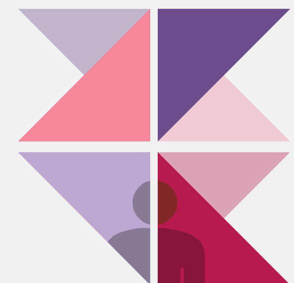
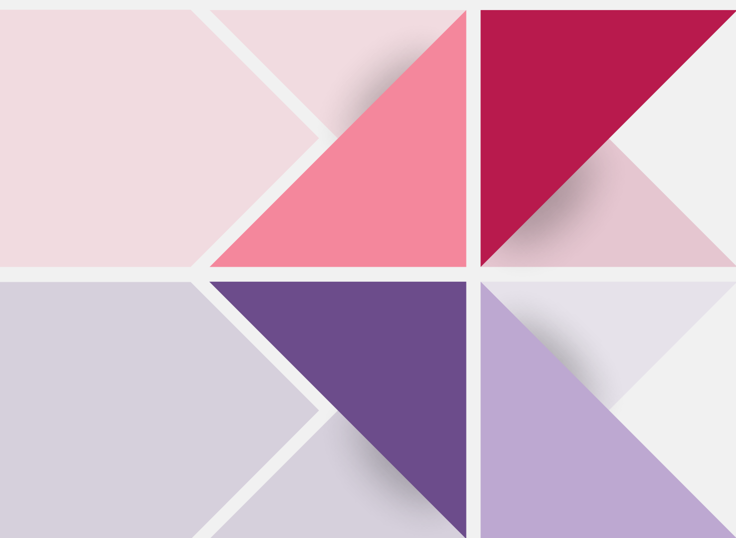
Supplementary





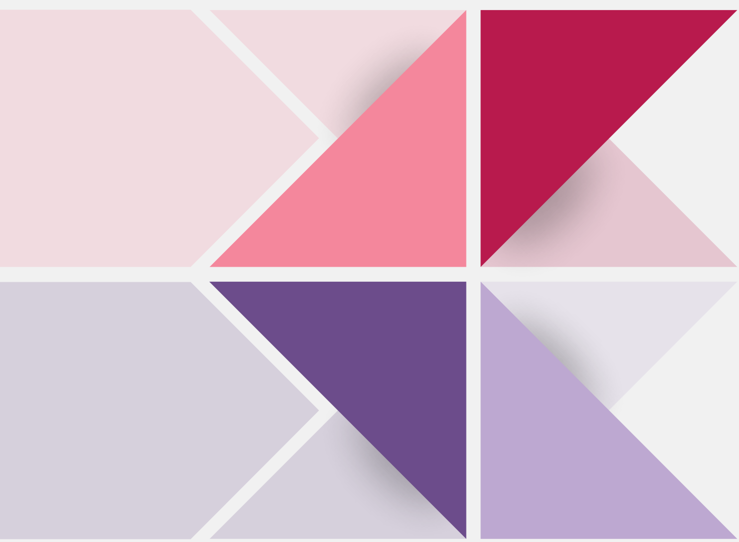
00

Midterm

Supplementary
Midterm

Date and Place

- 2023 / 11 / 9 (Thursday) 13:10-16:05
- 教學一館 33404
- You will not take the test if arriving the 33404 after 13:35



01

Printf

Output - printf()

- The printf function must be supplied with a format string, followed by any values that are to be inserted into the string during printing

printf(*string*, *expr* 1, *expr* 2, …);

- The format string may contain both ordinary characters and conversion ***specifications***, which begin with the % character

```
int p = 3;
printf("The value is %d\n", p);
```

Supplementary

Printf

Conversion specifications

- %●
  - %c - Character
  - %d - Integer
  - %f - Floating point
  - %s - String
  - %e - Exponential format
  - %g - Either exponential format or fixed decimal format, depending on the number's size

```
float i = 123.223;
printf("i = %f\n", i);
```

```
i = 123.223000
```

```
float i = 123.223;
printf("i = %e\n", i);
```

```
i = 1.232230e+002
```

```
float i = 123.223;
printf("i = %g\n", i);
```

```
i = 123.223
```

