Computer Programming
Bachelor in Biomedical Engineering
Bachelor in Applied Mathematics and Computing
Course 2020 / 2021

Exercise Sheet 4 - SOLUTIONS

Iteration Statements: For
Conditional Statements: Switch

Content Table

Exercise 1

Write a program that asks the user to introduce a number and calculates the factorial of that number.

Example of execution:

```
Introduce a number: 4
The factorial of 4 is 24
```

SOLUTION

```
clear;
num = input('Introduce a number: ');
fact = 1;
for i = 1:num
    fact = fact * i;
end
fprintf('The factorial of %d is %d\n', num, fact);
```

Exercise 2

Write a program that asks the user to introduce 10 numbers and prints the sum of all of them.

Example of execution:

```
Introduce a number: 4
Introduce a number: 2
Introduce a number: 7
Introduce a number: 5
Introduce a number: 3
Introduce a number: 9
Introduce a number: 1
Introduce a number: 6
Introduce a number: 2
Introduce a number: 2
The total is 41
```

SOLUTION

```
clear;
total = 0;
for num = 1:10
    value = input('Introduce a number: ');
    total = total + value;
end
fprintf('\n The total is %d\n', total);
```

Exercise 3

Write a program that computes the squares and cubes of the numbers from 0 to 10. The output should look like this:

```
Number Square Cube

0     0     0
1     1     1
2     4     8
3     9     27
4     16    64
5     25    125
6     36    216
7     49    343
8     64    512
9     81    729
10    100   1000
```

SOLUTION

```
clear;
fprintf('Number\tSquare\tCube');
for num = 0:10
    fprintf('\n%d\t%d\t%d',num,num^2,num^3);
end
```

Exercise 4

Write a program to help the user fill a vector. The program asks the size of the vector and then it asks to introduce its elements. Finally, it displays the content of the vector.

Example of execution:

```
Introduce the length of the vector: 3
Introduce a number: 1
Introduce a number: 6
Introduce a number: 2
You have introduced a vector with the following values:
1 6 2
```

SOLUTION

```
clear;
vectsize = input('Introduce the length of the vector: ');
vect = zeros(1,vectsize);
for i = 1:vectsize
```

```
  vect(i) = input('Introduce a number: ');
end
disp('You have introduced a vector with the following values: ');
for i = vect
  fprintf('%d ',i);
end
```

OR

```
for i = 1:vectsize
  fprintf('%d ',vect(i));
end
```

Exercise 5

Modify the previous program so that the content of the vector is displayed in reverse order.

Example of execution:

```
Introduce the length of the vector: 3
Introduce a number: 9
Introduce a number: 7
Introduce a number: 2
You have introduced a vector with the following values:
2 7 9
```

SOLUTION

```
clear;
vectsize = input('Introduce the length of the vector: ');
vect = zeros(1,vectsize);
for i = 1:vectsize
  vect(i) = input('Introduce a number: ');
end
disp('You have introduced a vector with the following values: ');
for i = vectsize:-1:1
  fprintf('%d ',vect(i));
end
```

OR

```
for i = vect(vectsize:-1:1)
  fprintf('%d ',i);
end
```

Exercise 6

Write a program that counts the number of occurrences of a number in a vector. First the program asks the user to introduce the size of the vector, and then it asks to introduce as many numbers as necessary to fill it. Next, the program asks the user to introduce a given number and returns how many times that number appears in the vector.

Example of execution:

```
Introduce the length of the vector: 5
Introduce a number: 4
Introduce a number: 2
Introduce a number: 4
Introduce a number: 4
Introduce a number: 3
Introduce the number to find: 4
The number 4 appears 3 times
```

SOLUTION

```
clear;
vectsize = input('Introduce the length of the vector: ');
vect = zeros(1,vectsize);
for i = 1:vectsize
  vect(i) = input('Introduce an element: ');
end
numberVal = input('Introduce the number to find: ');
timesFound = 0;
for j = 1:vectsize
    if vect(j) == numberVal
        timesFound = timesFound + 1;
    end
end
fprintf('The number %d appears %d times\n', numberVal, timesFound);
```

Exercise 7

Write a program that allows the user to fill a vector with numbers. Next, it asks him/her to choose between displaying the maximum or minimum number in the vector and prints the result. Solve this exercise without using the functions min or max.

