Python - Calculating pi

**Question 1**



(1)

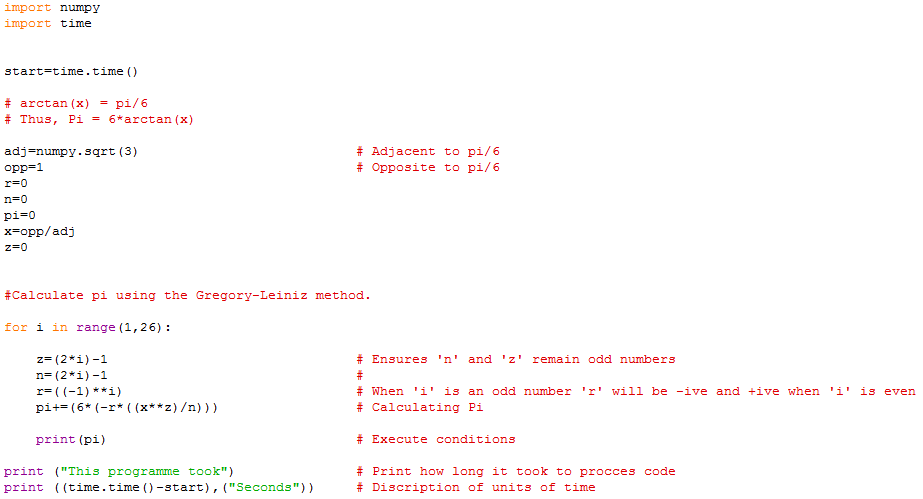
Then we can integrate to give,

(2)



Using the triangle given, we have **Eq.3**. Where

(3)

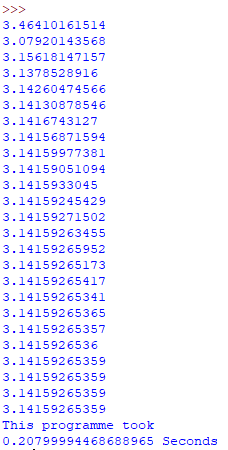
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**Fig 1.1** Code used to calculate ,using the Gregory-Liniz method. Discribing the infinaite sereis from **Eq.3.**

Line 26

‘’ and ‘’ will alwas remain negative as ‘’ increases. Going up in incrments of 2. They also remain the same value as per **Eq.3**.

The ‘’ term is responsiable for alternating the series between negative and possitive. When ‘’ is even, ‘’ will render the term possotive and visa versa. Hence the series alternates between negative and possative terms.



**Fig 1.2** Shows the output from the code used in **Fig 1.1**.

23rd term in range.

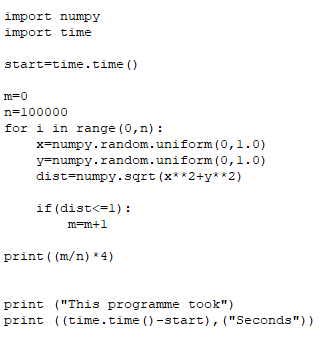
**Fig 1.2** Shows how long it took to compile the code from **Fig 1.1** in seconds**.** It also shows us how many terms was necessary before our degree of accuracy became unchanging.

**Fig 1.2** shows that the algorithm becomes less accurate after 23 terms. Even increasing the range to 1 to 500 as per **Fig 1.3** had no effect on the accuracy of our result.



**Fig 1.3** Increasing the range from 26 to 500



1. 

**Fig 1.4** shows the code for Monte CarloMethod of calculating .

The *Monte Carlo* method for caluating uses a random number genertor to calculate and can be to varying degrees of accuarcy every time it is ran (Unless seeded). For this method, the range was from 1 to 9999 and was only correct to 2 decimal places. Unlike the Gregory-Liniz method from **Fig 1.1** which was only in the range 1 to 25 which was true upto 10 decimal places.

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**Fig 1.5** shows the accuracy and time it took for the Monte Carlo method.



Looking at **Fig 1.5** It took the Monte Carlo far longer to to run (0.34 seconds) than the Gregory-Liniz method (0.21 seconds) from **Fig 1.2**. This is mainly due to the extented range used with the Monte Carlo. However if we lowered the range it to thatt of **Fig 1.2** then the accuracey would be way off. Thus I conclude that the the Gregory-Liniz method is far quicker and far more effective than the random natured Monte Carlo method.