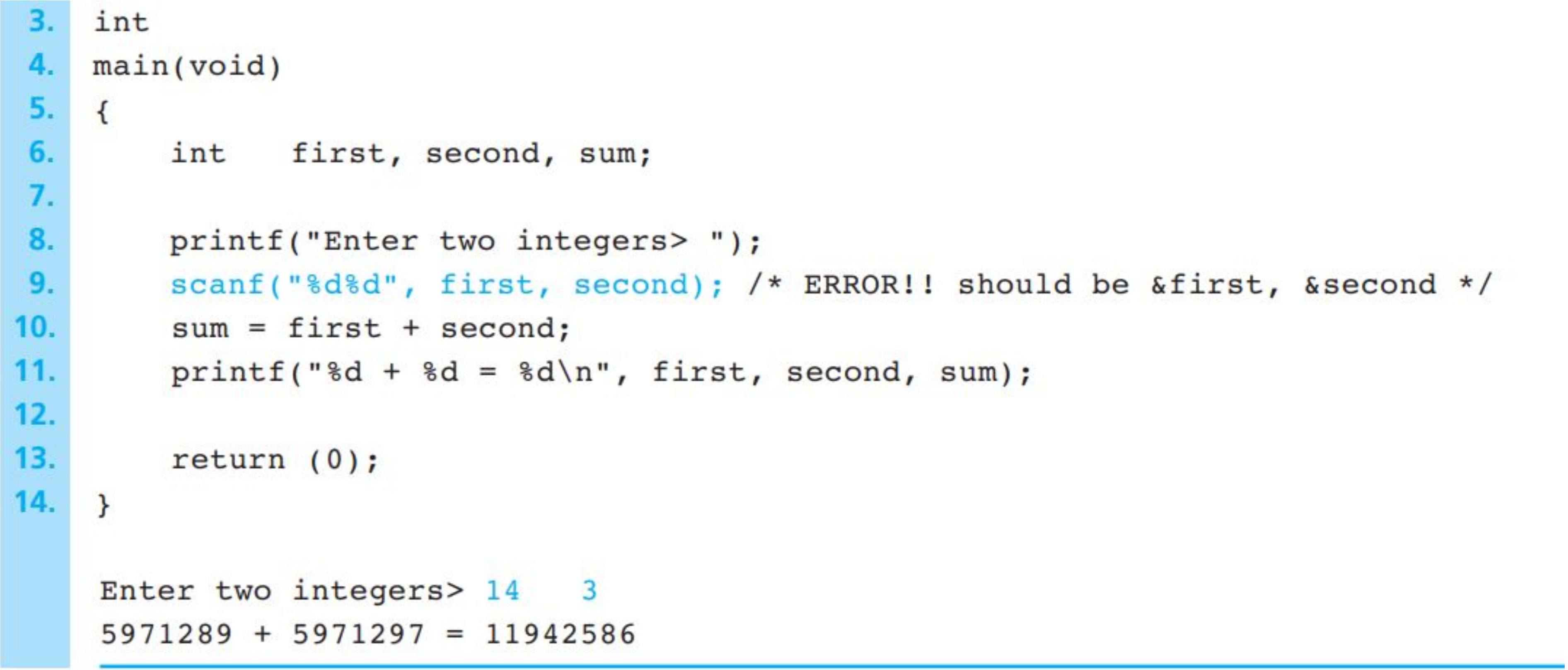
# Run-Time Error example



```
263 int
264 main(void)
265 {
266         int     first, second;
267         double temp, ans;
268
269         printf("Enter two integers> ");
270         scanf("%d%d", &first, &second);
271         temp = second / first;
272         ans = first / temp;
273         printf("The result is %.3f\n", ans);
274
275         return (0);
276 }
```

```
Enter two integers> 14 3
Arithmetic fault, divide by zero at line 272 of routine main
```

# Logic Errors example



```
int
main(void)
{
      int   first, second, sum;

      printf("Enter two integers> ");
      scanf("%d%d", first, second); /* ERROR!! should be &first, &second */
      sum = first + second;
      printf("%d + %d = %d\n", first, second, sum);

      return (0);
}
```

```
Enter two integers> 14   3
5971289 + 5971297 = 11942586
```

