EE231002 Introduction to Programming

Lab02. Approximating π

Due: Sep. 24, 2019

The following equation has been proven and as the number of terms approaches infinite it converges to value shown on the right side of the equation.

$$\frac{1}{2\cdot 3\cdot 4}-\frac{1}{4\cdot 5\cdot 6}+\frac{1}{6\cdot 7\cdot 8}-\cdots=\frac{1}{4}(\pi-3).$$

The aim of this lab is to verify the above equation, we define

$$S2=\frac{1}{2\cdot 3\cdot 4}-\frac{1}{4\cdot 5\cdot 6},$$
$$S4=\frac{1}{2\cdot 3\cdot 4}-\frac{1}{4\cdot 5\cdot 6}+\frac{1}{6\cdot 7\cdot 8}-\frac{1}{8\cdot 9\cdot 10},$$
$$S6=\frac{1}{2\cdot 3\cdot 4}-\frac{1}{4\cdot 5\cdot 6}+\frac{1}{6\cdot 7\cdot 8}-\frac{1}{8\cdot 9\cdot 10}+\frac{1}{10\cdot 11\cdot 12}-\frac{1}{12\cdot 13\cdot 14}.$$

Given the partial sums, then we can find the approximated value of π as below.

$$S2=\frac{1}{4}(PI2-3),$$
$$S4=\frac{1}{4}(PI4-3),$$
$$S6=\frac{1}{4}(PI6-3).$$

As the number of terms increases, the value of PIn should approach π. Your assignment is to write a `C` program to calculate $PI2$, $PI4$, $PI6$, $PI8$, $PI10$ and $PI12$. The output of you program should have the following format.

```
$ ./a.out
PI2 = 3.13333
PI4 = x.xxxxx
PI6 = x.xxxxx
PI8 = x.xxxxx
PI10 = x.xxxxx
PI12 = x.xxxxx
```

Notes.

1. Create a directory **`lab02`** and use it as the working directory.
2. Name your program source file as **`lab02.c`**.

3. The first few lines of your program should be comments as the following.

```
// EE231002 Lab02. Approximating Pi
// ID, Name
// Date
```

4. After finishing editing your source file, you can execute the following command to compile the program,

   ```
   $ gcc lab02.c
   ```

   If no compilation errors, the executable file, **a.out**, should be generated, and you can execute it by typing

   ```
   $ ./a.out
   ```

5. After you finish verifying your program, you can submit your source code by

   ```
   $ ~ee2310/bin/submit lab02 lab02.c
   ```

   If you see a "submitted" message, then you are done. In case you want to check which file and at what time you submitted your labs, you can type in the following command:

   ```
   $ ~ee2310/bin/subrec lab02
   ```

   It will show the last few submission records.

6. (Challenge, no submission is required.) Since this is a convergent series, the approximation should approach π. You are encouraged to find the value of π as accurate as possible.