3TP3 LAB ONE

McMaster University

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Question 1

Since the purpose of question 1 is to plot some unit step functions and unit impulse functions listed, it is required to create two functions for the unit step function and, u [], and the unit impulse function, δ []. The functions of the unit step function and, u [], and the unit impulse function are shown below.

Unit step function

```matlab
1   function y = unitstep(x)
2   % The unit step function, u(x), with u(0) = 1.
3
4       if (nargin ~= 1)
5           disp('unit step requires 1 argument!');
6           return
7       end
8
9       y = cast(x >= 0, class(x));
10
```

Unit impulse function

```matlab
1   function y = unitimpulse(x)
2   % The unit impulse function, delta(x)
3
4       if (nargin ~= 1)
5           disp('unit step requires 1 argument!');
6           return
7       end
8
9   y = cast(x == 0, class(x));
```

After we defined the functions of the unit step function and the unit impulse function in our own .m files, we can use them to define specific discrete time signals. Hence, we can just add each terms together by using some math calculation symbols of MATLAB code. The code is shown below.

```matlab
1       %%Question 1
2       %Use MATLAB to stem plot the following discrete time signals
3       %Our range is from -10 to 10
4
5  -    clc;
6  -    clear;
7  -    n = -10:10;
8
9       % 1a) x[n] = u[n] -2u[n-1] + u[n-4]
10 -    question1a = unitstep(n) - 2*unitstep(n-1) + unitstep(n-4)
11 -    question1a;
12
13      % 1b) x[n] = (n+2)u[n+2] -2u[n] -nu[n-4]
14 -    question1b = (n+2).*unitstep(n+2) - 2*unitstep(n) - n.*unitstep(n-4);
15 -    question1b;
16
17      % 1c) x[n] = δ[n+1] - δ[n] + u[n+1] -u[n-2]
18 -    question1c = unitimpulse(n+1) - unitimpulse(n) + unitstep(n+1) - unitstep(n-2);
19 -    question1c;
20
21      % 1d) x[n] = (e^(0.8n))u[n+1] + u[n]
22 -    question1d = (exp(0.8*n)).*unitstep(n+1) + unitstep(n);
23 -    question1d;
24
```
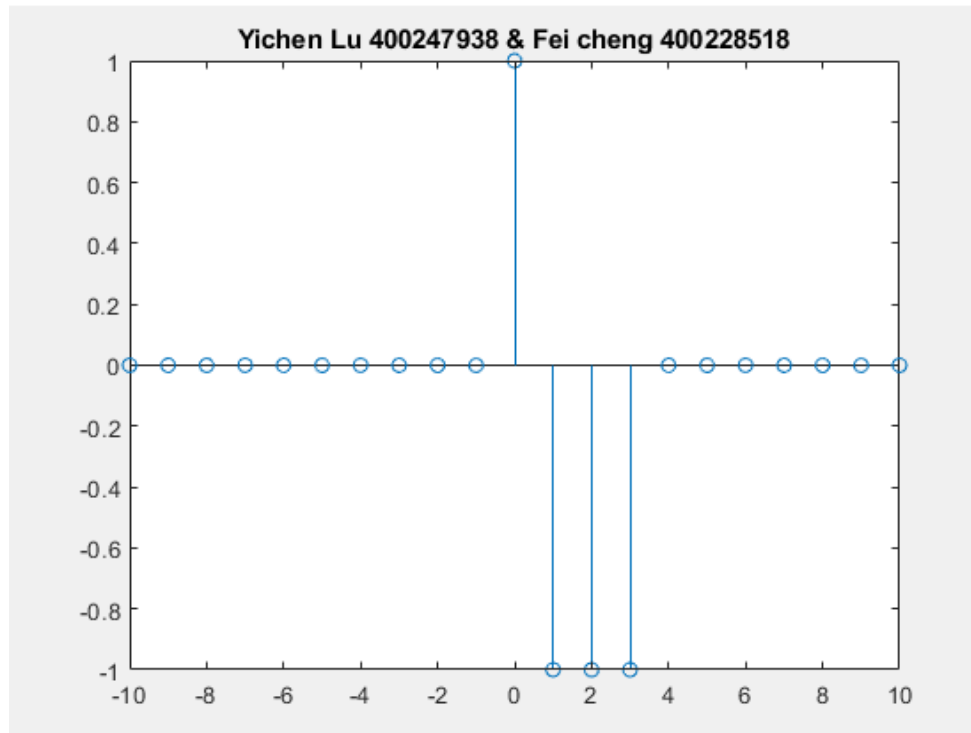
The defined discrete time signals can be plotted by the stem function in MATLAB. In addition, we add a title for each graph generated.

```matlab
25 -    stem(n,question1a)
26      %%stem(n,question1b);
27      %%stem(n,question1c);
28      %%stem(n,question1d);
29 -    title('Yichen Lu 400247938 & Fei cheng 400228518')
30
31
32
```
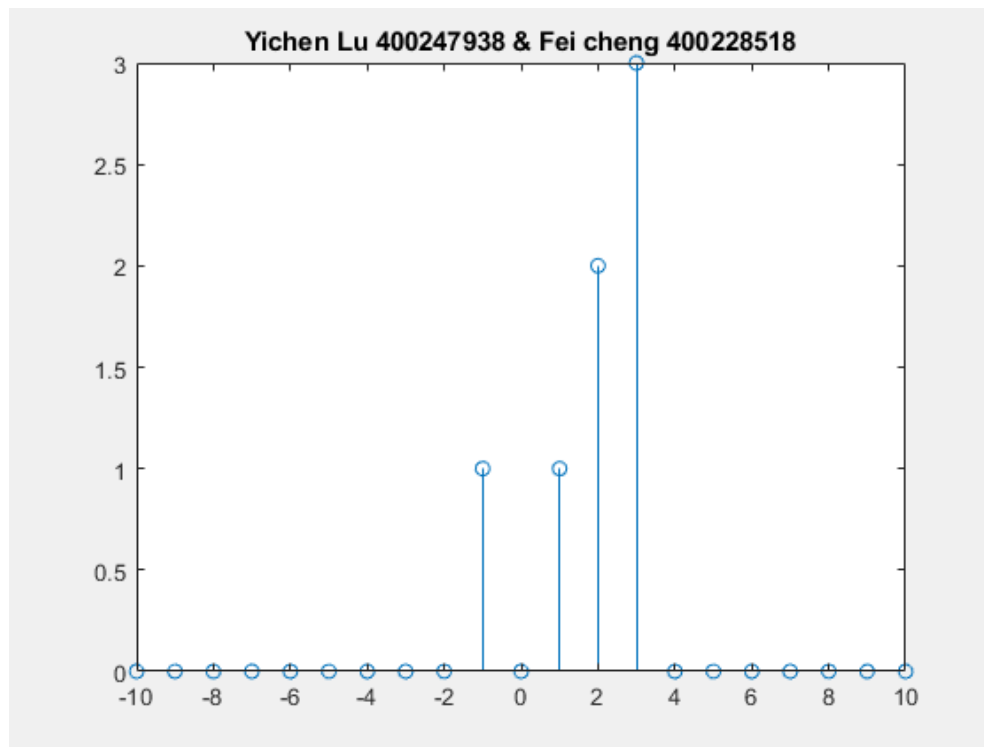
Figure Question 1a

