

HW #5: Iterations

Getting started

Download lab05 materials from D2L (including this instruction and four starter codes)
Enter Mimir IDE
Change into the cse220 directory
Create a new directory called lab05
Change into the new directory
Upload starter codes to Mimir IDE, save them in /home/(your_username)/cse220/lab05/
Implement the program below in your lab05 directory

Program 1: Euler's number

The number e is a mathematical constant approximated at 2.718.
The formula for computing it is as follows:

$$e = 1 + 1/1! + 1/2! + 1/3! + 1/4! + \dots$$

Write a program **Euler_float.c** that approximates the value of e by using the following equation:

$$e = 1 + 1/1! + 1/2! + 1/3! + 1/4! + \dots + 1/n!$$

where n is a number entered by the user (**Hint: scanf**).

Your program will first compute e as 1, then as $1 + 1/1!$, then as $1 + 1/1! + 1/2!$ and so on. In each step, print the step number and the value of e , as follows (with 20 digits after the decimal point):

```
1:      2.00000000000000000000
2:      2.25000000000000000000
3:      ....
```

Quick Reminder: $5!$ is also known as factorial(5) and is $5 * 4 * 3 * 2 * 1$.

Change the type of e from float to double (**Hint: float, double**). Write a similar program named **Euler_double.c**.

Remove the intermediate print statements and only print the value once at the end of your program (**Hint: printf**).

Compile your program into an executable called **euler_float** and **euler_double**.

Hints: Program 1 helps you understand and practice the following points,

1. How to define **float** and **double** variable? How to **convert an integer into float or double**?
What's the difference between float and double?
2. Practice using **for** loop.
3. Practice using **scanf** and **printf**.
4. Practice using operators: **/, *, +...**
5. Take $n=5$ as an example, your code should output similar results like the following. Note that the results are not exactly the same for **euler_float** and **euler_double**.

```

user@mimir: ~/cse220/lab05 > ./euler_float
5
1: 2.00000000000000000000
2: 2.50000000000000000000
3: 2.66666674613952636719
4: 2.70833349227905273438
5: 2.71666693687438964844
user@mimir: ~/cse220/lab05 > ./euler_double
5
1: 2.00000000000000000000
2: 2.50000000000000000000
3: 2.66666666666666651864
4: 2.70833333333333303727
5: 2.71666666666666634100

```

Program 2: Interest Rates

Write a program **InterestRates.c** that computes the interest amount on **multiple loans for one year** (**Hint:** the program does not stop after finishing one loan. It continues working until the user gives an invalid input, which is 0. You may consider **while** and **if & break**). The program should terminate when the loan amount entered is 0 as in the following example (**Following the last hint: if & break**). The program should ask the user to enter the loan amount and the interest rate (**Hint: scanf**). It should then output the interest amount of 1 year with two digits after the decimal (**Hint: printf**).

Compile your program into an executable file and run it. The output should be similar like the following:

```

user@mimir: ~/cse220/lab05 > ./interest_rate
Enter loan amount ($): 15000
Enter yearly interest rate (%): 6.25
Interest amount ($): 937.50

Enter loan amount ($): 135
Enter yearly interest rate (%): 21
Interest amount ($): 28.35

Enter loan amount ($): 0

```

Hints: Program 2 helps you understand and practice the following points,

1. Practice **if** and **break**.
2. Practice using **scanf** and **printf** the provided specific format.
3. Practice using operators: **/**, *****, **+**...
4. Total loan amount (this year) = Total loan amount (last year) + Total loan amount (last year) * yearly interest rate * 0.01. There is a 0.01 because we use percentage for yearly interest rate.