

## Lab 5

### Loops

#### PROGRAM SPECIFICATIONS

Pi can be approximated by the following series:

$$4 - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \frac{4}{9} - \dots$$

As you add more terms of the series together, you get the value of Pi with more precision. The drawback to this series is that it very slowly approximates Pi. However, since we have a computer, we can overcome this to some degree because of the speed at which computers perform arithmetic.

Your task:

- Get an integer greater than 9 from the user that represents to which term to approximate Pi
  - You must ensure the integer they enter is greater than 9 with a while loop
  - As long as the user enters an invalid number, re-prompt for input
- Once a valid integer is obtained, calculate the approximate value of Pi to that term
- Print the values of the 10 terms leading up to and including the last term specified, formatted to 15 digits to the right of the decimal point, preceded by the term number (see example run below).
- After the results have been displayed, the user will be asked if s/he wants to perform another approximation of Pi.
  - You must ensure that the user only enters yes or no. Any other input will reprompt the user.
  - If the answer is yes, get another term and perform the calculation as specified above.
  - The user should be asked if s/he wants to go again until the answer is no.
  - You must handle all cases of “yes” and “no”
- Make sure that when you print the terms they are in nice columnar form.
  - In the example above, when terms 1 through 10 are printed, term 10 is not neatly aligned with the rest – the ones digits should be aligned, etc.

### EXAMPLE RUN:

Welcome to the Pi approximation program.

This program will approximate Pi based on the following series:

$4 - 4/3 + 4/5 - 4/7 + 4/9 - \dots$

Enter the term number to which you would like to approximate Pi  
(note that 4 is term 1, 4/3 is term 2): 9

Invalid input! Please enter a term greater than 9: -999

Invalid input! Please enter a term greater than 9: 0

Invalid input! Please enter a term greater than 9: 20

The values of Pi from term 11 to term 20 are

-----

Term 11: 3.232315809405594

Term 12: 3.058402765927333

Term 13: 3.218402765927333

Term 14: 3.070254617779185

Term 15: 3.208185652261944

Term 16: 3.079153394197428

Term 17: 3.200365515409549

Term 18: 3.086079801123835

Term 19: 3.194187909231942

Term 20: 3.091623806667840

Would you like to try again (yes/no)? yo!

Invalid input, please enter yes or no: yes

Enter the term number to which you would like to approximate Pi  
(note that 4 is term 1, 4/3 is term 2): 10

The values of Pi from term 1 to term 10 are

-----

Term 1: 4.000000000000000

Term 2: 2.666666666666667

Term 3: 3.466666666666667

Term 4: 2.895238095238096

Term 5: 3.339682539682540

Term 6: 2.976046176046176

Term 7: 3.283738483738484

Term 8: 3.017071817071818

Term 9: 3.252365934718877

Term 10: 3.041839618929403

Would you like to try again (yes/no)? no

## TO TURN IN

A **zip** file that contains the Lab5 folder:

- Your Java source file, packages etc.
- An output run of your program named **cscd210lab5output.txt**
  - At least 3 runs over your program and make sure you test your go again
  - One run must be greater than 100 for the term

Name your zip your last name first letter of your first name lab5.zip (Example: steinerslab5.zip)