Computer Programming
Bachelor in Biomedical Engineering
Bachelor in Applied Mathematics and Computing

Course 2020 / 2021

Exercise Sheet – Preparing Midterm Exam 1

Content Table

Exercise 1

Write a program that helps primary school students learn how to multiply. The program generates two random numbers between 0 and 9, asks the student to multiply them and inform him/her if the answer is correct. The program will ask the user if he/she wants to repeat the exercise.
Note: the formula 10*rand() will produce a random number between 0 and 9 with decimals.

Example of execution:

Introduce the result of multiplying 4 by 0: 0
Correct answer!
Do you want to try again? (Y/N) Y
Introduce the result of multiplying 3 by 1: 3
Correct answer!
Do you want to try again? (Y/N) Y
Introduce the result of multiplying 7 by 3: 22
Wrong answer.
The right answer was 21.
Do you want to try again? (Y/N) N

```
clear;
varMore = 'Y';
while (varMore == 'Y')
    varA = floor(rand*10);
    varB = floor(rand*10);
    rdo = varA * varB;
    fprintf('Introduce the result of multiplying %d by %d: ',varA, varB);
    userRdo = input('');
    if rdo == userRdo
        disp('Correct Answer!');
    else
        fprintf('Wrong answer.\nThe right answer was: %d\n', rdo);
    end
    varMore = input('Do you want to try again? (Y/N) ','s');
end
```

Exercise 2

Modify the program in order to inform the user how many consecutive correct answers he/she has achieved.

Example of execution:

Introduce the result of multiplying 4 by 0: 0
Correct answer!
1 correct answers!
Do you want to try again? (Y/N) Y
Introduce the result of multiplying 3 by 1: 3
Correct answer!
2 correct answers!
Do you want to try again? (Y/N) Y

Introduce the result of multiplying 3 by 2: 6
Correct answer!
3 correct answers!
Do you want to try again? (Y/N) Y
Introduce the result of multiplying 7 by 3: 22
Wrong answer.
The right answer was 21.
Do you want to try again? (Y/N) Y
Introduce the result of multiplying 2 by 2: 4
Correct answer!
1 correct answers!
Do you want to try again? (Y/N) N

```
clear;
varMore = 'Y';
answer = 0;
while (varMore == 'Y')
    varA = floor(rand*10);
    varB = floor(rand*10);
    rdo = varA * varB;
    fprintf('Introduce the result of multiplying %d by %d: ',varA, varB);
    userRdo = input('');
    if rdo == userRdo
        disp('Correct Answer!');
        answer = answer + 1;
        fprintf('%d correct answers!\n', answer);
    else
        fprintf('Wrong answer.\nThe right answer was: %d\n', rdo);
        answer = 0;
    end
    varMore = input('Do you want to try again? (Y/N) ','s');
end
```

Exercise 3

Write a program to play the game of Nim against the computer. The game starts with 20 coins. The player removes 1, 2 or 3 coins. Then the computer can remove 1 to 3 coins. The game continues like this until no coins are left. The ones who removed the last coin loses.
Note: The program should generate a random number to determine the number of coins the computer removes at each turn. To generate a random value between 1 and N you can use *randi(N)*

Example of execution:

There are 20 coins left ooooooooooooooooooooo How
many coins do you want to remove? 3
You removed 3
I am removing 2
There are 15 coins left oooooooooooooooo
How many coins do you want to remove? 5
There are 15 coins left and you can remove a maximum of 3 How
many coins do you want to remove? 2
You removed 2
I am removing 3

There are 10 coins left ooooooooooo
How many coins do you want to remove? 3
You removed 3
I am removing 3
There are 4 coins left oooo
How many coins do you want to remove? 3
You removed 3
I am removing 1
I lose!

```
clear;
bEnd = 0;
coins = 20;
while (bEnd == 0)
    fprintf('There are %d coins left ', coins);
    for i=1:coins
        fprintf('o');
    end
    fprintf('\n');
    user = input('How many coins do you want to remove? ');
    while (user > coins) || (user <= 0) || (user > 3)
        fprintf('There are %d coins left and you can remove a maximun of
3\n', coins);
        user = input('How many coins do you want to remove? ');
    end
    coins = coins - user;
    fprintf('You removed %d\n', user);
    if (coins == 0)
        disp('You lose!');
        bEnd = 1;
    else
        if coins > 3
            maxcoins = 3;
        else
            maxcoins = coins;
        end
        computer = randi(maxcoins);
        coins = coins - computer;
        fprintf('I am removing %d\n', computer);
        if (coins == 0)
            disp('I lose!');
            bEnd = 1;
        end
    end
end
```

Exercise 4

Write a program that, given a vector of numbers A, prints the most
repeated number in the vector on screen.