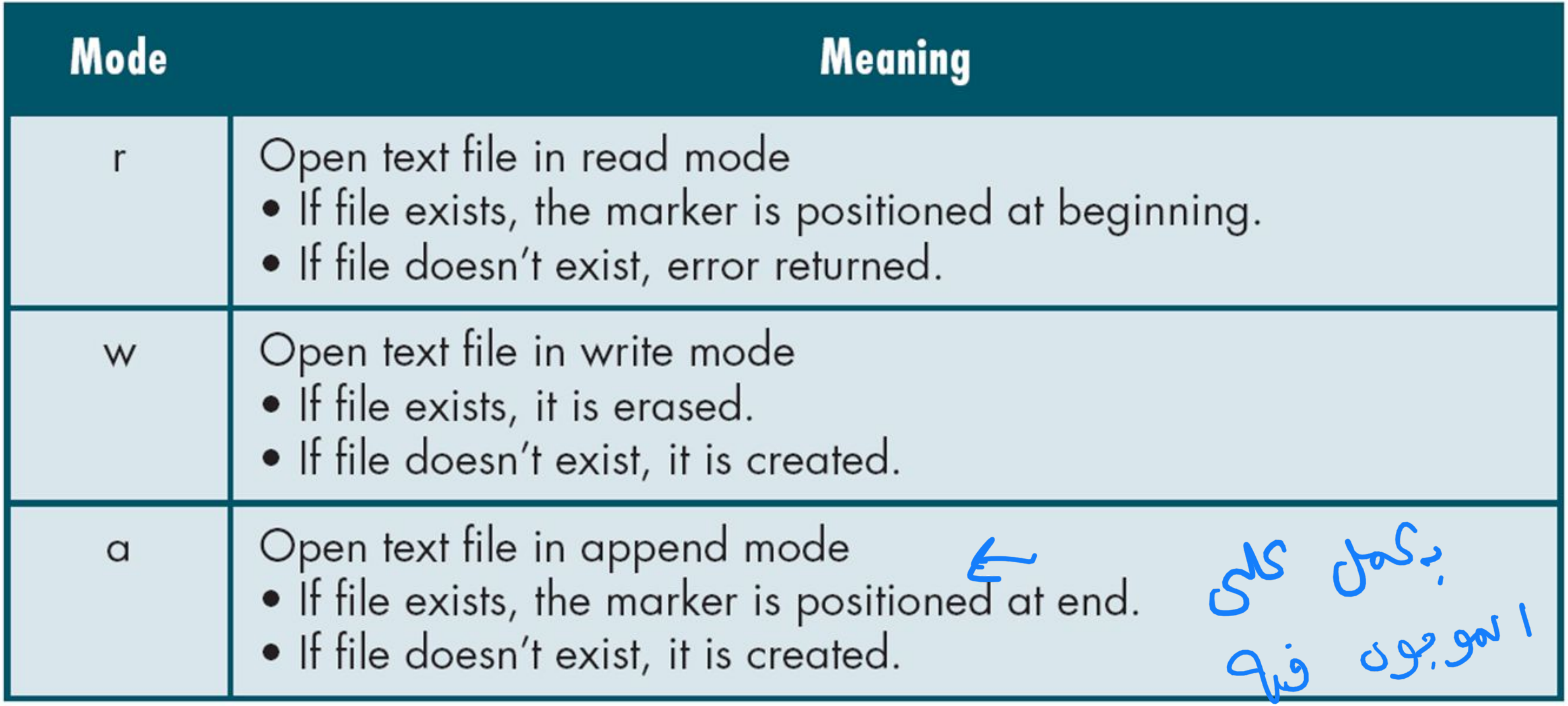
# Chapter 2

- File I/O

# File I/O

- Declare a file pointer variables.
  - **FILE *input;**
  - **FILE *output;**
- Then call a function that opens the files
  - **input = fopen(“File_Input.txt”, “r”);**
  - **output = fopen(“File_Output.txt”, “w”);**
- Now we can read or write from / to file.
  - **fscanf(input, “%d”, &x);**
  - **fprintf(output, “%d\n”, x);**
- Last step close the file.
  - **fclose(input)**
  - **fclose(output)**

