

LAB 11: USER-DEFINED FUNCTION

OBJECTIVES FOR STUDENTS

1. Modularize a program system and pass information between systems modules or functions.
[*Memodulkan sistem aturcara dan menghantar maklumat antara modul sistem atau fungsi.*]
2. Differentiate between passing data by value and passing data by reference.
[*Membezakan antara penghantaran data secara nilai dan penghantaran data secara rujukan.*]
3. Return function results through a function's arguments.
[*Memulangkan hasil fungsi menerusi argumen fungsi.*]

ASSUMPTIONS

1. Students should have the knowledge of the predefined functions.
[*Pelajar sepatutnya mempunyai pengetahuan dalam fungsi takrifan piawai.*]
2. Students should have the knowledge of the previous lesson.
[*Pelajar sepatutnya mempunyai pengetahuan daripada pelajaran sebelum ini.*]

LAB EXERCISES

EXERCISE 1:

[*LATIHAN 1*]

1. Given the following program in Program 11.1.
[*Diberikan aturcara berikut dalam Program 11.1.*]

```
1 //Program 11.1
2 #include <stdio.h>
3 #include <conio.h>
4
5 void func1(); void func2();
6
7 int main(){
8     int input;
9
10    printf ("Enter a number >");
11    scanf ("%d", &input);
```

```

12
13     if (input < 10) {
14         printf("Faculty of Computer Science & Info.
Systems\n");
15         printf("  Universiti Teknologi Malaysia\n");
16     } else {
17         printf("  Universiti Teknologi Malaysia\n");
18         printf("Faculty of Computer Science & Info.
Systems\n");
19     }
20     getch(); return 0;
21 }

```

- i. Understand the code in program 11.1 and run the program.
[Fahamkan aturcara tersebut dan laksanakan.]
- ii. Change the code so that it follows the design of the structured chart as in Figure 11.1.
[Tukarkan aturcara tersebut supaya ia mematuhi reka bentuk carta berstruktur seperti Rajah 11.1]

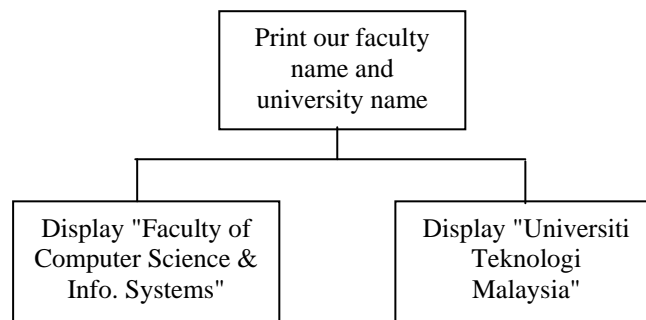


Figure 11.1: Structure chart for a simple print problem

2. Refer to problem in Lab 8, Exercise 8. The program must use 4 functions: the greeting, input, calculation, and output.
[Rujuk kepada masalah pada Lab 8 Latihan 8. Aturcara hendaklah menggunakan 4 fungsi: pamer selamat datang, baca input dari pengguna, pengiraan jumlah liter, dan output.]

EXERCISE 2:

[LATIHAN 2]

1. Given Program 11.2 which consists of a void function. Compile and identify the output of the program. State the name of function call, function header and function declaration in the program.
[Diberi Program 11.2 yang mengandungi fungsi tanpa parameter. Kompil dan kenal pasti output bagi aturcara tersebut. Nyatakan nama fungsi, kepala fungsi dan pengisytiharan fungsi bagi aturcara tersebut.]

```

1 //Program 11.2 - void function example
2 #include <stdio.h>
3 #include <conio.h>
4
5 void printmessage ();
6
7 int main ()
8 {
9     printmessage ();
10    getch();return 0;
11 }
12
13 void printmessage ()
14 {
15     printf ("I'm a function!");
16 }

```

2. Given Program 11.3 which consists of a function that is passing data by value. Compile and identify the output of the program. State the name of function call, function header and function declaration in the program.

[Diberi Program 11.3 yang menghantar data secara nilai. Kompil dan kenal pasti output bagi aturcara tersebut. Nyatakan nama fungsi, kepala fungsi dan pengisytiharan fungsi bagi aturcara tersebut.]

```

1 //Program 11.3
2 #include <stdio.h>
3 #include <conio.h>
4
5 int subtraction (int, int);
6
7 int main ()
8 {
9     int x=5, y=3, z;
10    z = subtraction (7,2);
11    printf ("The first result is %d\n", z);
12    printf ("The second result is %d\n",
13    subtraction(7,2));
14    printf ("The third result is %d\n",
15    subtraction(x,y));
16    z= 4 + subtraction (x,y);
17    printf ("The fourth result is %d\n", z);
18    getch();return 0;
19 }
20
21 int subtraction (int a, int b)
22 {
23     int r;
24     r=a-b;
25     return (r);
26 }

```

3. Given Program 11.4 which consists of a function that is passing data by reference. Compile and identify the output of the program. State the name of function call, function header and function declaration in the program.

