SOFTWARE ENGINEERING PROCESSES–CALCULATOR

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Introduction

F5: $\Gamma(x)$ which is named as gamma function, is a commonly used extension of the factorial function to complex numbers

- For the gamma function, 0 and all the negative integers are not defined.
- When for any positive integer a, then the gamma function is related to the factorial function $\Gamma(a) = (a-1)!$
- For complex numbers with a positive real part, then the gamma function is defined as $\Gamma(a) = \int_0^\infty x^{a-1}e^{-x}\,dx$.
- The previous definition can be extended to the whole complex number domain except negative integer by using analytic continuation.

Requirements

1. **R1**:When the user entered the parameter a, the calculating system shall verify the validation of the parameter. If it is not valid, show up the error message and give the tip and instruct the user to enter the value with correct format.
2. **R2**:When the parameter a for the gamma function is received,the calculating system shall process the gamma function with the received parameter a within 2 or 3 seconds.
3. **R3**:The result of the calculating system shall be accurate and correct after user giving a valid input.
4. **R4**:The calculating system shall be maintainable.

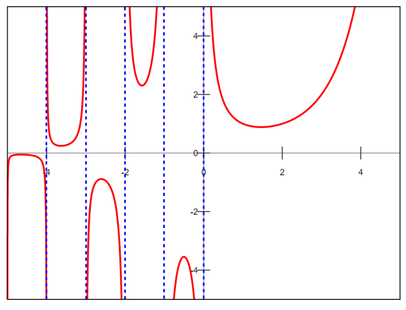

Figure 1: Gamma Function

Approach

- **Algorithm**:There are 2 methods to implement gamma function, namely Lanczos approximation and Stirling's approximation. Comparing output of two methods, Lanczos approximation is more accurate and is used to serve for implementation.
- **Debugger**:Debugger support in eclipse is used to debug this calculator application. Eclipse IDE support the debug perspective which can be run easily to check the intermediate status of variable.
- **Quality Check**: The 'Checkstyle' plugin for eclipse is used to review the code specification and ensure that java code follows a standard code style, which saves plenty of time to check the coding standard manually line by line, and it allows us to easily modify the improper format by following the given instruction.

Quality Attributes

- **Usable**:The calculator application provides a relative easy and clear front look, which will less likely to make user get confused.
- **Maintainable**:The calculator application is maintainable because of the separation of the function modules.Therefore the application will be maintainable and modifiable for the future changes.
- **Correct**:The correctness and accuracy is the primary request for the calculator application, since it calculate to 15 decimal place.
- **Efficient**:The calculator application is efficient which is achieved by simple and clear process.
- **Robust**:The calculator application is robust which is achieved by concerning the extreme cases and dealing with them correspondingly.

Important Result

The following part includes the graphical user interface as a result of the project and also suggestions I got from my teammates during the reviewing and testing session.

Source Code Review

- **Code distribution**: The main file includes both functional code and configuration code, which makes the code is not properly distributed. Therefore I separate the main file into two files for better understanding.
- **Duplicate code**: The method size is not that reasonable which makes it not easy to keep manageable. Too many conditions fragments exist, so the refactoring is applied to the specific method.

Results

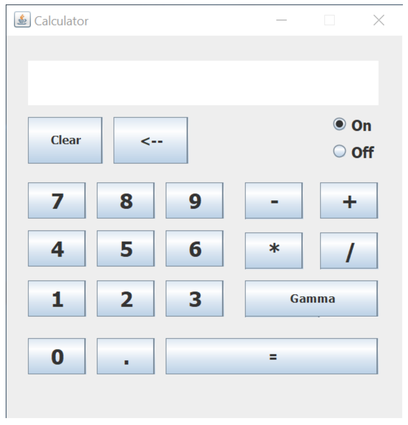

Figure 2: Calculator user interface

Test Cases Review

The following table is the test result based on gamma function method, according to the comparison between the expected and obtained value, it can tell that the deviation is within the range.

Input	Expected Value	Obtained Value
1	1.0	0.9999999999999998
-2.4	-1.108029947033346058329	-1.108029947033344
1.5	0.8862269254527580136491	0.8862269254527586

Table 1: Gamma function Testing Result Table

Conclusion

Form this calculator application, a process is followed from the very start to collect the background knowledge, and based on that the requirements are analyzed. After the brainstorming about the pseudo code format within the group range, the implementation phase starts, followed by debugging and code standard checking. Finally, from the peer review, I learned a lot and refactored my code accordingly.

References

- [Jekyll.math.byuh.edu]Properties of the Gamma function http://www.jekyll.math.byuh.edu/courses/m321/handouts/gammaproperties.pdf
- [En.wikipedia.org] Gamma function https://en.wikipedia.org/wiki/Gamma function

Acknowledgements

I do appreciate Professor P. Kamthan and my teammates' help and suggestion.

Contact Information

- Github address : https://github.com/panjingya/SOEN6011.git