Supplementary

Printf

Output - printf()

- A conversion specification can have the form %m.pX or %-m.pX, where the m and p are integer constants and X is a letter

```
printf("%10.2f\n", i);   // m = 10, p = 2, X = f

printf("%10f\n", i);   // m = 10, p = missing, X = f

printf("%f\n", i);   // m and p are miss, X = f
```

- m specifies the minimum number of characters to print

```
int i = 123;
printf("%10d\n", i);   // It will print • • • • • • • 123
```

- Putting a minus sign in front of m causes left justification

```
printf("%-10d\n", i);   // It will print 123 • • • • • • •
```

Output - printf()

- The meaning of the precision, p, depends on the choice of X, the conversion specifier
- The **d** specifier is used to display an integer in decimal form
  - p indicates the minimum number of digits to display (extra zeros are added to the beginning of the number if necessary)

```
int i = 314;
printf("i = %.4d\n", i);
```

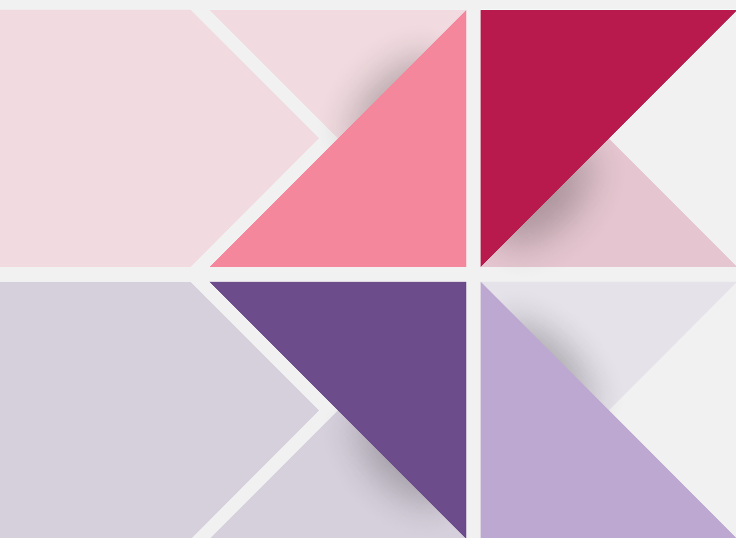
```
i = 0314
```

```
float i = 3.141592;
printf("i = %.4f\n", i);
```

```
i = 3.1416
```

```
float i = 3.141592;
printf("i = %10.4f\n", i);
```

```
i =     3.1416
```



02

++ and --

Supplementary

++ and --

Increment and decrement operators

- "++" and "--"
  - ++ : adds 1 to its operand
  - -- : subtracts 1 to its operand
- They can be employed as prefix (++i) or postfix (i++) operators
- They have side effects

```
int prefix_i = 1;
printf("prefix_i is %d\n", ++prefix_i);
printf("prefix_i is %d\n", prefix_i);
```

```
int postfix_i = 1;
printf("postfix_i is %d\n", postfix_i++);
printf("postfix_i is %d\n", postfix_i);
```

- "++prefix_i" means "increment prefix_i immediately", while "postfix_i++" means "use the old value of postfix_i for now, but increment it later"
- How much later? The C standard doesn't specify a precise time, but it's safe to assume that the variable will be incremented before the next statement is executed

Supplementary

++ and --

```
x = y += z++-i+--j / -k
x = y += (z++)-i+--j / -k
x = y += (z++)-i+(--j) / -k
x = y += (z++)-i+(--j) / (-k)
x = y += (z++)-i+((--j) / (-k))
x = y += ((z++)-i)+((--j) / (-k))
x = y += (((z++)-i)+((--j) / (-k)))
x = (y += (((z++)-i)+((--j) / (-k))))
```