[Diberi Program 11.4 yang menghantar data secara rujukan. Kompil dan kenal pasti output bagi aturcara tersebut. Nyatakan nama fungsi, kepala fungsi dan pengisytiharan fungsi bagi aturcara tersebut.]

```
1 //Program 11.4
2 #include <stdio.h>
3 #include <conio.h>
4
5 void duplicate (int &a, int &b, int &c)
6 {
7     a*=2;
8     b*=2;
9     c*=2;
10 }
11
12 int main ()
13 {
14     int x=1, y=3, z=7;
15     duplicate (x, y, z);
16     printf ("x=%d, y=%d, z=%d", x, y, z);
17     getch();return 0;
18 }
```

4. Given Program 11.5 which consists of a function that is returning more than one value. Compile and identify the output of the program. State the name of function call, function header and function declaration in the program.

[Diberi Program 11.5 yang mengembalikan lebih dari satu nilai. Kompil dan kenal pasti output bagi aturcara tersebut. Nyatakan nama fungsi, kepala fungsi dan pengisytiharan fungsi bagi aturcara tersebut.]

```
1 //Program 11.5
2 #include <stdio.h>
3 #include <conio.h>
4
5 void prevnext (int x, int *prev, int *next);
6
7 int main ()
8 {
9     int x=100, y, z;
10    prevnext (x, &y, &z);
11    printf ("Previous=%d, Next=%d", y, z);
12    getch();return 0;
13 }
14 void prevnext (int x, int *prev, int *next)
15 {
16     *prev = x-1;
17     *next = x+1;
18 }
```

5. Given Program 11.6 which consist of fixed value in a function. Compile and identify the output of the program. State the name of function call, function header and function declaration in the program.

[Diberi Program 11.6 yang mempunyai nilai tetap dalam fungsi. Kompil dan kenal pasti output bagi aturcara tersebut. Nyatakan nama fungsi, kepala fungsi dan pengisytiharan fungsi bagi aturcara tersebut.]

```

1 //Program 11.6
2 #include <stdio.h>
3 #include <conio.h>
4
5 int divide (int a, int b=2);
6
7 int main ()
8 {
9     printf ("20/default-value is: %d", divide (12));
10    printf ("\n");
11    printf ("20/4 is: %d", divide (20,4));
12    getch();return 0;
13 }
14
15 int divide (int a, int b)
16 {
17     int r;
18     r=a/b;
19     return (r);
20 }
```

6. Given Program 11.7 which consists of inline function. Compile and identify the output of the program. State the name of function call, function header and function declaration in the program.

[Diberi Program 11.7 yang terdiri daripada fungsi dalam baris. Kompil dan kenal pasti output bagi aturcara tersebut. Nyatakan nama fungsi, kepala fungsi dan pengisytiharan fungsi bagi aturcara tersebut.]

```

1 //Program 11.7
2 inline float cube (const float a) {return a*a*a;}
3
4 int main ( ){
5     float side;
6     printf ("Enter the side length of your cube:  ");
7
8     scanf ("%f", &side);
9     printf ("Volume of cube with side %f is %f\n",
10    side, cube(side));
11    return 0;
12 }
```

EXERCISE 3:

[LATIHAN 3]

1. Download Program 11.9. This program is demonstrates scoping issues with global variables and local variables.

[Muat turun Program 11.9. Aturcara ini menunjukkan isu skop pembolehubah global dan pembolehubah setempat.]

```
1 //Program 11.9
2 #include <stdio.h>
3 #include <conio.h>
4
5 void a(void);
6 void b(void);
7
8 int x = 1;
9 int linenum = 0;
10
11 int main( ){
12     int x = 5;
13
14     linenum++;
15     printf ("%dx = %d\n", linenum, x);
16     {
17         int x = 7;
18
19         linenum++;
20         printf ("%dx = %d\n", linenum, x);
21     }
22     linenum++;
23     printf ("%dx = %d\n", linenum, x);
24
25     a(); b();
26
27     linenum++;
28     printf ("%dx = %d\n", linenum, x);
29     getch(); return 0;
30 }
31
32 void a(void){
33     int x = 25;
34
35     linenum++;
36     printf ("%dx = %d\n", linenum, x);
37 }
38
39 void b(void){
40     linenum++;
41     printf ("%dx = %d\n", linenum, x);
42 }
```

