PROBLEM 2. **Dhruviben Modi**
SOEN 6011 **40166396**
SOFTWARE ENGINEERING PROCESSES Due Date: August 5, 2022
Github address : git@github.com:mdhruvi/SOEN-6011-project.git

1 Explicit Assumption

1. n is positive real number $n \in R^+$
2. For n $\in Z^+$, it is easier to compute $\Gamma(n)$

2 Requirements and corresponding properties

F4 - $\Gamma(x)$

(1) First Requirement : The Gamma Function $\Gamma(x)$ requires x as its variable input in order to proceed.

- ID : FR1
- Version number: 1.0
- Priority: High
- Rationale: x
- Difficulty: Easy.
- Type: Functional requirement

(2) Second Requirement : If the user provides a legitimate input in domain of R^+, the Gamma function's output must be exact and correct.

- ID : FR2
- Version number: 1.0
- Priority: High
- Rationale: $x > 0$, The fundamental goal of the calculating system is to provide an accurate answer quickly, hence this criteria is essential.
- Difficulty: Difficult, selection of correct algorithm.
- Type: Functional requirement

(3) Third Requirement : When the user entered the parameter x, Gamma calculator will check the value of a parameter. If the entered value is zero or negative it displays the error message.

- ID : FR3
- Version number: 1.0

- Priority: High
- Rationale: For the gamma function, 0 and all the negative integers are not defined. For example $\Gamma(0) = \int_0^\infty x^{-1}e^{-x}\,dx$. It is not integrable. For small value of x, it appears to decay slowly, but for large values, it decays quite quickly. Non-Integral form is:

  $\lim_{a\to 0}\int_a^1 x^{-1}e^{-x}dx \geq \frac{1}{e}\lim_{a\to 0}\int_a^1 \frac{dx}{x} = \lim_{a\to 0} -log_a = \infty$

  Thus $\Gamma\,(0)$ is undefined, and hence it is also undefined for all the negative integers.
- Difficulty: Easy
- Type: Functional requirement

(4) Fourth Requirement : To avoid a stack overflow, the gamma function can be calculated if the inputs are positive integers using the tail recursion function.

- ID : FR4
- Version number: 1.0
- Priority: High
- Rationale: $\{\ \forall n \in R^+ \mid\ \Gamma(n) = (n-1)!\ \}$
- Difficulty: Moderate, The system's modules must be reasonably separated from one another for ease of management and maintenance due to the system's complexity.
- Type: Functional Requirements

(5) Fifth Requirement : The output of the gamma function can be computed for the fractional value of the input parameter using Stirling's approximation for performing definite integration.

- ID : FR5
- Version number: 1.0
- Priority: High
- Rationale: $\{\ \forall n \in R^+ \mid \text{y } \Gamma n = \sqrt{2\cdot\pi\cdot n}\cdot(\frac{n}{e})^n\ \}$
- Difficulty: Difficult
- Type: Functional Requirements

(6) Sixth Requirement : The system must be maintainable and managable to achieve usability.

- ID : FR6
- Version number: 1.0
- Priority: High

- Rationale: To make a system well-organized it is essential that each modules must be implemented separately, otherwise it is difficult to manage such complex system.
- Difficulty: Moderate
- Type: Non-Functional Requirement

(7) Seventh Requirement : The system portability.

- ID : FR7
- Version number: 1.0
- Priority: High
- Rationale: Java's architectural neutral features give the system the flexibility to function on many system architectures.
- Difficulty: Moderate
- Type: Non-Functional Requirement

(8) Eighth Requirement : The system Usability.

- ID : FR8
- Version number: 1.0
- Priority: High
- Rationale: Any user should be able to easily comprehend the system. For a novice user, error messages must be helpful.
- Difficulty: Easy
- Type: Non-Functional Requirement

3 References

29148-2018 — ISO/IEC/IEEE International Standard – Systems and software engineering – Life cycle processes – Requirements engineering. (2018, November 30). Retrieved from https://standards.ieee.org/standard/29148-2018.html