# File Open Modes



| Mode | Meaning |
|---|---|
| r | Open text file in read mode<br>• If file exists, the marker is positioned at beginning.<br>• If file doesn't exist, error returned. |
| w | Open text file in write mode<br>• If file exists, it is erased.<br>• If file doesn't exist, it is created. |
| a | Open text file in append mode<br>• If file exists, the marker is positioned at end.<br>• If file doesn't exist, it is created. |

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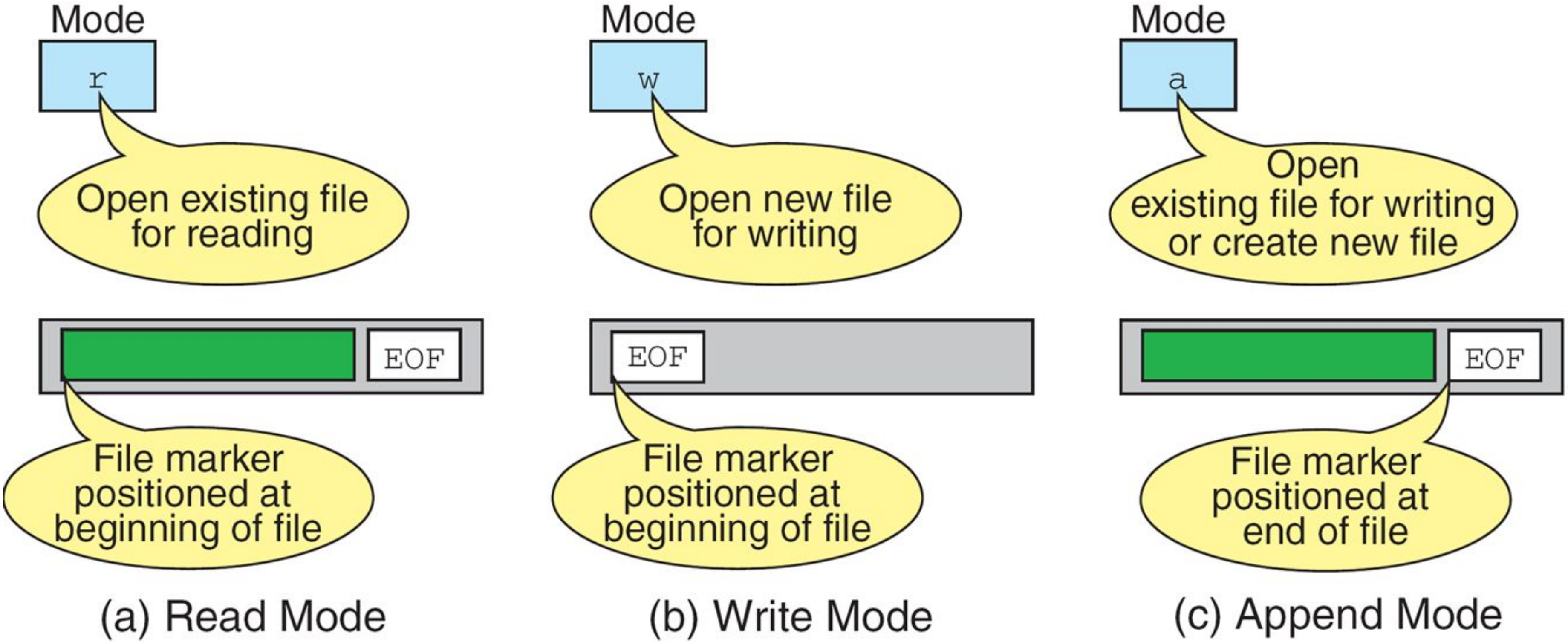
# File Open Modes


Mode
r
Open existing file for reading
EOF
File marker positioned at beginning of file
(a) Read Mode
Mode
w
Open new file for writing
EOF
File marker positioned at beginning of file
(b) Write Mode
Mode
a
Open existing file for writing or create new file
EOF
File marker positioned at end of file
(c) Append Mode