Precedence	Name	Symbol(s)		
1	Postfix increment	Operand++		
	Postfix decrement	Operand--		
2	Prefix increment	++Operand		
	Prefix decrement	--Operand		
	Unary plus	+Operand		
	Unary minus	-Operand		
3	Multiplicative	Operand * / % Operand		
4	Additive	Operand + - Operand		
5	Assignment	Operand	= *= /= %= += -=	Operand

Supplementary

++ and --

(a)

```
i = 1;
printf("%d ", i++ - 1);
printf("%d", i);
```

(b)

```
i = 10, j = 5;
printf("%d ", i++ - ++j);
printf("%d %d", i, j);
```

(c)

```
i = 7, j = 8;
printf("%d ", i++ - --j);
printf("%d %d", i, j);
```

(a)

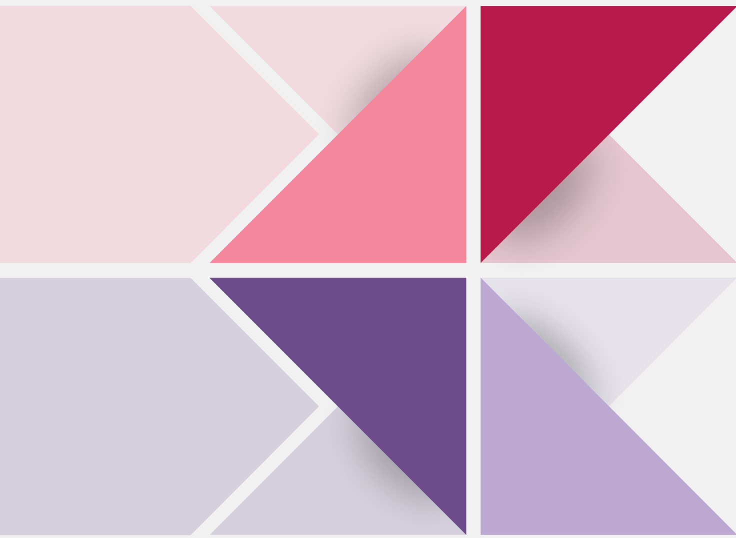
0 2

(b)

4 11 6

(c)

0 8 7



03

If and Switch

Supplementary

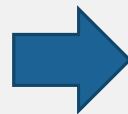
If and Switch

if (*expression*) *statement* else if *statement* else *statement*

```
if ( m < n)
  printf("m is less than n\n");
else if (m == n)
  printf("m is equal to n\n");
else
  printf("m is greater than n\n");
```

expression 1 *?* *expression* 2 : *expression* 3

```
int x=1, y=2, z;
if (x > y) z = x;
else z = y;
if (x > 0) z= x + y;
else z = 0 + y;
```



```
int x=1, y=2, z;
z = x>y? x : y;
z = (x >=0? x : 0) + y;
```