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Figure Question 1b

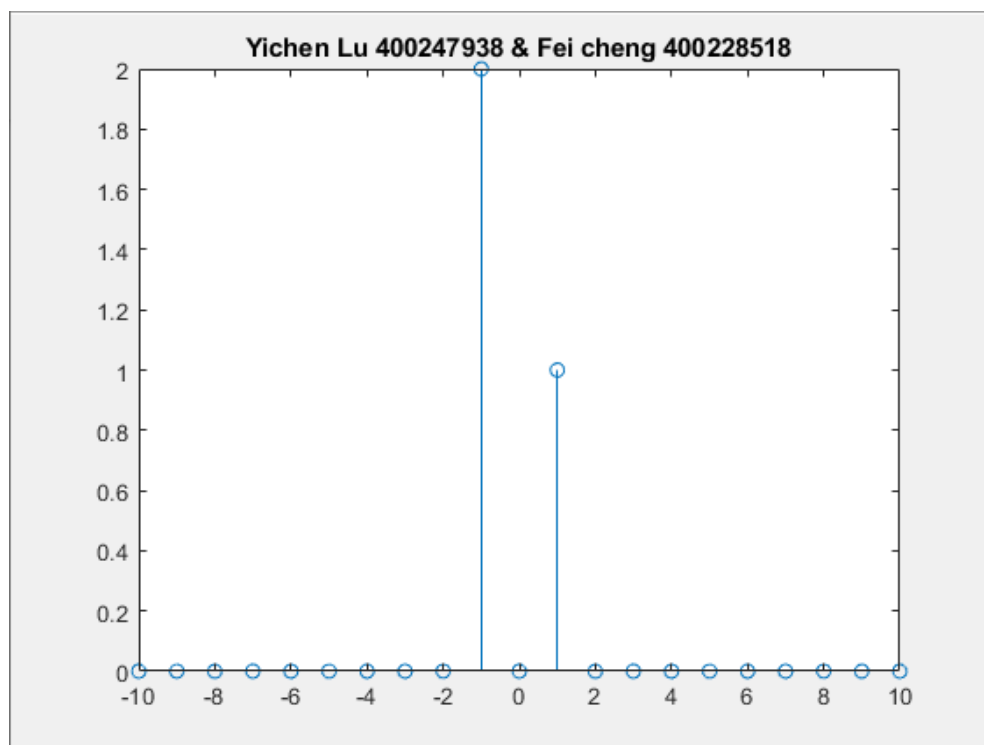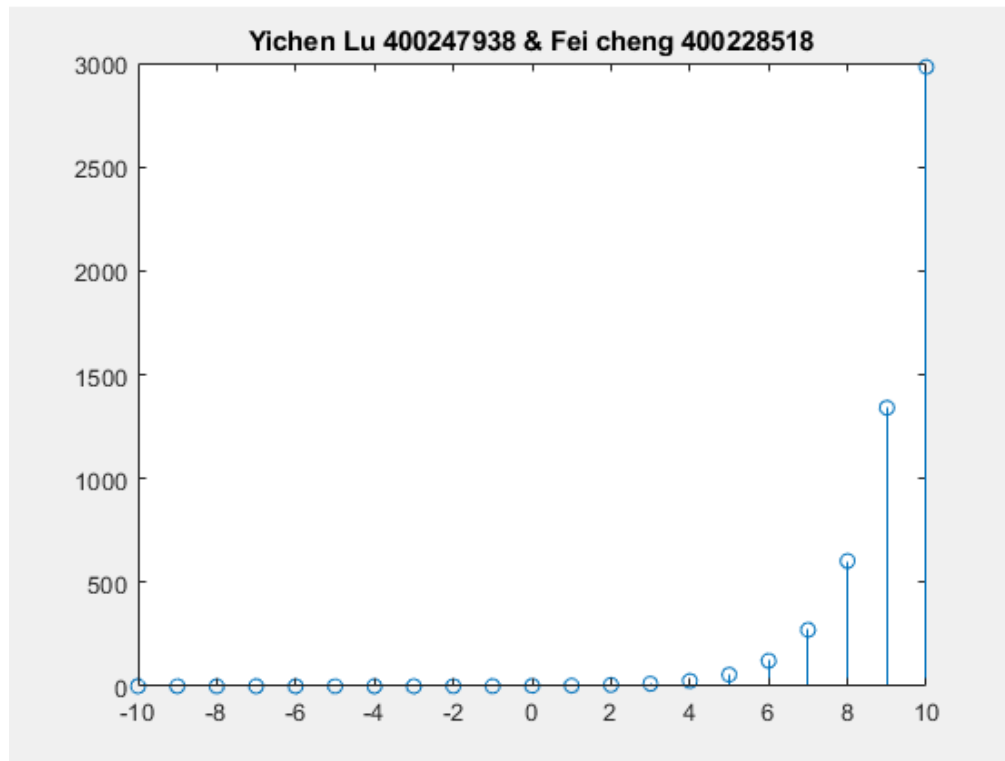**Figure Question 1c**

Figure Question 1d

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Question 2

2a

First, we used three functions in MATLAB, which are detectImportOptions, setvartype and readtable. The purpose of detectImportOptions is to detect the file that we will import and use. And then, the purpose of setvartype is to record the 'ID_Number' and 'Name' as string type in MATLAB. Afterwards, it is necessary to read the excel file into MATLAB by using the function of readtable.

Secondly, we used two for loops to calculate the lab grades for each student and compare the lab grades with the originally recorded highest lab grades – 'max'. If the new lab grade is higher, the max would record it and the 'name' would record the row number. When the two loops finish, 'max' would contain the highest lab grades and 'name' would record the row number.

Finally, we just need to output table {name,1} that is the cell of the table and max as the results, which are the name and total lab mark of the person who obtained the highest mark respectively.