- i. Compile and identify the output of the program.
[*Kompil dan kenalpasti output aturcara tersebut.*]
 - ii. Identify which variable x that is being printed for each line of the output.
[*Kenalpasti pembolehubah x manakah yang dicetak untuk setiap baris output.*]
2. Download Program 11.10. This program is demonstrates scoping issues with static variables and local variables.
[*Muat turun Program 11.10. Aturcara ini menunjukkan isu skop pembolehubah statik, pembolehubah setempat dan pembolehubah global.*]

```

1 //Program 11.10
2 #include <stdio.h>
3 #include <conio.h>
4
5 void shownum(); // Function prototype
6
7 int main()
8 {
9     for (int count = 0; count < 5; count++)
10         shownum();
11     getch(); return 0;
12 }
13
14 void shownum()
15 {
16     static int num=5;
17     int num2=10;
18
19     printf ("num is %d\n", num);
20     printf ("num2 is %d\n", num2);
21     num++; num2++;
22 }

```

- i. Compile and identify the output of the program.
[*Kompil dan dapatkan output aturcara tersebut.*]
- ii. What are the difference between static variable and local variable?
[*Apakah perbezaan antara skop pembolehubah statik dan pembolehubah setempat?*]
- iii. What are the differences between static variable and global variable?
[*Apakah perbezaan antara skop pembolehubah statik dan pembolehubah global?*]

EXERCISE 4:**[LATIHAN 4]**

1. Given Program 11.11 that reads three integer numbers and find the maximum number among the three. Complete the program by writing a function named `maximum`, that finds the largest of the three numbers.

[Diberikan Program 11.11 yang membaca tiga nombor integer dan mencari nombor maksimum daripada ketiga-tiga nombor tersebut. Lengkapi aturcara tersebut dengan menulis fungsi untuk mencari nombor terbesar di antara ketiga-tiga nombor.]

```
1 //Program 11.11
2 #include <stdio.h>
3 #include <conio.h>
4
5 int maximum(int,int,int);
6
7 int main()
8 {
9     int a, b, c ;
10
11     printf ("Enter Three Integers: ");
12     scanf ("%d %d %d", &a, &b, &c);
13     printf ("Maximum is: %d\n", maximum(a,b,c));
14
15     getch(); return 0;
16 }
```

2. Given Program 11.12 that reads an integer number and determines whether the number is even or odd. Complete the program by writing a function named `is_even`, that prints "yes" if the number is even, or prints "no", otherwise.

[Diberikan Program 11.12 yang membaca satu nombor integer dan menentukan sama ada nombor itu adalah genap atau ganjil. Lengkapi aturcara tersebut dengan menulis fungsi bernama `is_even`, yang mencetak "yes" sekiranya nombor adalah genap atau mencetak "no" jika sebaliknya.]

```
1 //Program 11.12
2 #include <stdio.h>
3 #include <conio.h>
4
5 void is_even(int a); // Function Prototype
6
7 int main(void)
8 {
9     int a;
10    printf ("Enter an integer:\n");
11    scanf ("%d", &a);
12    printf ("Is %d even?", a);
13    is_even(a);
14    printf ("\n");
15    getch();
16    return 0;
17 }
```


3. Given Program 11.13 that reads the distance in miles and hours, calculates and prints miles per hour. Complete the program by writing the function prototype named `GetData` (at line 5), writing the code that invoke the function `GetData` (at line 13), and writing the body of the function `GetData` that reads miles and hours (at line 23).

[Diberikan Program 11.13 yang membaca jarak dalam unit batu serta jam, mengira dan mencetak batu sejam. Lengkapi aturcara tersebut dengan menulis prototaip fungsi bernama `GetData` (pada baris 5), menulis kod yang memanggil fungsi `GetData` (pada baris 13), dan menulis badan fungsi `GetData` yang membaca batu dan jam (pada baris 23).]

```
1 //Program 11.13
2 #include <stdio.h>
3 #include <conio.h>
4
5 /* Write the function(s) prototype for GetData */
6
7 int main ()
8 {
9     float miles;
10    float hours;
11    float milesPerHour;
12
13 /* Write the code(s) to invoke function GetData */
14
15    milesPerHour = miles / hours;
16    printf ("%10f %10f %10f\n", miles, hours,
17 milesPerHour);
18
19    getch();
20    return 0;
21 }
22
23 /* Write the body of the function(s) GetData that
24 read miles and hours */
```

4. Given Program 11.14 that has a function named `average`, which finds the average of given numbers. Complete the program by writing the function prototype named `average` (at line 5 and 6) that sends 3 parameters, writing the code that invoke the function `average` (at line 15 and 16), and writing the body of the overloaded function `average` that finds the average of three numbers (at line 22).