Note:
- You can consider that there are no numbers in the vector that are
  repeated the same number of times.
- You cannot use the MATLAB function *sort*

```
clear;
% insert random vector, e.g. A = [2 1 3 4 5 6 2 3 2];
result = -1;
maxcount = 0;
for i=1:length(A)
    count = 0;
    for j=1:length(A)
        if A(i) == A(j)
            count = count +1;
        end
    end
    if count > maxcount
        maxcount = count;
        result = A(i);
    end
end
fprintf('The most repeated number is %d\n', result);
```

Exercise 5

Write a program that, given a vector of numbers A, prints the total number of pairs of numbers (numbers that appears twice) in the vector on screen.

```
clear;
% insert random vector, e.g. A = [2 2 3 3 5 6 4 4 7];
result = 0;
for i=1:length(A)
    count = 0;
    for j=1:length(A)
        if A(i) == A(j)
            count = count +1;
        end
    end
    if count == 2
        result = result +1;
    end
end

result = result / 2;
fprintf('%d\n', result);
```

Exercise 6

Write a program that asks the user to introduce which snack they want to eat for each day of the week. They can choose between healthy (apple, orange) or unhealthy (brownie, candy) snacks. The program will display whether the user chose a healthy or unhealthy snack. If the user makes an invalid choice, the program will display an error message and they lose their snack for that day. At the end, the program will display the average number of healthy and unhealthy snacks. Furthermore, if the user ate less than 3 healthy snacks per week, the program will display a message saying the user should eat more healthy snacks (otherwise, the program displays a message saying the user eats enough healthy snacks).

Example of execution:

Available snacks:
(a)pple (healthy)
(b)rownie (unhealthy)
(o)range (healthy)
(c)andy (unhealthy)
Day 1
Which snack would you like to eat? a
You have chosen to eat a healthy snack.
Day 2
Which snack would you like to eat? b
You have chosen to eat an unhealthy snack.
Day 3
Which snack would you like to eat? o
You have chosen to eat a healthy snack.
Day 4
Which snack would you like to eat? b
You have chosen to eat an unhealthy snack.
Day 5
Which snack would you like to eat? t
Sorry, this snack is not available.
Day 6
Which snack would you like to eat? b
You have chosen to eat an unhealthy snack.
Day 7
Which snack would you like to eat? c
You have chosen to eat an unhealthy snack.
You have eaten 2 healthy and 4 unhealthy snacks this week.
You should eat more healthy snacks.

```
clear;
disp('Available snacks:');
disp('(a)pple (healthy)');
disp('(b)rownie (unhealthy)');
disp('(o)range (healthy)');
disp('(c)andy (unhealthy)');
healthy = 0;
unhealthy = 0;
for n_days = 1:7
    fprintf('Day %d\n', n_days)
    snack = input('Which snack would you like to eat? ', 's');
    switch snack
        case {'a', 'o'}
            disp('You have chosen to eat a healthy snack.');
            healthy = healthy + 1;
        case {'b', 'c'}
            disp('You have chosen to eat an unhealthy snack.');
            unhealthy = unhealthy + 1;
        otherwise
            disp('Sorry, this snack is not available.');
    end
end
fprintf('You have eaten %d healthy and %d unhealthy snacks this week.\n',
healthy, unhealthy);
if (healthy < 3)
    disp('You should eat more healthy snacks.');
else
    disp('You eat enough healthy snacks.');
end
```

Exercise 7

Write a program that asks the user to introduce the temperature for 7 days straight. If a temperate is introduced that is higher than the average temperature so far (including the present day) plus 2 degrees, the user gets a message that it was an exceptionally warm day. At the end, the temperature for each day is displayed, as well as the number of exceptionally warm days.

Example of execution:

Day 1
Introduce the temperature: 10
Day 2
Introduce the temperature: 13
Day 3
Introduce the temperature: 14
Day 4
Introduce the temperature: 14
Day 5
Introduce the temperature: 15
Day 6
Introduce the temperature: 16
It was exceptionally warm today.
Day 7
Introduce the temperature: 16
Temperature day 1: 10
Temperature day 2: 13
Temperature day 3: 13
Temperature day 4: 14
Temperature day 5: 15
Temperature day 6: 16
Temperature day 7: 16
There was/were 1 exceptionally warm day(s).

```
clear;
temp = zeros(1,7);
counter = 0;
sumtemp = 0;
avgtemp = 0;
for i = 1:7
    fprintf('Day %d\n', i);
    temp(i) = input('Introduce the temperature: ');
    sumtemp = sumtemp + temp(i);
    avgtemp = sumtemp / i;
    if(temp(i) > (avgtemp + 2))
        counter = counter + 1;
        disp('It was exceptionally warm today.');
    end
end
for i = 1:7
    fprintf('\n Temperature day %d : %d', i, temp(i));
end
fprintf('\n There was/were %d exceptionally warm day(s).', counter);
```