The code for 2a

```matlab
1 -     clc;
2 -     clear;
3 -     opts = detectImportOptions('course_grades_2021.xlsx');
4 -     opts = setvartype(opts, {'ID_Number', 'Name'}, 'string');
5 -     table = readtable('course_grades_2021.xlsx', opts);
6
7 -     max = 0;
8
9 -     for i = 2:21
10 -        sum = 0;
11 -        for j = 3:6
12 -            sum = sum + table{i,j};
13 -        end
14 -        if (sum > max)
15 -            max = sum;
16 -            name = i;
17 -        end
18 -    end
19
20 -    Name = table{name,1}
21 -    TotalLabMark = max
22
```

The output for 2a

```
Name =

    "Zander Kendall"


TotalLabMark =

    27
```

2b

First, we used three functions in MATLAB, which are detectImportOptions, setvartype and readtable. The purpose of detectImportOptions is to detect the file that we will import and use. And then, the purpose of setvartype is to record the 'ID_Number' and 'Name' as string type in MATLAB. Afterwards, it is necessary to read the excel file into MATLAB by using the function of readtable.

Secondly, we used two for loops to calculate the Exam grades for each student and compare the Exam grades with the originally recorded highest Exam grades – 'max'. If the new Exam grade is higher, the max would record it and the 'name' would record the row number. When the two loops finish, 'max' would contain the highest Exam grades and 'name' would record the row number.

Finally, we just need to output table {name,1} that is the cell of the table and max as the results, which are the name and total exam mark of the person who obtained the highest mark respectively.

The code for 2b

```matlab
1 -     clc;
2 -     clear;
3 -     opts = detectImportOptions('course_grades_2021.xlsx');
4 -     opts = setvartype(opts, {'ID_Number', 'Name'}, 'string');
5 -     table = readtable('course_grades_2021.xlsx', opts);
6
7 -     max = 0;
8
9 -     for i = 2:21
10 -         sum = 0;
11 -         for j = 8:11
12 -             sum = sum + table{i,j};
13 -         end
14 -         if (sum > max)
15 -             max = sum;
16 -             name = i;
17 -         end
18 -     end
19
20 -     Name = table{name,1}
21 -     TotalExamMark = max
22
```

The output for 2b

```
Name =

    "Anthony Bernard"


TotalExamMark =

    37
```
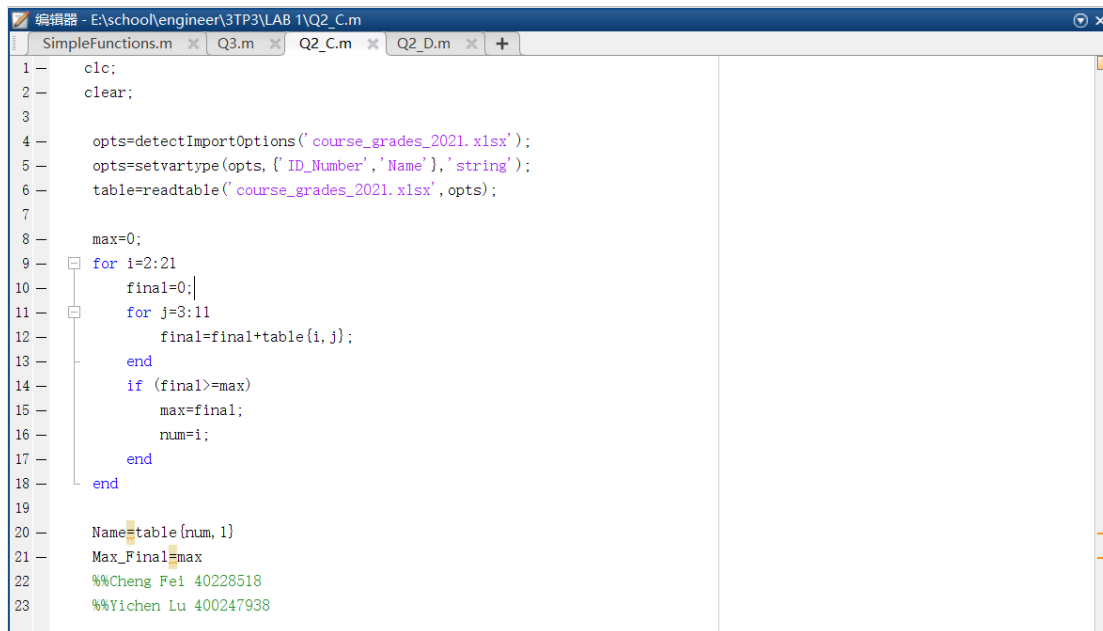
2c

First, we used three functions in MATLAB, which are detectImportOptions, setvartype and readtable. The purpose of detectImportOptions is to detect the file that we will import and use. And then, the purpose of setvartype is to record the 'ID_Number' and 'Name' as string type in MATLAB. Afterwards, it is necessary to read the excel file into MATLAB by using the function of readtable.