Supplementary

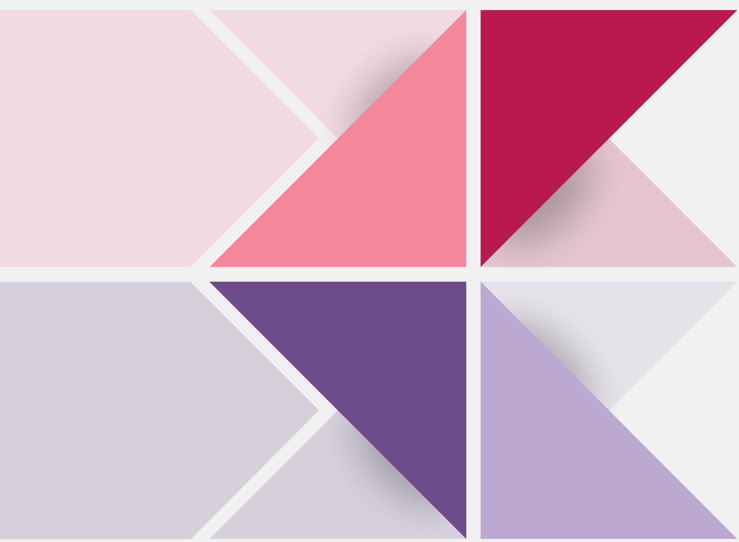
If and Switch

Switch statement

```
switch (grade)
{
    case 3:
            printf("Very good\n");
            break;
    case 2:
            printf("Good\n");
            break;
     case 1:
            printf("Average\n");
            break;
     case 0:
            printf("Failing\n");
            break;
     default:
            printf("Illegal grade\n");
            break;
}
```

```
switch (grade)
{
    case 3:
            printf("Very good\n");
    case 2:
            printf("Good\n");
    case 1:
            printf("Average\n");
