Problem 1:

Write a program that calculates the factorial of a positive integer, factorial of zero is one. If the user entered a negative number, the program should print an error message and ask the user to reinter the number. After displaying the result, the program should ask the user if he wishes to calculate the factorial of another number or he wants to terminate the program. (**Don't** use MATLAB built in factorial function)

Example

Enter a positive integer: 5

Factorial of 5 is 120
Do you want another calculation (y/n)? y

Enter a positive integer: -3
Error! Enter a positive integer: -7
Error! Enter a positive integer: 3

Factorial of 3 is 6
Do you want another calculation (y/n)? y

Enter a positive integer: 6

Factorial of 6 is 720
Do you want another calculation (y/n)? n

Thank you! Program has been terminated.

```
% Solution for Problem 1
%Written by Youssouf Salah Eldeen
clc
clear % clear command window and workspace
a='y'; %intialize a to be 'yes' to enter the following loop
while a=='y'
%intialize fac with 1 to be the variable of summing the factorial
fac=1;
%intialize N to be the integer for which the factorial is to be
%calculated (N=-1 to enter the following loop)
    N=-1;
%while loop to iterate prompting the user till they enter a valid positive
number
    while N<0
%prompt for the user to enter an integer
        N=input('Enter a positive integer: ');
        if N<0
%Error statement in case negative number is entered
            fprintf('Error! ')
        end
    end
% return (new empty line) to match the formatting required
    fprintf('\n')
    for i=1:N %for loop to calculate the factorial of N
        fac=fac*i;
    end
%output the result in the desired format
    fprintf('Factorial of %d is %d\n',N,fac)
%prompt the user for another calculation
    a=input('Do you want another calculation (y/n)?','s');
%return (new empty line) to match the formatting required
    fprintf('\n')
end
fprintf('Thank you! Program has been terminated.\n')
```

Problem 2:

Write a program that prompts the user to enter the height of water in a cuboid tank with a square base, base length of the tank and the water flow rate. Calculate how long it takes for the tank to be empty. Print a table showing the day and the height of water in each day.

Example

Input:
Enter the start height (m): 6
Enter water flow rate (m^3/day): 8
Enter base length (m): 2
Output:
Day Height

0	6
1	4
2	2
3	0

The tank becomes empty after 3 days

N.B.

- Input and output MUST be printed exactly as the above example.

```
%program to calculate how long to empty the tank
clc
clear
%prompt the user to enter the start height of the water
h=input('Enter the start height (m): ');
%prompt the user to enter the water flow rate
v=input('Enter water flow rate (m^3/day): ');
%prompt the user to enter the length base
len=input('Enter base length (m): ');
%initialize day by 0 (represent the number of days
needed)
day=0;
%area of the tank base
a=len^2;

fprintf('Day Height\n');
```

```
%initalize hn with the start height value
hn=h;
%loop till the water height becomes zero (till the tank
becomes empty)
while hn>=0
    %to print the value of each day's height
    fprintf('%2d %5.0f\n',day,hn);
    %increment the value of day by 1
    day=day+1;
    %calculate the value of new height by subtract the
start height
    % by the value decreased after a certain days
    hn=h-v*day/a;

end
%print how long it takes for the tank to be empty
fprintf('The tank becomes empty after %d days',day-1);
```

Problem 3:

Write a program that prompts the user to enter how long it takes for a cuboid tank with a square base to be full with water, base length of the tank and the water flow rate. Calculate the height of the water in this tank after this period. Print a table showing the day and the height of water in each day.

Example

Input:
Enter the number of days: 4
Enter water flow rate (m^3/day): 8
Enter the base length of the tank (m): 2
Output:
Day Height
1 2
2 4
3 6
4 8
The water height becomes 8 m after 4 days

N.B.