Secondly, we used two for loops to calculate the final grades for each student and compare the final grades with the originally recorded highest final grades – 'max'. If the new final grade is higher, the max would record it and the 'num' would record the row number. When the two loops finish, 'max' would contain the highest final grades and 'num' would record the row number.
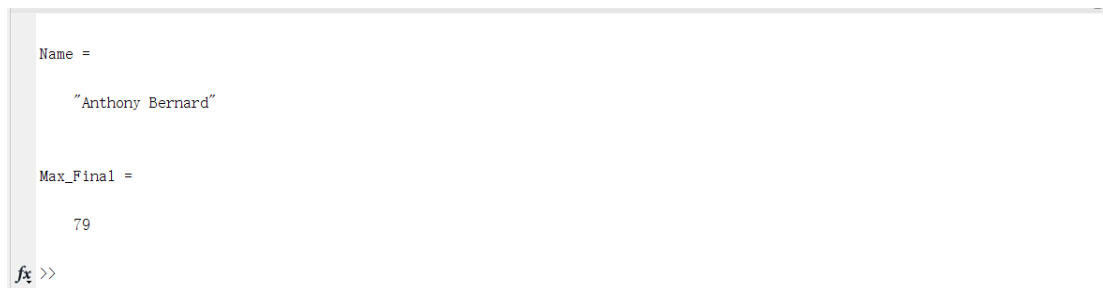
Finally, we just need to output table {num,1} that is the cell of the table and max as the results, which are the name and total final mark of the person who obtained the highest mark respectively.

The code for 2c

```
1    clc;
2    clear;
3
4    opts=detectImportOptions('course_grades_2021.xlsx');
5    opts=setvartype(opts, {'ID_Number','Name'},'string');
6    table=readtable('course_grades_2021.xlsx',opts);
7
8    max=0;
9    for i=2:21
10       final=0;
11       for j=3:11
12           final=final+table{i,j};
13       end
14       if (final>=max)
15           max=final;
16           num=i;
17       end
18   end
19
20   Name=table{num,1}
21   Max_Final=max
22   %%Cheng Fei 40228518
23   %%Yichen Lu 400247938
```

The output for 2c

```
Name =

    "Anthony Bernard"


Max_Final =

    79

fx >>
```

2d.

First, we used three functions in MATLAB, which are detectImportOptions, setvartype and readtable. The purpose of detectImportOptions is to detect the file that we will import and use. And then, the purpose of setvartype is to record the 'ID_Number' and 'Name' as string type in MATLAB. Afterwards, it is necessary to read the excel file into MATLAB by using the function of readtable.

At last, we create two new cells which contains the two students' information, then we create a new matrix with the two new cells and the original table and output the matrix.

The code for 2d

```
编辑器 - E:\school\engineer\3TP3\LAB 1\Q2_D.m                                    ⊗ ×
SimpleFunctions.m  ×  Q3.m  ×  Q2_C.m  ×  Q2_D.m  ×  +
1 —    clc;
2 —    clear;
3
4 —    opts=detectImportOptions('course_grades_2021.xlsx');
5 —    opts=setvartype(opts, {'ID_Number','Name'},'string');
6 —    table=readtable('course_grades_2021.xlsx',opts);
7
8 —    Cheng={'Cheng Fei','400228518',10,10,10,10,20,10,10,10,10};
9 —    Yichen={'Yichen Lu','400247938',10,10,10,10,20,10,10,10,10};
10 —   newtable=[table;Cheng;Yichen]
```

