SOEN 6011 SEP **Mahavir Patel**
Problem 2 **40198619**
Function 6 : $B(x, y)$ Beta Function Date: 05/07/2022

Assumptions

1. x and y are positive real numbers $x, y \in R^+$.
2. It is simpler to calculate $B(x, y)$ using the factorial for $x, y \in Z^+$.
3. If x and y are real numbers, there is no need to compute the integral function. The gamma values of the numbers may be used to derive the beta value using Stirling's approach.

Requirements

1. **First Requirement**
   - **ID =** FR1
   - **Type =** Functional Requirements
   - **Version =** 1.0
   - **Difficulty =** Easy
   - **Description =** The Beta function $B(x, y)$ requires x and y as its two variable inputs in order to operate.
   - **Rationalle =** x and y
2. **Second Requirement**
   - **ID =** FR2
   - **Type =** Functional Requirements
   - **Version =** 1.0
   - **Difficulty =** Easy
   - **Description =** The Beta function $B(x, y)$ requires two real positive numbers as it's defined in the R^+ domain.
   - **Rationalle =** $x \geq 0$ and $y \geq 0$
3. **Third Requirement**
   - **ID =** FR3
   - **Type =** Functional Requirements
   - **Version =** 1.0
   - **Difficulty =** Easy
   - **Description =** The Beta Value of the function is in real positive numbers i.e R^+
   - **Rationalle =** $B(x, y) \geq 0$

4. **Fourth Requirement**
   - **ID =** FR4
   - **Type =** Functional Requirements
   - **Version =** 1.0
   - **Difficulty =** Easy
   - **Description =** If the given inputs are positive integers then beta Values can be easily computed by using the Beta - Gamma Function relation.
   - **Rationalle =** { $\forall x, y \in$Z$^+$ |B(x,y)=$\Gamma x \Gamma y_{\overline{\Gamma(x+y)}}$ }
5. **Fifth Requirement**
   - **ID =** FR5
   - **Type =** Functional Requirements
   - **Version =** 1.0
   - **Difficulty =** Moderate
   - **Description =** To calculate Beta function for large integer values, Gamma Function should be used in order to prevent stack overflow by using tail recursive function.
   - **Rationalle =** { $\forall x, y \in$R$^+$ |B(x,y)=$\Gamma x \Gamma y_{\overline{\Gamma(x+y)}}$ where $\Gamma n = (n-1)!$ }
6. **Sixth Requirement**
   - **ID =** FR6
   - **Type =** Functional Requirements
   - **Version =** 1.0
   - **Difficulty =** Difficult
   - **Description =** For the decimal number gamma value can be calculated using the stirlings's approximation which helps in determining the Beta value without using the integral functions.
   - **Rationalle =** { $\forall x, y \in$R$^+$ |B(x,y)=$\Gamma x \Gamma y_{\overline{\Gamma(x+y)}}$ where $\Gamma n = \sqrt{2 \cdot \pi \cdot n} \cdot (\frac{n}{e})^n$ }
7. **Seventh Requirement**
   - **ID =** FR7
   - **Type =** Functional Requirements
   - **Version =** 1.0
   - **Difficulty =** Moderate
   - **Description =** There is no definition of beta values for negative or zero values. There shouldn't be any inputs besides the numeric values; x and y can be similar or different, but there shouldn't be any inputs other than the numeric values.
   - **Rationalle =** { $\forall x, y \in$R$^+$ | x>0 *and* y>0, x = y *or* x $\neq y$ }