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# End of File

- There are a number of ways to test for the end-of-file condition.
  - Using function feof()

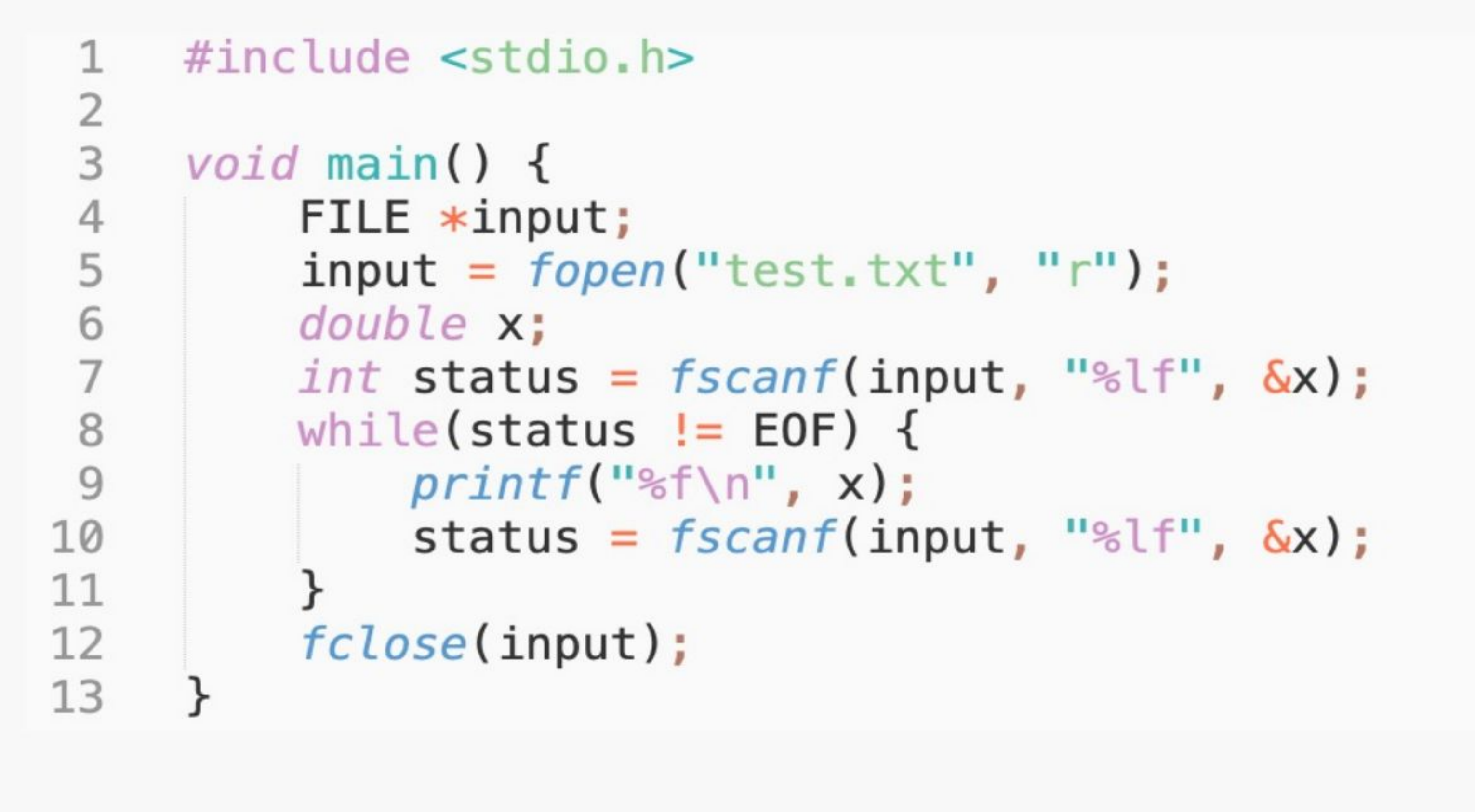
```
if (feof(input))
printf("\n End of file reached.");
```