Exercise 8

Write a program that asks the user to indicate whether they watched TV that day (for 7 days) and – if yes – input the number of hours they watched TV. The day limit is set to 3 hours, and the week limit to 7 x 3 hours = 21 hours. If the user watched more than 3 hours on a certain day, they get a message that they watched too much TV for that day. The user also gets a message with the remaining hours they have left for the week. If the user did not watch TV that day, they get a bonus of 3 hours added to their remaining hours. At the end, if the remaining number of hours is larger than 0, they get a message saying that they don't watch too much TV. Otherwise, they get a message that they do. Finally, the number of days that they watched too much TV (over 3 hours) is displayed.

Example of execution:


```
Day 1
Did you watch TV today (Y/N)? Y
How many hours of TV did you watch? 2
The remaining hours for this week is equal to 19.
Day 2
Did you watch TV today (Y/N)? Y
How many hours of TV did you watch? 4
You watched too much TV today.
The remaining hours for this week is equal to 15.
Day 3
Did you watch TV today (Y/N)? Y
How many hours of TV did you watch? 1
The remaining hours for this week is equal to 14.
Day 4
Did you watch TV today (Y/N)? N
You get a bonus of 3 hours.
The remaining hours for this week is equal to 17.
Day 5
Did you watch TV today (Y/N)? Y
How many hours of TV did you watch? 5
You watched too much TV today.
The remaining hours for this week is equal to 12.
Day 6
Did you watch TV today (Y/N)? Y
How many hours of TV did you watch? 3
The remaining hours for this week is equal to 9.
Day 7
Did you watch TV today (Y/N)? Y
How many hours of TV did you watch? 2
The remaining hours for this week is equal to 7.
You do not watch too much TV.
On 2 day(s) you watched more than 3 hours of TV.
```

```
clear;
%vector = [];
counter = 0;
remhours = 21;
for i = 1:7
    tv = input('Did you watch TV today (Y/N)? ', 's');
```

```
    if(tv == 'Y')
        hours = input('How many hours of TV did you watch? ');
        %vector(i) = hours;
        if (hours > 3)
            disp ('You watched too much TV today');
            counter = counter + 1;
        end
        remhours = remhours - hours;
    else
        remhours = remhours + 3;
        disp('You get a bonus of 3 hours.')
    end
    fprintf('The remaining hours for this week is equal to %d.\n',
remhours);
end
if (remhours > 0)
    disp('You do not watch too much TV.');
else
    disp('You watch too much TV.');
end
fprintf('On %d day(s) you watched more than 3 hours of TV.\n', counter);
```

Exercise 9

Write a program that helps the user check which hotels in a given city satisfy certain criteria. First, the program asks the user to introduce the limits of his/her budget (minimum and maximum price), if he/she will go with a pet, and watches HBO. Next, it asks the number of hotels he/she wants to check, and asks for their characteristics. This includes: hotel name, price, pet allowed and HBO included. The program assigns to each hotel a number (id) that corresponds to its order of introduction. Finally, the program prints a list with the ids of the hotels introduced that satisfy the criteria initially specified.

Example of execution:

Introduce the minimum price: 10
Introduce the maximun price: 100
Do you bring a pet with you (Y/N)?: N
Do you watch HBO (Y/N)?: Y
How many hotels do you want to check?: 4

Hotel Nº 1
Introduce hotel name: TRIP
Introduce hotel price: 80
Pet friendly (Y/N)?: Y
HBO included (Y/N)?: Y

Hotel Nº 2
Introduce hotel name: AIRS
Introduce hotel price: 120
Pet friendly (Y/N)?: Y
HBO included (Y/N)?: N

Hotel Nº 3
Introduce hotel name: RIA

Introduce hotel price: 12
Pet friendly (Y/N)?: N
HBO included (Y/N)?: Y

Hotel Nº 4
Introduce hotel name: YMA
Introduce hotel price: 200
Pet friendly (Y/N)?: Y
HBO included (Y/N)?: Y

The ids of the hotels that satisfy your criteria is/are:
1 3

```
clear;
minbudget = input('Introduce the minimum price: ');
maxbudget = input('Introduce the maximun price: ');
pet = input('Do you bring a pet with you (Y/N)?: ', 's');
hbo = input('Do you watch hbo (Y/N)?: ', 's');
number = input ('How many hotels do you want to check?: ');
vhotels = [];
cont = 0;
for i=1:number
    fprintf('\nHotel N° %d\n',i);
    name = input('Introduce hotel name: ','s');
    price = input('Introduce hotel price: ');
    petfriendly = input('Pet friendly (Y/N)?: ','s');
    hboinc = input('HBO included (Y/N)?: ','s');
    if ((price <= maxbudget) && (price >= minbudget)) && ((pet == 'N') ||
(petfriendly == 'Y'))  && ((hbo == 'N') || (hboinc == 'Y'))
        cont = cont + 1;
        vhotels(cont) = i;
    end
end
disp ('The ids of the hotels that satisfy your criteria is/are: ');
for i=1:length(vhotels)
    fprintf('%d ', vhotels(i));
end
```