    case 0:
            printf("Failing\n");
    default:
            printf("Illegal grade\n");
}
```

```
switch (grade)
{
    case 3:
    case 2:
    case 1:
            printf("Passing\n");
            break;
    case 0:
            printf("Failing\n");
            break;
    default:
            printf("Illegal grade\n");
            break;
}
```



04

For Loop

Supplementary

For Loop

for (*exp* 1; *exp* 2; *exp* 3)
{
        statements
}

1) 先執行運算式1。

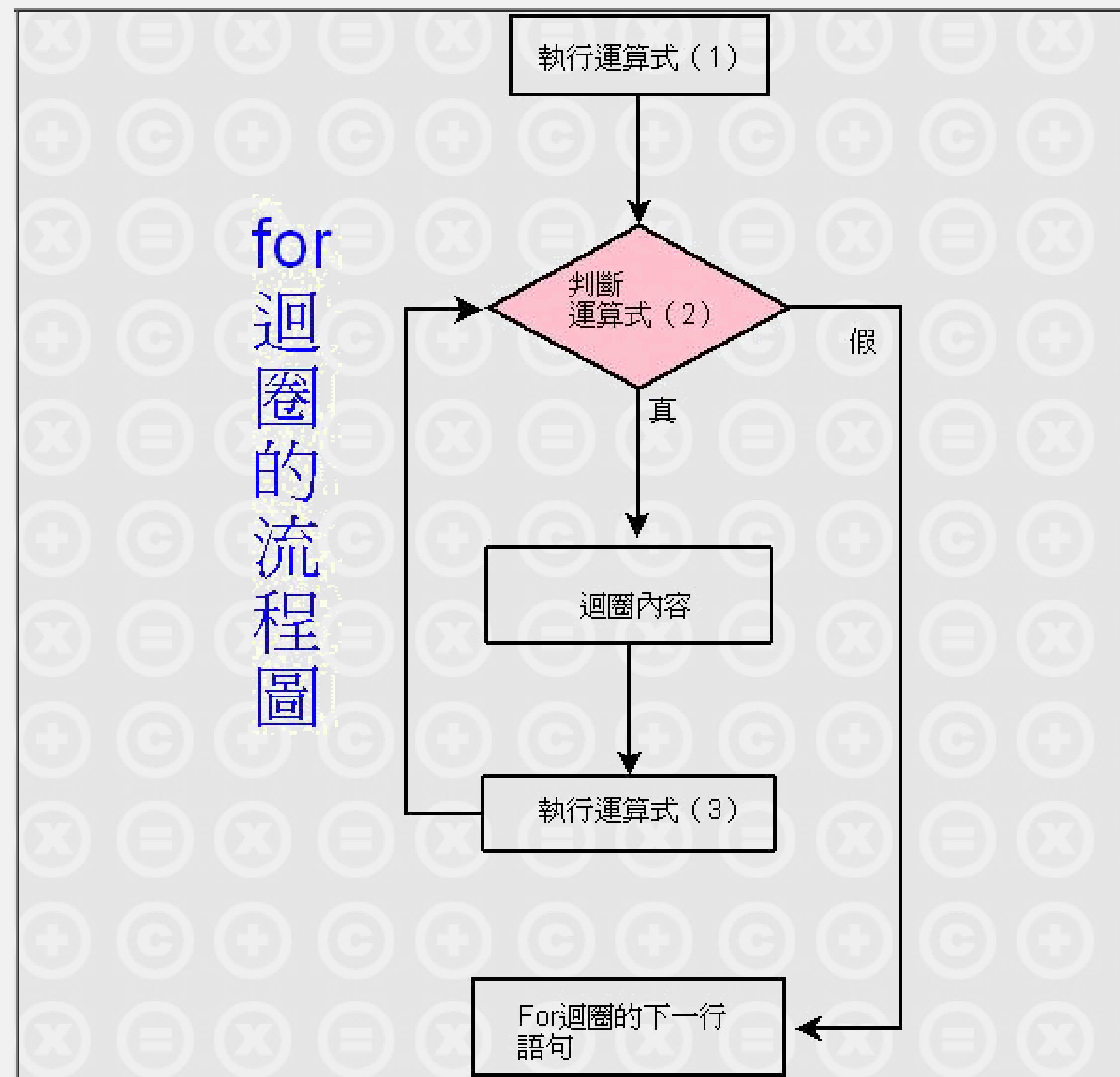
2) 再執行運算式2，若其值為真（非0），則執行for語句中指定的內嵌語句，然後執行下面 第 3 步；若其值為假（為0），則結束迴圈，轉到第 5 步。