The output for 2d

Name	ID_Number	Lab_1	Lab_2	Lab_3	Lab_4	Midterm	Exam_1	Exam_2	Exam_3	Exam_4
"Maximum Mark"	"0"	10	10	10	10	20	10	10	10	10
"Kacie Stephenson"	"1803933"	3	9	9	0	7	4	5	8	10
"Yassin Jordan"	"1884159"	9	2	10	3	8	3	9	5	7
"Lowri Mathews"	"1853847"	9	0	0	2	17	6	10	7	4
"Tiya Sheridan"	"1810192"	10	1	0	6	15	8	7	6	6
"Nikola Forrest"	"1891352"	4	7	0	6	5	0	5	5	10
"Veer Blair"	"1811313"	4	8	5	3	12	7	4	0	2
"Isabelle Mcgrath"	"1804841"	1	7	4	0	13	8	9	6	0
"Samir Greaves"	"1881925"	6	3	7	1	6	4	6	5	9
"Zander Kendall"	"1877711"	8	10	5	4	17	4	8	10	2
"Shahzaib Buckley"	"1830894"	4	5	7	9	8	5	7	0	6
"Morgan Bush"	"1855191"	1	6	7	10	1	5	7	2	8
"Amaan Robbins"	"1821012"	2	8	4	4	8	0	9	5	8
"Theodore Lawson"	"1844339"	0	7	10	7	14	9	2	2	9
"Ace Branch"	"1898468"	10	1	3	7	11	9	9	3	6
"Anthony Bernard"	"1883633"	4	1	10	8	19	10	9	9	9
"Tobey Bell"	"1808742"	2	10	8	2	10	9	0	8	6
"Jannat Cassidy"	"1863450"	5	2	4	5	10	4	5	9	3
"Imran Marquez"	"1830190"	9	9	1	6	17	10	0	7	5
"Amani Castro"	"1835544"	5	9	5	7	3	7	6	8	4
"Blanka Holt"	"1820930"	9	5	2	0	8	6	0	7	10
"Cheng Fei"	"400228518"	10	10	10	10	20	10	10	10	10
"Yichen Lu"	"400247938"	10	10	10	10	20	10	10	10	10

Question Three

The original image:

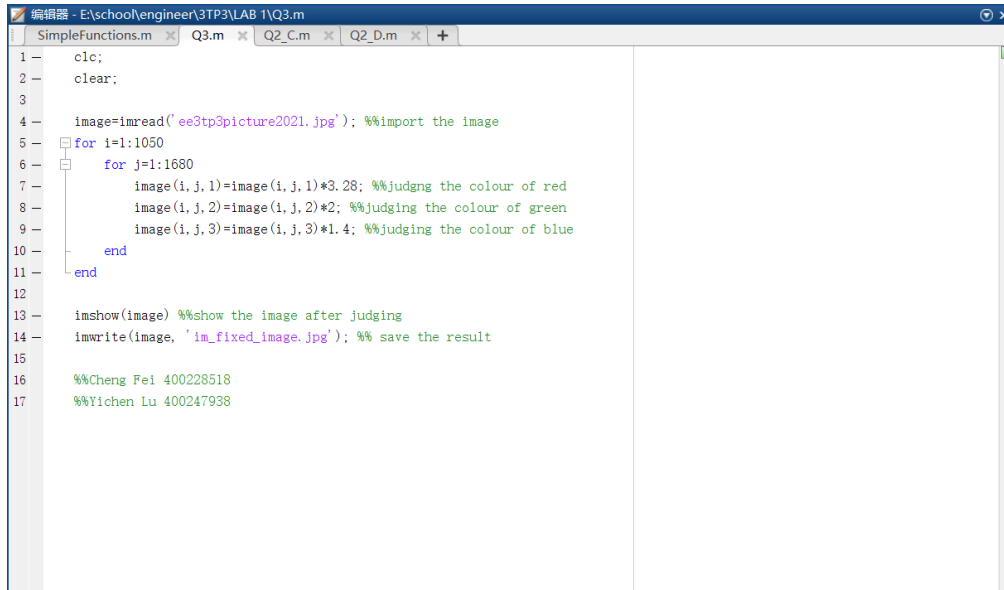**The image after image processing:**

First, we used the function of imread in MATLAB to import the image that we want to image process. And then, we use two loops to image process every pixel's color. After changing, we export the output and the save it as a jpg file.

The screenshot of the code:


```matlab
clc;
clear;

image=imread('ee3tp3picture2021.jpg'); %%import the image
for i=1:1050
    for j=1:1680
        image(i,j,1)=image(i,j,1)*3.28; %%judgng the colour of red
        image(i,j,2)=image(i,j,2)*2; %%judging the colour of green
        image(i,j,3)=image(i,j,3)*1.4; %%judging the colour of blue
    end
end

imshow(image) %%show the image after judging
imwrite(image, 'im_fixed_image.jpg'); %% save the result

%%Cheng Fei 400228518
%%Yichen Lu 400247938
```