- Input and output MUST be printed exactly as the above example.

```
%a program to calculate water height after specific
time
clc
%prompt the user to enter the period in days
d=input('Enter the number of days: ');
%prompt the user to enter the water flow rate
v=input('Enter water flow rate (m^3/day): ');
%prompt the user to enter the length base
len=input('Enter base length (m): ');
%area of the tank base
a=len^2;

fprintf('Day Height\n');
%loop for each day
for i=1:d
    %calculate the height after each day
    h=v*i/a;
    %to print the value of each day's height in a table
form
    fprintf('%d %5.0f\n',i,h);
end
%print the final water height after a certain period
fprintf('The water height becomes %.0f m after %d
days',h,d);
```

Problem [5 pt.] Write a matlab program that read the number of songs duration in minutes and seconds and check whatever they can be saved on 80 minutes CD. If they can be saved on that CD then print out the time left on the CD. Otherwise print “longer than CD time”.**(Hint: inputs and outputs must follow the following format)**

Example1:

Enter the number of songs: 4
Enter duration of song 1:
Minutes: 10
Seconds: 50
Enter duration of song 2:
Minutes: 5
Seconds: 33
Enter duration of song 3:
Minutes: 15
Seconds: 10
Enter duration of song 4:
Minutes: 9
Seconds: 55
There are 38 minutes and 32 seconds of space left on the 80-minutes CD.

Example2:

Enter the number of songs: 5
Enter duration of song 1:
Minutes: 30
Seconds: 10
Enter duration of song 2:
Minutes: 20
Seconds: 50
Enter duration of song 3:
Minutes: 15
Seconds: 55
Enter duration of song 4:
Minutes: 25
Seconds: 30
Enter duration of song 5:
Minutes: 10
Seconds: 7
Longer than 80-minutes CD.

```
clc
clear
no_songs = input('Enter the number of songs: ');
total = 0;
for i = 1 : no_songs
    fprintf('Enter duration of song %d: \n',i);
    min = input('Minutes: ');
    sec = input('Seconds: ');
    total = total + min * 60 + sec;
end
if(total > 80*60)
    fprintf('Longer than 80-minutes CD.\n');
else
    free = 80*60 - total;
    min = fix(free/60);
    sec = rem(free,60);
    fprintf('There are %d minutes and %d seconds of space left on the 80-
minutes CD.\n',min,sec);
end
```

Country A has a population of 500 inhabitants, and Country B has a population of 800.The population of the 2 countries grows every year according to the following relation:

PopA_at_year(n+1) = PopA_at_year(n) * (1 + (growth_rateA)/100).

PopB_at_year (n+1) = PopB_at_year(n)* (1 + (growth_rateB)/100).

The growth_rateA is larger than the growth_rateB.

Write a program that asks the user to input the growth rate(A) andthe growth rate(B), and outputthe population of the 2 countries every year until the population of country A is greater than the population of country B.

(Hint: the user must enter the growth rate of country A greater than country B otherwise the program must output error message to the user).

Example1:

Please input the growth_rateA: 3

Please input the growth_rateB: 5
ERROR!! The growth_rateA must be greater thangrowth_rateB.

Example2:

Please input the growth_rateA: 3
Please input the growth_rateB: 2
Country A has 51500000inhabitants.
Country B has 71400000inhabitants.

```
clear
clc
A = 500;
B = 800;
rateA = input('Enter Rate of A: ');
rateB = input('Enter Rate of B: ');
if rateA < rateB
    fprintf('ERROR!!!\n');
else
    while A < B
        A = A + A * rateA / 100;
        B = B + B * rateB / 100;
        fprintf('A has %.0f inhabitants\n',A);
        fprintf('B has %.0f inhabitants\n\n',B);
    end
end
```

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1) u(n) is defined with:

- u(0) = a (a is an integer)
- if u(n) is even then u(n+1)=u(n)/2, otherwise u(n+1)=3*u(n)+1

Hint: For all value of a, there exists a value N such that u(N)=1.Write a program that asks the user to type the value of an integer a and writes all the values of u(n) from n=1 to n=N.

Example

Enter a: 10
u(1) = 5
u(2) = 16
u(3) = 8

u(4) = 4
u(5) = 2
u(6) = 1

```
clc
clear
a = input('Enter a: ');
u = a;
i = 0;
while u ~= 1
    if rem(u,2) == 0
        u = u / 2;
    else
        u = u * 3 + 1;
    end
    i = i + 1;
    fprintf('u(%d) = %d\n',i,u);
end
```