Example of execution:

```
Introduce the length of the vector: 4
Introduce a number: 4
Introduce a number: 7
Introduce a number: 8
```

```
Introduce a number: 4
Do you want to display the minimum(m) or the maximum(x)? m
The minimum value is 4
```

SOLUTION

```
clear;
vectsize = input('Introduce the length of the vector: ');
vect = zeros(1,vectsize);
for i = 1:vectsize
  vect(i) = input('Introduce a number: ');
end
op = input('Do you want to display the minimum(m) or the maximum(x)?',
's');
result = vect(1);
for j = vect
    switch op
        case 'm'
            if j < result
                result = j;
            end
        case 'x'
            if j > result
                result = j;
            end
    end
end
if op == 'm'
    fprintf('The minimum value is %d', result);
else
    fprintf('The maximum value is %d', result);
end
```

Exercise 8

Write a program that finds all the factors of a number.

Example of execution:

```
Introduce a number: 60
The factors of 60 are 1 2 3 4 5 6 10 12 15 20 30 60
```

SOLUTION

```
num = input('Introduce a number: ');
fprintf('The factors of %d are ', num);
for i = 1:num/2
      if(rem(num,i)==0)
        fprintf('%d ', i);
      end
end
fprintf('%d ', num);
```

Exercise 9

Write a program that asks the user to introduce the size of a vector and numbers to fill it. Next, it asks the user to introduce two values: a minimum and a maximum. The program creates a new vector containing the elements of the first vector within that range, and prints them on screen.

Example of execution:

```
Introduce the length of the vector: 5
Introduce a number: 2
Introduce a number: 10
Introduce a number: 7
Introduce a number: 3
Introduce a number: 8
Introduce the minimum value: 5
Introduce the maximum value: 9
The values in the final vector are:
7
8
```

SOLUTION

```
clear;
vectsize = input('Introduce the length of the vector: ');
vect = zeros(1,vectsize);
for i = 1:vectsize
  vect(i) = input('Introduce a number: ');
end

minimum = input('Introduce the minimum value: ');
maximum = input('Introduce the maximum value: ');
count   = 0;
vectout = [];
disp('The values in the final vector are:')
for j = 1:length(vect)
    if ((vect(j) > minimum) && (vect(j) < maximum))
        count = count + 1;
        vectout(count) = vect(j);
        fprintf('%d\n', vectout(count));
    end
end
```

ANOTHER SOLUTION

```
clear;
vectsize = input('Introduce the length of the vector: ');
vect = zeros(1,vectsize);
for i = 1:vectsize
  vect(i) = input('Introduce a number: ');
end
```

```
minimum = input('Introduce the minimum value: ');
maximum = input('Introduce the maximum value: ');
vectout = [];
for j = 1:length(vect)
    if((vect(j) > minimum) && (vect(j) < maximum))
        vectout = [vectout vect(j)]; % This concatenates vect(j) to
vectout
    end
end
disp('The values in the final vector are');
fprintf('%d\n', vectout);
```

Exercise 10

Write a program designed to help young learners practice the multiplication tables. The program asks the learner to introduce a number and the results of multiplying it by the numbers from 1 to 10. The program checks the user's answers, and displays the correct result when they are wrong. At the end it also prints the learner's total score in the exercise (number of correct responses).

Example of execution:

```
Introduce a number from 1 to 10: 4
Introduce the result of multiplying 4 by 1: 4
Correct
Introduce the result of multiplying 4 by 2: 8
Correct
Introduce the result of multiplying 4 by 3: 5
Wrong. The answer is 12
Introduce the result of multiplying 4 by 4: 15
Wrong. The answer is 16
Introduce the result of multiplying 4 by 5: 20
Correct
Introduce the result of multiplying 4 by 6: 24
Correct
Introduce the result of multiplying 4 by 7: 38
Wrong. The answer is 28
Introduce the result of multiplying 4 by 8: 32
Correct
Introduce the result of multiplying 4 by 9: 36
Correct
Introduce the result of multiplying 4 by 10: 40
Correct
Your score is 7
```

SOLUTION

```
clear;
number = input ('Introduce a number from 1 to 10: ');
total = 0;
for i = 1:10
  fprintf('\nIntroduce the result of multiplying %d by %d: ', number,
i);
  response = input('');
  rdo = number * i;
  if(response == rdo)
      fprintf('Correct');
      total = total + 1;
  else
      fprintf('Wrong. The answer is %d', rdo);
  end
end
fprintf('\nYour score is %d\n', total);
```

Exercise 11

Write a program that asks the user to introduce a number *n* and fills a vector with the *n* first Fibonacci numbers.
Remember: The first two numbers in the Fibonacci sequence are 0 and 1, and each subsequent number is the sum of the previous two.