Another ways to use macro EOF.

```
If(input==EOF)
printf ("End-of-file encountered.\n”) ;
```

**EOF is a constant variable in C, and its value is -1.**

# Reading from Files - Example



```c
#include <stdio.h>

void main() {
    FILE *input;
    input = fopen("test.txt", "r");
    double x;
    int status = fscanf(input, "%lf", &x);
    while(status != EOF) {
        printf("%f\n", x);
        status = fscanf(input, "%lf", &x);
    }
    fclose(input);
}
```

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# Writing to Files – Example

- Write a program that reads numbers from the user.
- Every time a new number is entered, calculate the square root of that number.
- Prints the number and its square root to a file.

Remmber :

☆ -1 → negative ⊖

☆ 1 → postive ⊕

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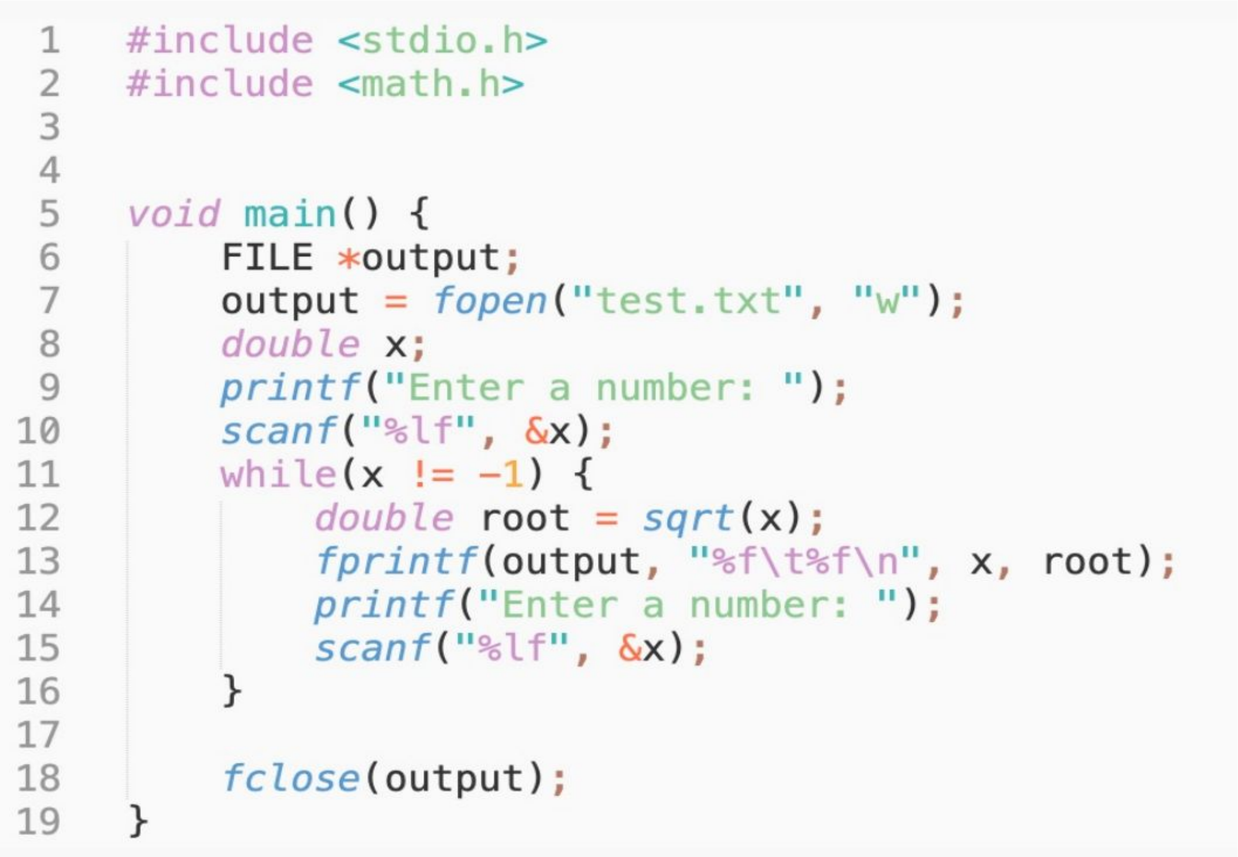
# Writing to Files – Example



```c
#include <stdio.h>
#include <math.h>


void main() {
    FILE *output;
    output = fopen("test.txt", "w");
    double x;
    printf("Enter a number: ");
    scanf("%lf", &x);
    while(x != -1) {
        double root = sqrt(x);
        fprintf(output, "%f\t%f\n", x, root);
        printf("Enter a number: ");
        scanf("%lf", &x);
    }

    fclose(output);
}
```