3) 執行運算式 3。

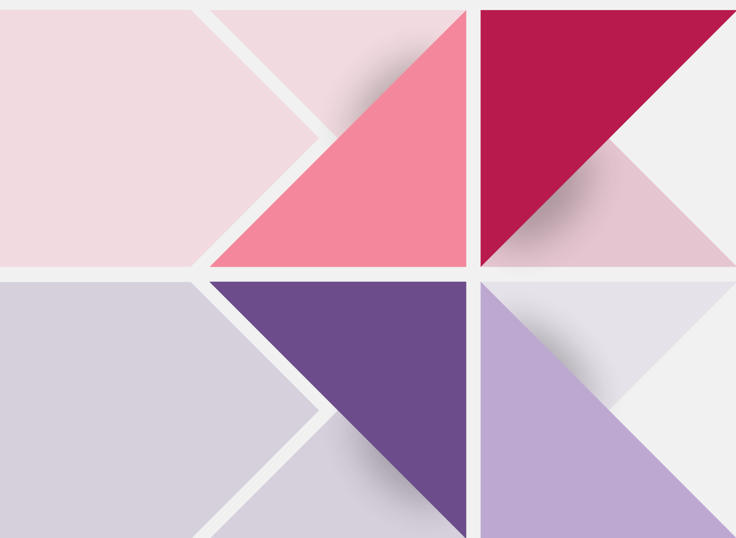
4) 轉回上面第 2 步繼續執行。

5) 迴圈結束，執行 for 語句下面的一個語句。

其執行過程可用右圖表示。



Reference



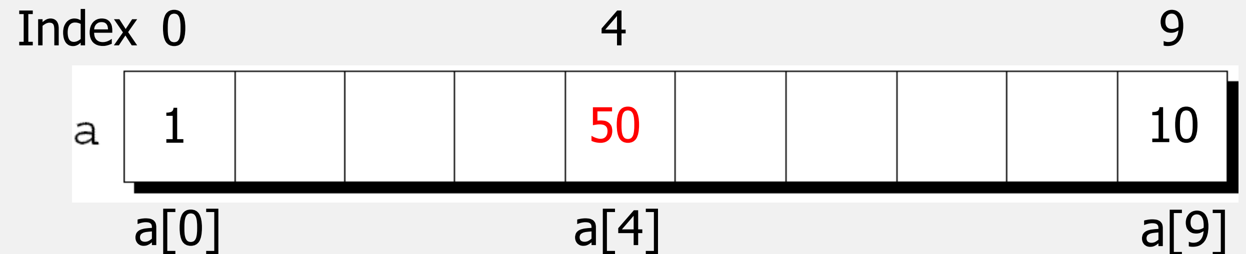
05

Array

How to access elements in the array?

- Write the array name followed by an integer value in square bracket
  - This is referred to as subscripting or indexing the array
  - Important concept: the range of index is from 0 to N-1

```
int a[10];
a[4] = 50;
```




```
int a[10], i;

for (i = 0; i < 10; i++)
     a[i] = 0;
```

Supplementary
Array

An array, like any other variable, can be given an initial value at the time it's declared

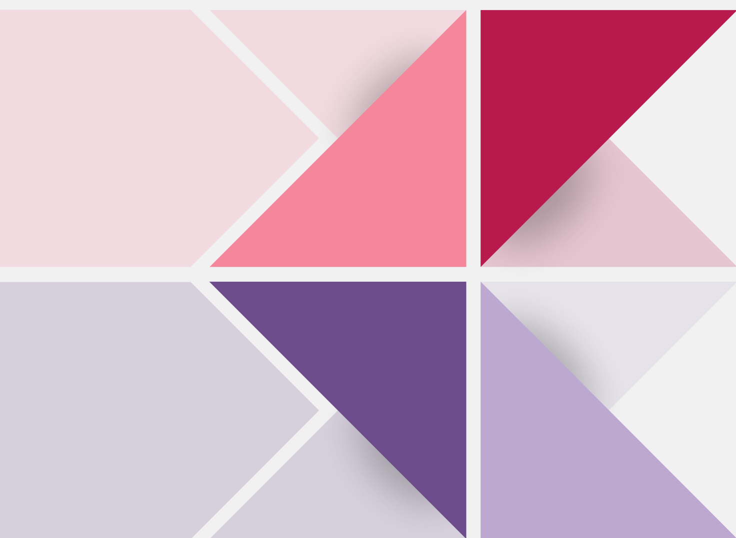
```
int a[10] = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};

int a[10] = {1, 2, 3, 4}; //initial value is {1, 2, 3, 4, 0, 0, 0, 0, 0, 0}
int a[10] = {0};          //initial value is {0, 0, 0, 0, 0, 0, 0, 0, 0, 0}

int a[10] = {6}; -> ?     //initial value is {6, 0, 0, 0, 0, 0, 0, 0, 0, 0}

int a[] = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};
```

Supplementary

Array

We can create an initializer for a two-dimensional array by nesting one-dimensional initializers

```
int x[3][4] = {{1, 1, 1, 1},
               {0, 1, 0, 1},
               {1, 0, 1, 0}};
```



