PROGRAMMAZIONE PROCEDURALE

A.A. 2023/2024

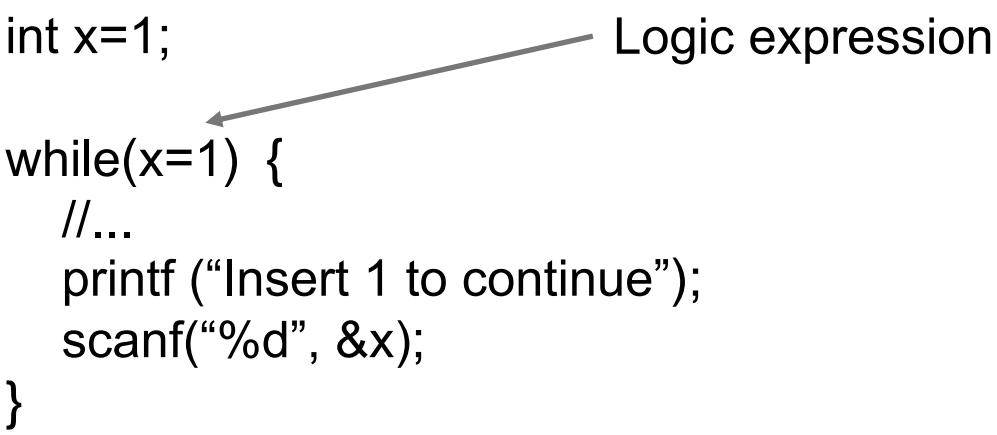
CONDITIONAL STATEMENTS AND LOOPS EXAMPLES

WHY LOOPS ARE IMPORTANT

- Loop can be defined as one of the basic logical structures of computer programming.
- Defining loops allows computers to perform the same task repeatedly.
- Every time you might use the words "each" and "every" in the natural language description of your program's specification you want a loop.
- Also forever
  - ✓while(1)

EXAMPLES ON LOOPS

LOGIC CONDITIONS



If you use a single equal sign to check equality, your program will instead assign the value on the right side of the expression to the variable on the left hand side, and the result of this statement is the value assigned. In this case, the value is always 1, which is treated as always true.

```
int x=1;

while(x==1) {
    //...
    printf ("Insert 1 to continue");
    scanf("%d", &x);
}
```

TRANSFORM LOOPS

```
int n= 4;

for (int i= 0; i < n; i++) {
    printf("OK\n");
}
```

```
int n= 4;
Int i= 0;

while (i < n) {
    printf("OK\n");
    i++;
}
```

```
int n= 4;
int i= 0;

do {
    printf("OK\n");
    i++;
} while (i < n);
```

DO...WHILE

```c
#include <stdio.h>

int main(){
    double number,  sum = 0;

    // loop body is executed at least once
    do    {
        printf("Enter a number: ");
        scanf("%lf", &number);
        sum += number;
    }   while(number != 0.0);

    printf("Sum = %.2lf",sum);
    return 0;
}
```

SCAN AN ARRAY

12206

```
// Arrays example
#include <stdlib.h>

int main () {
    int foo [] = {16, 2, 77, 40, 12071};
    int n, result=0;

    for ( n=0 ; n<5 ; ++n ) {
        result += foo[n];
    }

    printf(“%d”, result);
    return 0;
}
```

SCAN A MATRIX

```
const int width= 5;
const int height= 3;

int main () {

    int mat [height][width];


    for (int n=0; n< height; n++)
        for (int m=0; m< width; m++)
            mat[n][m]= (n+1)*(m+1);

}
```

	0	1	2	3	4
0	1	2	3	4	5
1	2	4	6	8	10
2	3	6	9	12	15

ARRAYS AS ARGUMENTS OF FUN.

- When the name of an array appears as a function argument, the compiler implicitly converts it into a pointer to the array's first element.
  - ✓ *int* name[] or
  - ✓ *int* *name is the same.

HOW TO PASS AN ARRAY

```
#include <stdio.h>

void fun(int a[], int n) {
    for ( int i = 0; i < n; ++i )
        a[i] = i;
}

int main(){
    int a[3];
    fun(a, 3);
}
```

```
#include <stdio.h>

void fun(int* a, int n) {
    for ( int i = 0; i < n; ++i )
        *(a + i) = i;
}

int main(){
    int a[3];
    fun(a, 3);
}
```

C does not have array variables

It is really just working with pointers with an alternative syntax.

