CONCORDIA UNIVERSITY

SOEN 6011: Software Engineering Processes

ETERNITY:FUNCTION F4
$\Gamma(\mathbf{x})$

Tavtej Singh Lehri
Student ID: 40121745

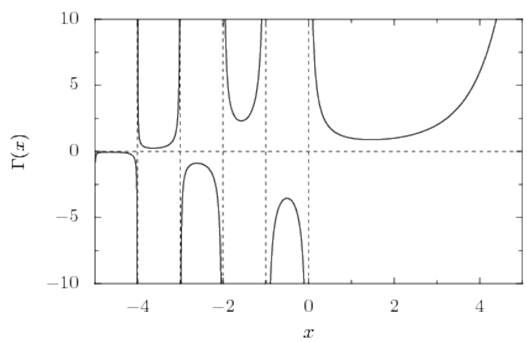

Figure 1: Graph of Gamma Function.[2]

https://github.com/tavtejS07/SOEN-6011

Contents

1 Problem 3

1.1 Algorithms

Algorithm 1 Lanczos Approximation for StrictMath

1: **if** x is negative or is NaN **then**
2: NaN
3: **if** x is equal to 0 **then**
4: **return** 1
5: **if** x is greater than 0 **then**
6: $double\ d = (x - 0.5) * log(x + 4.5) - (x + 4.5)$
7: $double\ e = 1.0 + X1/(x + 0) - X2/(x + 1) + X3/(x + 2) -$
8: $X4/(x + 3) + X5/(X + 4) - X6/(x + 5)$
9: **return** $d + log(d1 * sqrt(2 * \pi)) - - > logGamma$
10: **Using the value returned in Line 9 calculate** $\Gamma(x)$
11: **return** $exp(logGamma(x))$

Algorithm 2 Stirling's Approximation for StrictMath

if x is negative or is NaN **then**
NaN
if x is equal to 0 **then**
return 1
if x is greater than 0 **then**
return sqrt(2*$\frac{\pi}{x}$)*($\frac{x}{e}$)^x

1.2 Technical Aspects

Algorithm 1 is Lanczos approximation of the function $\Gamma(x)$. This is an alternative to the Stirling's approximation. The advantage of this is the less number of single or double floating point precision required. If a real constant is known then we can easily calculate the coefficients in advance and use a single formula.

Algorithm 2 is the approximation of factorials. It has Big Oh! of O(nlogn).

Calculation factorial for larger numbers take time if we implement n!. Using the Stirling's approximation it reduces the time of calculation.

Bibliography

[1] Libretexts. (2022, February 27). *E14.2: Definition and properties of the gamma function.*Mathematics LibreTexts. Retrieved July 25, 2022, from `https://math.libretexts.org/Bookshelves/Analysis/Complex_Variables_with_Applications_(Orloff)/14%3A_Analytic_Continuation_and_the_Gamma_Function/14.02%3A_Definition_and_properties_of_the_Gamma_function`

[2] Gamma function. (2011, July 25). *Gamma function*- Knowino. (n.d.). Retrieved July 27, 2022, from `https://www.tau.ac.il/ tsirel/dump/Static/knowino.org/wiki/Gamma_function.html`