[Diberikan Program 11.14 yang mempunyai fungsi sarat bernama `average`, yang mendapatkan purata bagi nombor yang diberi. Lengkapi aturcara tersebut dengan menulis prototaip fungsi bernama `average` (pada baris 5 dan 6), menulis kod yang memanggil fungsi `average` (pada baris 15 dan 16) dengan menghantar 3 parameter, dan menulis badan fungsi sarat `average` yang mendapatkan purata bagi tiga nombor (pada baris 22).]

```
1 //Program 11.14
2 #include<stdio.h>
3 #include<conio.h>
4
5 /* Write the function prototype for the function
6 average that sends 3 parameters */
7
8 int main()
9 {
10     int number_A = 5, number_B = 3, number_C = 10;
11
12     printf ("The integer average of %d and %d and %d
13 is\n", number_A, number_B, number_C);
14
15 /* Write the code that invoke the function average
16 with 3 parameters */
17
18     getch();
19     return 0;
20 }
21
22 // write the body of the function average
```

EXERCISE 5:**[LATIHAN 5]**

1. Write a complete program that consists of 4 user-defined functions as listed below, to solve the problem as designed in the flow chart in Figure 11.2. You need to draw a structured chart design before writing the program.

[Tuliskan satu aturcara lengkap yang mengandungi 4 fungsi seperti yang disenaraikan di bawah, untuk menyelesaikan masalah seperti yang direkabentuk pada carta alir di Rajah 11.2. Anda perlu melukis satu reka bentuk carta berstruktur sebelum menulis aturcara tersebut.]

- i. `int getCoin()`
To read the value of a coin input from the user.
[Untuk membaca satu nilai duit siling yang diinput oleh pengguna.]
- ii. `void calculateCoin(int & totalCoin, int coin)`
To calculate the total coins entered by the user and display the total amount.
[Untuk mengira jumlah siling yang dimasukkan oleh pengguna dan mencetak jumlah keseluruhannya.]
- iii. `int calculateBalance(int totalcoin)`
To compute the balance of the coin and display the balance amount.
[Untuk mengira baki duit siling dan mencetak jumlah bakinya.]
- iv. `int main()`
To solve the problem by calling the appropriate function based on the following designed flow chart at Figure 11.2.
[Untuk menyelesaikan masalah dengan memanggil fungsi-fungsi yang bersesuaian berdasarkan reka bentuk carta alir pada Rajah 11.2.]

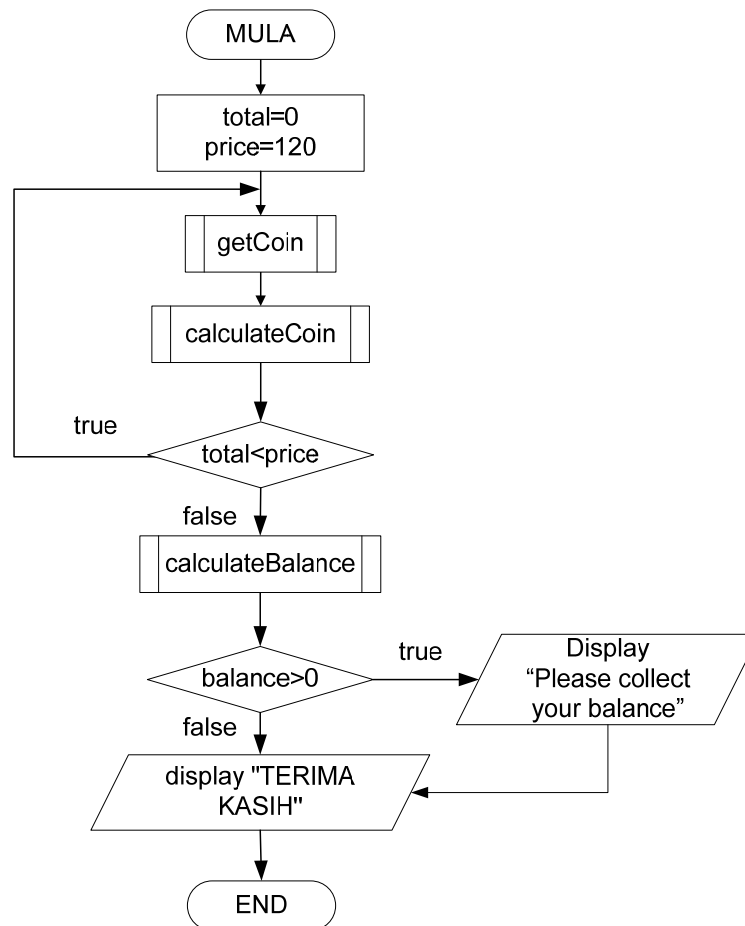


Figure 11.2

EXERCISE 6:
[LATIHAN 6]