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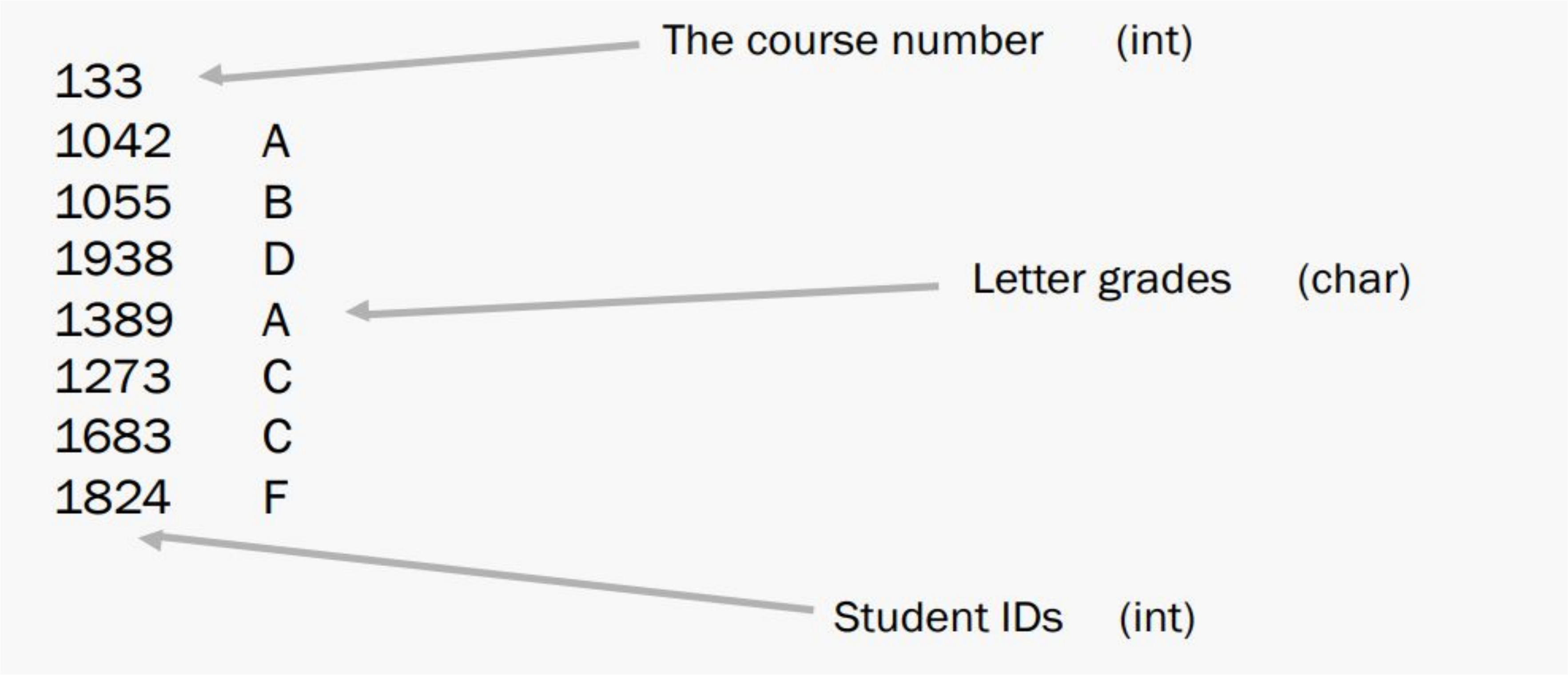
# Reading Different Data Types from Files



```
133
1042    A
1055    B
1938    D
1389    A
1273    C
1683    C
1824    F
```