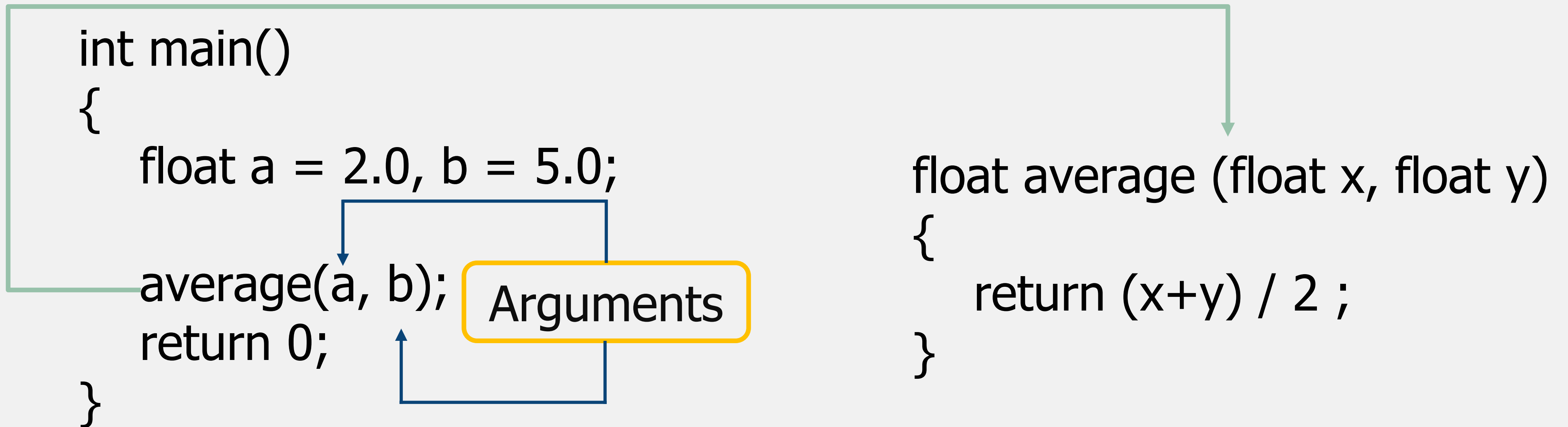
06

Function

Supplementary

Function

A function is called with the combination of function name and a list of arguments



Arguments are used to provide information to a function

- If calling average(a, b), the values of *a* and *b* will be *copied* into the parameters x and y

Supplementary

Function

If calling a function before defining it, error messages will be shown by the compiler

- The compiler will assume that average returns an int value

```
int main()
{
    float a = 2.0, b = 5.0;
    printf("Average is: %f\n", average(a, b));
    return 0;
}
float average (float x, float y)
{
    return (x+y) / 2 ;
}
```

```
test.c: In function 'main':
test.c:5:29: warning: implicit declaration of function 'average' [-Wimplicit-function-declaration]
     printf("Average: %f\n", average(2,3));
                             ^~~~~~~
test.c: At top level:
test.c:9:7: error: conflicting types for 'average'
 float average(int x, int y)
       ^~~~~~~
test.c:5:29: note: previous implicit declaration of 'average' was here
     printf("Average: %f\n", average(2,3));
                             ^~~~~~~
```

Supplementary

Function

How to avoid?

- Declare a function before calling it to provide the compiler with a brief glimpse
- The declaration must be consistent with the function's definition
- General form of function declaration

(*return type*) *function_name* (*parameters*);

```
float average (float x, float y);
int main()
{
    float a = 2.0, b = 5.0;
    printf("Average is: %f\n", average(a, b));
    return 0;
}
```

Array arguments

- When a function parameter is a one-dimensional array, the length of the array can be left unspecified such as

```
int f(int a[])   // no length specified
{
      …
}
```

- However, there is no any easy way in C for a function to determine the length of an array passed to it

```
int f(int a[])
{
    printf("sizeof(a) = %d\t sizeof(a[0]) = %d", sizeof(a), sizeof(a[0]));
    return sizeof(a) / sizeof(a[0]);
}
```

sizeof(a) = 4   sizeof(a[0]) = 4

Supplementary

Function

How recursion works?

```
x = fact(3);

int fact(int n)
{
    if (n <= 1)
        return 1;
    else
        return n * fact(n - 1);
}
```

fact(3) finds that 3 is not less than or equal to 1, and it calls fact(2)
fact(2) finds that 2 is not less than or equal to 1, and it calls fact(1)
fact(1) finds that 1 is less than or equal to 1, and it returns 1,
causing fact(2) to return $2 \times 1 = 2$, and
causing fact(3) to return $3 \times 2 = 6$