Analysis of Methods for the Computational Approximation of π

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Abstract

Contents

1 Introduction

Write a brief description (background/significance) of what the project is about.

Pi is calculated using the methods of numerical integration, sum of alternating series, and a Monte Carlo estimator. [Needs a lot more, and this is not meant to be the topic sentence, just a general idea of what could be in this paragraph.]

2 Problem Statement

State fully and precisely the mathematical problem. Explain meaning of all symbols used. Make clear what is given and what we are looking for.

2.1 Part I

Text introducing this subsection.

2.2 Part II

Text introducing this subsection.

2.3 Part III

Text introducing this subsection.

3 Method/Analysis

Begin with naming or characterizing the method/approach to be used, perhaps explain the basic idea behind it, to what type of problems it applies, under what conditions, what it achieves, what are its main features, advantages, disadvantages. Justify why it is applicable to this problem, stating clearly any assumptions you need to make about the problem for the method to apply. Name some other methods/approaches one could use, and if/why your method may be preferable.

3.1 Part I

Put an explanation of the methodology behind the numerical integration method here, such as where pi comes from in the integral and why.

3.2 Part II

Put an explanation for how and why pi emerges from the alternating series here. The whole 'arctan' component and more too.

3.3 Part III

A Monte Carlo estimator is a method of approximating an explicit value using randomness. In the case of approximating pi, a uniform sample of random points will approach the ratio between the Pi occurs in many, many parts of geometry. The most prevalent location being the equation to find the area of a circle, $A = \pi r^2$.

4 Solutions/Results

This section contains the presentation of your solution and results. Describe your implementation of the method(s) for this specific problem, any special features, numerical methods implementation strategy, choices of any parameters, stopping criteria, etc. Present the results in words and plots (annotate by hand if necessary), explain what they mean. Include your code in an Appendix.

4.1 A subsection

Text introducing this subsection.

4.1.1 A subsubsection

Text introducing this subsubsection.

4.1.2 A further subdivision

Text introducing this subsubsection.

5 Discussion/Conclusions

Interpret your solution physically, what we learn from it, comment on strengths and weaknesses of the solution method, any nice features you want to brag about, possible ways to improve it (e.g. how to make it more accurate, more efficient), as appropriate.

References

[1] Heath, Michael T., Scientific Computing: An Introductory Survey, McGraw Hill, 2002.

A Python Codes

Text introducing this appendix. Subsections and further divisions can also be used in appendices.

```
#!/usr/bin/env python3
import math

"""
===============================================================================
MA305 - cw #: your name - date
Purpose: Find the number of trailing zeros in factorial(n).
===============================================================================
"""

n=input('Enter a positive integer:')
n=int(n)

count=0
for i in range(1,n+1):
    count += n//5**i #pow(5,i)

print(' Number of trailing zeros in factorial(',n,'):', count)
print(' Factorial (',n,')=',math.factorial(n))
```