

MCS 260 Project Five : interval arithmetic due Wednesday 5 December at 1PM

The goal of this project is to develop a class to perform elementary interval arithmetic. Interval arithmetic was developed as an approach to put bounds on rounding errors in mathematical computations as a way to obtain reliable results.

For two intervals $[a, b]$ and $[c, d]$, the basic arithmetical operations are defined as

$$\begin{aligned} [a, b] + [c, d] &= [a + c, b + d] \\ [a, b] - [c, d] &= [a - d, b - c] \\ [a, b] \times [c, d] &= [\min(ac, ad, bc, bd), \max(ac, ad, bc, bd)] \\ [a, b] / [c, d] &= [\min(a/c, a/d, b/c, b/d), \max(a/c, a/d, b/c, b/d)] \end{aligned}$$

In this project you will define a class `Interval` and use operator overloading to implement the four basic arithmetical operations on intervals.

If we store the class definition in the file `interval.py`, then an interactive session might run as:

```
>>> from interval import *
>>> x = Interval(3)
>>> x
[3.000000,3.000000]
>>> y = Interval(2,4)
>>> y
[2.000000,4.000000]
>>> x + y
[5.000000,7.000000]
>>> x - y
[-1.000000,1.000000]
>>> x * y
[6.000000,12.000000]
>>> x / y
[0.750000,1.500000]
```

Observe the value of the default right end point of the interval and the representation of intervals. Some important points:

1. You must ensure that Python stores the end points of the interval as floats, otherwise the division might yield unexpected results for integer end points.
2. Provide proper documentation, i.e.: every function must have a documentation string.
3. Handing in an incomplete but working program is better than handing in a program that crashes or does not run at all.
4. The first line of your Python program must be

```
# MCS 260 Project Five by <Author>
```

 where you replace the `<Author>` by your name.
5. Email your solution to the project to jan@math.uic.edu before 1PM on Wednesday 5 December so the date of the email is proof of an on time submission. As a backup, bring also a printed version of your solution to class.

If you have questions or difficulties with the project, feel free to come to my office for help.