The course number (int)

Letter grades (char)

Student IDs (int)

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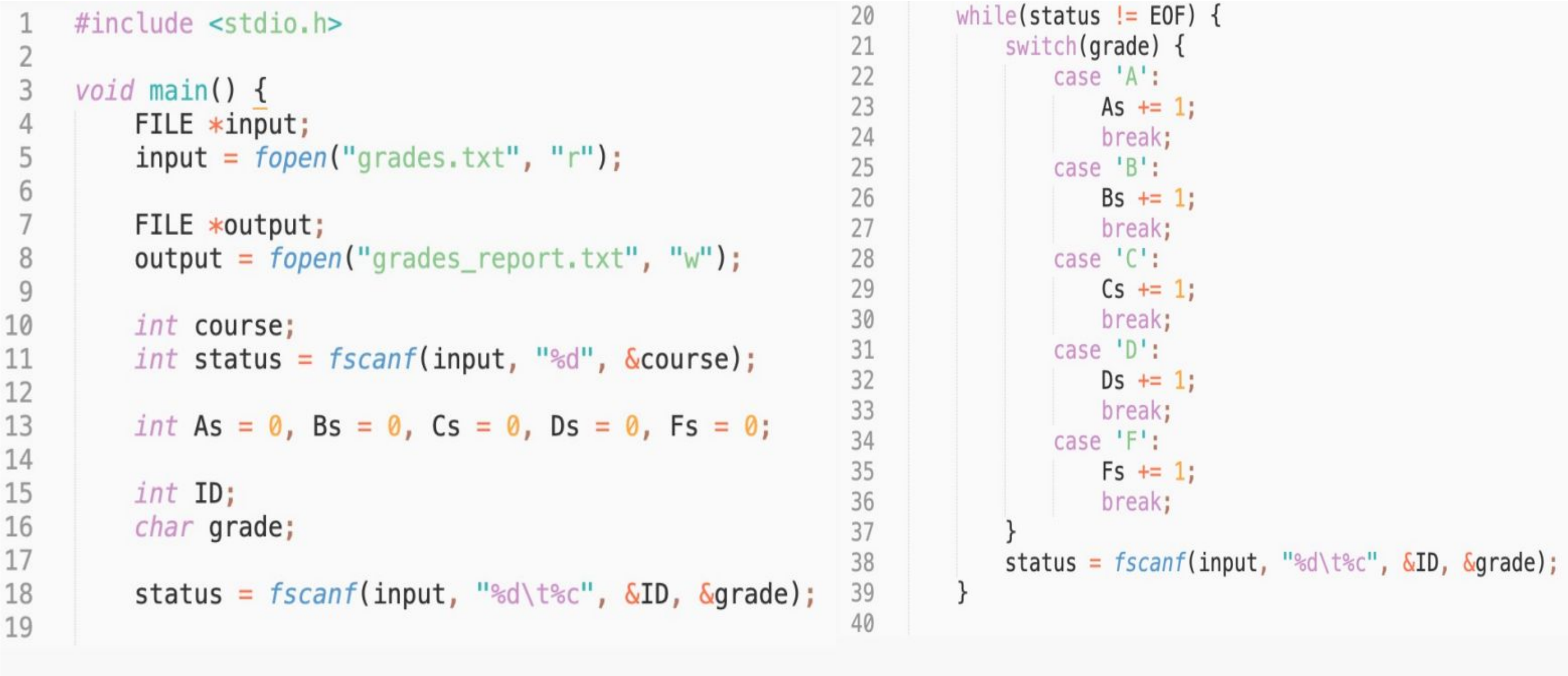
# Reading Different Data Types from Files



```c
#include <stdio.h>

void main() {
    FILE *input;
    input = fopen("grades.txt", "r");

    FILE *output;
    output = fopen("grades_report.txt", "w");

    int course;
    int status = fscanf(input, "%d", &course);

    int As = 0, Bs = 0, Cs = 0, Ds = 0, Fs = 0;

    int ID;
    char grade;

    status = fscanf(input, "%d\t%c", &ID, &grade);

    while(status != EOF) {
        switch(grade) {
            case 'A':
                As += 1;
                break;
            case 'B':
                Bs += 1;
                break;
            case 'C':
                Cs += 1;
                break;
            case 'D':
                Ds += 1;
                break;
            case 'F':
                Fs += 1;
                break;
        }
        status = fscanf(input, "%d\t%c", &ID, &grade);
    }