HOW TO PASS A MATRIX

```c
#include <stdio.h>

int matrix_sum (int row, int column, int m[row][column]) {
    int sum= 0;

    for (int i= 0; i < row; i++)
        for (int j= 0; j < column; j++)
            sum+= m[i][j];
     return sum;
}

int main()
{
    int m[2][3]= {1,4,5,2,1,1};
    int result;
    result= matrix_sum(2, 3, m);
    printf("%d", result);
}
```

1 4 5
2 1 1

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AN ADVANCED EXAMPLE

NESTED LOOPS (BUBBLE SORT)

```c
#include <stdio.h>

int main() {
  int n, c, d, swap;
  printf("Enter number of elements\n");
  scanf("%d", &n);
  printf("Enter %d integers\n", n);
  int array[n];

  for (c = 0; c < n; c++)
    scanf("%d", &array[c]);

  for (c = 0 ; c < ( n - 1 ); c++)
  {
    for (d = 0 ; d < n - c - 1; d++)
    {
      if (array[d] > array[d+1])
      {
        swap       = array[d];
        array[d]   = array[d+1];
        array[d+1] = swap;
      }
    }
  }
return 0;
}
```

BUBBLE SORT

6 5 3 1 8 7 2 4

EXAMPLES ON SELECTION STATEMENTS

LOGIC CONDITIONS

```
int age= 17;

if  (age  =  18)
    printf("OK!");
```

What is the value of age = 18? 18

Is 18 true of false in C? true

It always prints "OK!" and age becomes 18

```
int age= 17;

if  (age  ==  18)
    printf("OK!");
```

It prints "OK!" only when age is equal to 18
age remains equal to 17

SELECTION STATEMENTS

```c
#include <stdio.h>

int main(){
    int number= 0;
    printf("Enter an integer: ");
    scanf("%d",&number);

    // True if remainder is 0
    if ( number%2 == 0 )
        printf("%d is an even integer.", number);
    else
        printf("%d is an odd integer.", number);

    return 0;
}
```

CASCADE OF IFS

```c
#include <stdio.h>

int main(){
    char grade= 'F';
    int score= 0;
    printf("Enter a score: ");
    scanf("%d", &score);

    // True if remainder is 0
    if (score >= 90)
        grade= 'A';
    if (score >= 80)
        grade= 'B';
    if (score >= 70)
        grade= 'C';
    if (score >= 60)
        grade= 'D' ;

    printf("Your grade is %c: ", grade);

    return 0;
}
```

≠

```c
#include <stdio.h>

int main(){
    char grade= 'D';
    int score= 0;
    printf("Enter a score: ");
    scanf("%d", &score);

    // True if remainder is 0
    if (score >= 90)
        grade= 'A';
    else
        if (score >= 80)
            grade= 'B';
        else
            if (score >= 70)
                grade= 'C';
            else
                if (score >= 60);

    printf("Your grade is %c: ", grade);

    return 0;
}
```

PAY ATTENTION TO NESTING

```
if (x > 10) {
    if (x < 20)
        printf("x is between 10 and 20");
    else
        printf("x is greater than 20");
}
```

=

```
if (x > 10)
    if (x < 20)
        printf("x is between 10 and 20");
    else
        printf("x is greater than 20");
```

```
if (x > 10) {
    if (x < 20)
        printf("x is between 10 and 20");
}
else
    printf("x is less than 10");
```

COMMON ERRORS

```
if  (age  >=  18);
    printf(“You can drink!\n”);
```

This will always print “Ok” even if age is less than 18

```
if  (age  >=  18)
    printf(“You can drink!\n”);
    printf(“Age greater than 18\n”);
```

This will always print “Age greater than 18” even If age is less than 18

```
if ( a < b)
    { do something here; }
else if (a > b)
    { do this other thing; }
else (a == b)
    { do something different; }
```

Else is not allowed to have a condition

COMMON ERRORS

```
if (20 > x > 10)
    printf("x is between 10 and 20");
```

```
int x= 15
if (20 > x > 10)
    printf("x is between 10 and 20");
```

> is associative left-to-right…

20 > x true(1)
1 > 10 false(0)

OK!

```
if (x > 10 && x < 20)
    printf("x is between 10 and 20");
```

1. If you have multiple cases, an if for each
2. If you condition is long, decompose and use logical operators

INFINITE LOOPS

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

int main()
{
    int i= 1;
     while (1) {

        i++;
        if (i < 0) {
            printf("%d\n", i);
            break;
        }
    }
}
```

```
MacBook-Francesco:ProgrammI francescosantini$ ./a.out
-2147483648
```

OVERFLOW

An int in two's complement

01111111 11111111 11111111 11111111	2,147,483,647
01111111 11111111 11111111 11111110	2,147,483,646
…	
00000000 00000000 00000000 00000010	2
00000000 00000000 00000000 00000001	1
00000000 00000000 00000000 00000000	0
10000000 00000000 00000000 00000000	-2,147,483,648
10000000 00000000 00000000 00000001	-2,147,483,647
…	
11111111 11111111 11111111 11111110	-2
11111111 11111111 11111111 11111111	-1