Example of execution:

```
Introduce the size of the vector: 10
The numbers in the vector are:
0 1 1 2 3 5 8 13 21 34
```

SOLUTION

```
clear;
n = input('Introduce the size of the vector: ');
vect = zeros(1,n);
if n >= 1
    vect(1) = 0;
end
if n >= 2
    vect(2) = 1;
end
for i = 3:n
    vect(i) = vect(i-2) + vect(i-1);
end
disp('The vector contains the following numbers:');
for num = vect
    fprintf(' %d ',num);
end
```

More Exercises to solve with Switch and conditionals

Exercise 12

Write a program that asks the user to introduce a day, month, and year, and tells the user the date of the next day. We will assume the date introduced by the user is always correct. Leaps years are not considered (February will always has 28 days) and the year will always be positive.

Example of execution

```
Introduce the day: 31
Introduce the month: 12
Introduce the year: 1992
The new date is 1-1-1993
```

SOLUTION

```
clear;
day   = input('Introduce the day: ');
month = input('Introduce the month: ');
year  = input('Introduce the year: ');

switch month
        case 2
            if (day == 28)
                newday   = 1;
                newmonth = month + 1;
                newyear  = year;
            else
                newday   = day + 1;
                newmonth = month;
                newyear  = year;
            end
        case {4, 6, 9, 11}
            if (day == 30)
                newday   = 1;
                newmonth = month + 1;
                newyear  = year;
            else
                newday   = day + 1;
                newmonth = month;
                newyear  = year;
            end
        case {1, 3, 5, 7, 8, 10}
            if (day == 31)
                newday   = 1;
                newmonth = month + 1;
                newyear  = year;
            else
                newday   = day + 1;
                newmonth = month;
                newyear  = year;
            end
```

```
        case 12
            if (day == 31)
                newday   = 1;
                newmonth = month + 1;
                newyear  = year + 1;
            else
                newday   = day +1;
                newmonth = month;
                newyear  = year;
            end
end

fprintf('The new date is %d-%d-%d\n',newday, newmonth, newyear);
```

Exercise 13

Write a program that allows the user to compute the price of an insurance policy taking into consideration the following:

- When computing the car insurance quote, we have to know whether the driver is male or female (male (m), female (f)), time passed since the last checkup (in years), car type: big (b), regular (r), small (s).
- Discounts are applicable according to several conditions:
  - If the car is small and the time passed since the last checkup is at least 5 years: 15% discount; if less than 5 years: 10%.
  - If the car is regular and the driver female: 16% discount; if the driver is male and time passed since the last checkup is less than 3 years: 17%; if the driver is male and time passed since the last checkup is more than 3 years: 10%.
  - If the car is big and time passed since the last checkup is at least 7 years: 20%; if time is less and the driver is female: 10%; if the driver is male 8%.
- Basic insurance fares are:
  - Small car: 645$.
  - Regular car: 860$
  - Big car: 1290$

SOLUTION

```
clear;
driver  = input ('Introduce the sex of the driver(f/m): ','s');
time    = input ('Introduce the number of years since the last
checkup: ');
typecar = input ('Introduce the type of car (b/r/s): ','s');
dto     = 0;
smallFare   = 645;
regularFare = 860;
bigFare     = 1290;
fare = 0;
switch typecar
    case 's'
```

```
        fare = smallFare;
        if (time >= 5)
            dto = 15;
        else
            dto = 10;
        end
    case 'r'
        fare = regularFare;
        if (driver == 'f')
            dto = 16;
        elseif (time <= 3)
            dto = 17;
        else
            dto = 10;
        end
    case 'b'
        fare = bigFare;
        if (time >= 7)
            dto = 20;
        elseif (driver == 'f')
            dto = 10;
        else
            dto = 8;
        end
end
totalfare = fare - fare*dto/100;
fprintf('The fare of the insurance is %5.2f\n', totalfare);
```