1. Write a program that reads a student's name together with his or her assessment marks. The program should then compute the total mark for each student and assign the appropriate grade. In order to compute the total mark, the distribution of marks is tabulated in Table 11.1, while the grade scale is tabulated in Table 11.2. Your program must use the following functions:
[Tuliskan satu aturcara yang membaca nama pelajar dan markah-markah penilaian pelajar tersebut. Aturcara ini perlu mengira jumlah markah bagi setiap pelajar dan memberi gred yang bersesuaian kepadanya. Untuk mengira jumlah markah Jadual 11.1 menunjukkan pembahagian markah, manakala skala gred dijadualkan di Jadual 11.2. Aturcara anda perlu menggunakan fungsi-fungsi berikut.]
 - i. A value-returning function named, `calculateTotal`, that determine the total mark for each student based on the mark distribution in Table 11.1. The function should not display the output of the total mark. That task must be done in the function main.
[Fungsi yang memulangkan satu nilai bernama, `calculateTotal`, yang menentukan jumlah markah untuk setiap pelajar berdasarkan pembahagian markah di Jadual 11.1. Fungsi ini tidak perlu mencetak

output bagi jumlah markah yang dihasilkan. Tugas ini perlu dilakukan dalam fungsi utama.]

- ii. A void function named, `assignGrade`, that determine and return each student's grade. The function should not display the output of the total mark. That task must be done in the function main.

[Fungsi void bernama, assignGrade, yang menentukan dan memulangkan gred untuk setiap pelajar. Fungsi ini tidak perlu mencetak output bagi jumlah markah yang dihasilkan. Tugas ini perlu dilakukan dalam fungsi utama.]

Table 11.1: Assessment Items

Assessments	Percentage (%)
Test 1	20
Assignments	30
Quiz	10
Lab works	10
Final Exam	30
Total	100

Table 11.2: Grade Scale

Assessments	Percentage (%)
A+	90-100
A	80-89
A-	75-79
B+	70-74
B	65-69
B-	60-64
C+	55-59
C	50-54
C-	45-49
D+	40-44
D	35-39
D-	30-34
E	00-29

- iii. Test your program on the following data. Read the data from a text file and send the output to another text file. Do not use global variables. Use the appropriate parameters to pass values in and out of functions.

[Uji aturcara anda dengan data berikut. Baca data dari fail teks dan hantar output ke fail teks yang lain. Jangan menggunakan pembolehubah global. Sila gunakan parameter yang bersesuaian untuk menghantar nilai ke dalam atau keluar dari fungsi.]

Hasyimah	85	90	88	79	90
Rahim 77	80	65	76	60	
Syadhila	79	88	68	79	85
Nurfarhana	81	84	84	82	85
Nurliyana	55	68	69	75	80
Ooi 88	82	88	81	86	
Ping 60	85	45	39	45	
Quah 85	67	50	75	67	
Sham 80	84	89	93	95	
Sien 32	45	86	78	65	
Selan 40	57	60	57	67	
Susan 89	79	88	81	80	
Tan 46	58	69	79	82	

Sample Output:

[Contoh Output:]

STUDENT	Test 1	Assignments	Quiz	Lab works	Final Exam	Total Mark	Grade
Hasyimah	85	90	88	79	90	87.7	A
Rahim	77	80	65	76	60	71.5	B+
Syadhila	79	88	68	79	85	82.4	A
Nurfarhana	81	84	84	82	85	83.5	A
Nurliyana	55	68	69	75	80	69.8	B
Ooi	88	82	88	81	86	84.9	A
Ping	60	85	45	39	45	59.4	C+
Quah	85	67	50	75	67	69.7	B
Sham	80	84	89	93	95	87.9	A
Sien	32	45	86	78	65	55.8	C+
Selan	40	57	60	57	67	56.9	C+
Susan	89	79	88	81	80	82.4	A
Tan	46	58	69	79	82	66.0	B