```

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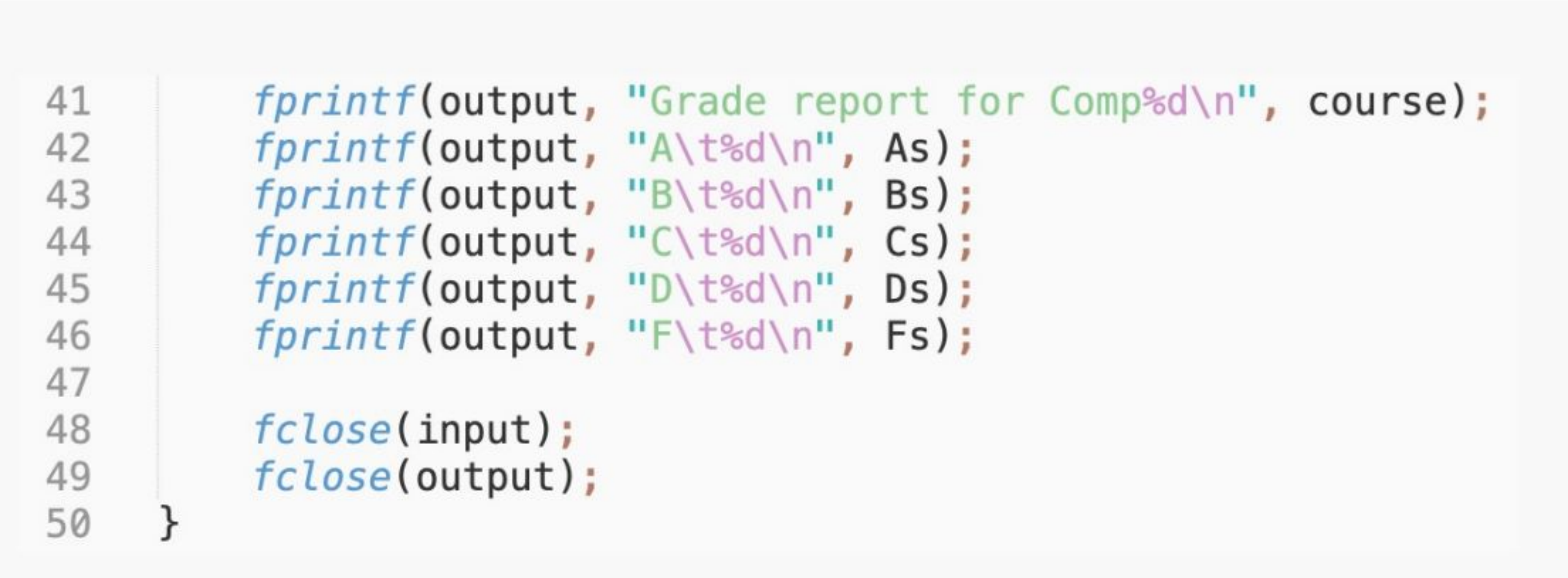
# Reading Different Data Types from Files



```
    fprintf(output, "Grade report for Comp%d\n", course);
    fprintf(output, "A\t%d\n", As);
    fprintf(output, "B\t%d\n", Bs);
    fprintf(output, "C\t%d\n", Cs);
    fprintf(output, "D\t%d\n", Ds);
    fprintf(output, "F\t%d\n", Fs);

    fclose(input);
    fclose(output);
}
```

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# Thank You.

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