Exercise 10

Write a program that counts the votes in the next election. There are only three parties: A, B, and C. The program asks for a number of votes and then asks them to introduce them one by one. If the user introduces something different to A, B, or C the vote is considered invalid. At the end, the program displays which party wins. In the case of a tie, the program just displays that there is a tie (no need to say between which parties).

Example of execution:

Introduce the number of votes: 6
Introduce   the   vote: A
Introduce   the   vote: A
Introduce   the   vote: B
Introduce   the   vote: A
Introduce   the   vote: C

Introduce   the   vote: E
Results
Number of invalid votes: 1
Votes: A A B A C E
Party A wins

Another example of execution:

Introduce the number of votes: 5
Introduce   the   vote: B
Introduce   the   vote: B
Introduce   the   vote: A
Introduce   the   vote: C
Introduce   the   vote: C
Results
Number of invalid votes: 0
Votes: B B A C C
There is a tie


```
clear;
contA = 0;
contB = 0;
contC = 0;
invalid = 0;
numvotes = input('Introduce the number of votes ');
vvotes  = [];
for i=1:numvotes
    vote = input('Introduce the vote: ','s');
    vvotes(i) = vote;
    switch vote
        case 'A'
            contA = contA + 1;
        case 'B'
            contB = contB + 1;
        case 'C'
            contC = contC + 1;
        otherwise
            invalid = invalid + 1;
    end
end
disp('Results');
fprintf('Number of invalid votes: %d\n', invalid);
for i=1:numvotes
    fprintf('%c ', vvotes(i));
end
fprintf('\n');
if (contA > contB) && (contA > contC)
    disp('Party A wins');
elseif (contB > contC) && (contB > contA)
    disp('Party B wins');
elseif (contC > contA) && (contC > contB)
    disp('Party C wins');
else
    disp('There is a tie');
end
```

Exercise 11

A hotel has three types of rooms: **studio (S)**, **double (D)** and **suite (U)**. The prices are different for the different months:

June and September	July and August	Rest of the year
Studio - **60** € per night	Studio - **68** € per night	Studio - **50** € per night
Double - **72** € per night	Double - **77** € per night	Double - **65** € per night
Suite - **82** € per night	Suite - **89** € per night	Suite - **75** € per night

Write a program that asks the user to introduce bookings (type of room, number of nights, and number of month) and displays the amount that will be charged. Beforehand, the program asks the user how many bookings he/she wants to introduce in the system. At the end, the program displays the total amount of euros charged.

Note: If the user introduces wrong information (i.e. wrong month or wrong type of room) the program displays and error message and ignores that booking.

Example of execution:

How many bookings do you want to introduce? 4

Introduce the number of the month: 1

Introduce the type of room (S/D/U): S

Introduce the number of nights: 1

The amount to pay is 50.00

Introduce the number of the month: 7
Introduce the type of room (S/D/U): U
Introduce the number of nights: 2
The amount to pay is 178.00

Introduce the number of the month: 14
Introduce the type of room (S/D/U): O
Introduce the number of nights: 1
Wrong data

Introduce the number of the month: 9

Introduce the type of room (S/D/U) U

Introduce the number of nights: 4
The amount to pay is 328.00

The total amount charged is 556

```
clear;
total = 0;
number  = input('Introduce the number of bookings: ');
for i = 1:number
    month  = input('Introduce the number of the month: ');
    room   = input('Introduce the type of room: (S/D/U) ','s');
    nigths = input('Introduce of nigths: ');
    if (room ~= 'S' && room ~= 'D' && room ~= 'U') || (month < 1) || (month
> 12)
        disp('Wrong data');
    else
        if (month == 6) || (month == 9)
            switch room
                case 'S'
                    price = 60;
                case 'D'
                    price = 72;
                case 'U'
                    price = 82;
            end
        elseif (month == 7) || (month == 8)
            switch room
                case 'S'
                    price = 68;
                case 'D'
                    price = 77;
                case 'U'
                    price = 89;
            end
        else
            switch room
                case 'S'
                    price = 50;
                case 'D'
                    price = 65;
                case 'U'
                    price = 75;
            end
        end
        bill = price * nigths;
        fprintf('The amount to pay is %.2f\n', bill);
        total = total + bill;
    end
end
fprintf ('The total is %.2f\n', total);
```