Concordia University

SOEN 6011 - Software Engineering Process

ETERNITY: FUNCTION
ab^x

Deliverable 1

Avneet Kaur Pannu
Student ID : 40168576
https://github.com/avneet-kaur/SOEN-6011

Contents

1 Introduction

An exponential function is a function with the general form ab^x, $a \neq 0$, b is a positive real number and $b \neq 1$ .In an exponential function, a is constant, the base b is a constant, and the exponent x is a real variable.[1]

1.1 Domain

- The domain is all real numbers.
  $-\infty < x < +\infty$, $x \in R$ [1]

1.2 Co-Domain

- The co-domain is also set of all real numbers.

1.3 Characteristic

- **Exponential growth** : In the function f(x) = b^x when $b > 1$, the function represents exponential growth. In figure 1, it is evident on the left side. [3]
- **Exponential decay** : In the function f(x) = b^x when $0 < b < 1$, the function represents exponential decay. In figure 1, it is evident on the right side.[3]
- **Commutativity**: Exponential function is not commutative which means $x^y \neq y^x$ for $x \neq y$. For example, $0^1 = 0$ and $1^0 = 1$.
- **Natural Exponential Function**: When the base is chosen to be b=e, the function f(x) = e^x is called natural exponential function.[1]
- In the function f(x) = ab^x when $|a| > 1$, it increases the speed of either growth or decay, and $0 < |a| < 1$ decreases the speed of either growth or decay.[2]

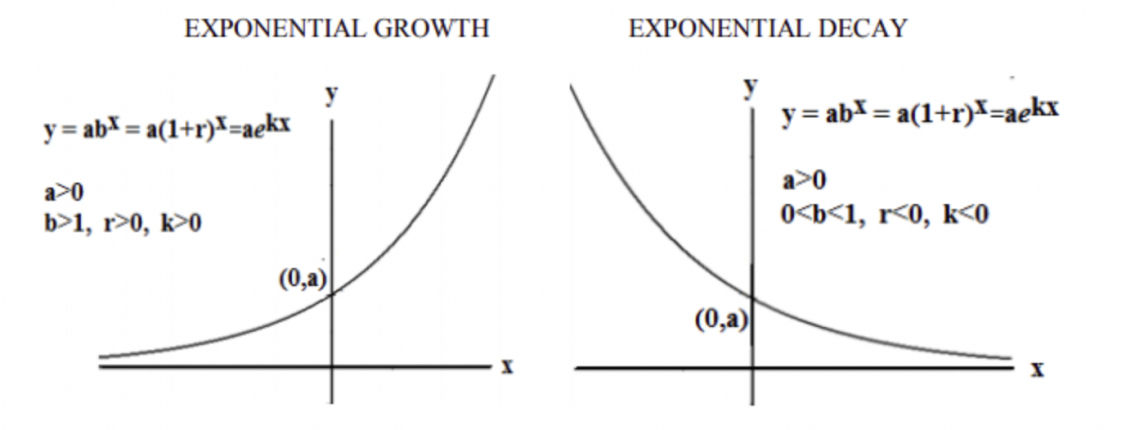

Figure 1: Exponential Growth and Exponential Decay

2 Functional Requirement

2.1 Definitions and abbreviations

Term	Definition
FR	Functional Requirement
NFR	Non-Functional Requirement
User	End user are the human users who interacts with the system
System	Application which is used for solving exponential function.

Table 1: Definitions and abbreviations

2.2 Assumptions

- The calculator must accepts the exponential constant like e in addition to the constants a and b.
-

2.3 Requirements

Functional Requirements

- **ID** :FR1
  Type :Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High

Difficulty : Easy
Description :The calculator should ask the user to input a, b, and x.
Rationale :In order to process function f(x) = ab^x and give output system needs input form the user.

- **ID** :FR2
  Type :Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description :When a user input is not a number, the system should provide an error message.
  Rationale :The only acceptable input for an exponential function calculation is a number.

- **ID** :FR3
  Type :Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description :If a user enters incorrect data, the system shouldn't shut down but rather prompt users to reenter their data.
  Rationale :The ability to perform calculations again and without closing the programme should be available to the user.

- **ID** :FR4
  Type :Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description : Whole numbers and rational numbers are accepted as user inputs.
  Rationale : The code does not handle irrational numbers. For instance, π, $\sqrt{2}$

- **ID** :FR5
  Type :Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description : Fractional inputs must be entered as double values.
  Rationale : If a user wants to provide a base or exponent value of 1/2, they must do so as 0.5.

- **ID** :FR6
  Type :Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description : Base b is restricted to positive number.
  Rationale : In order to guarantee b^x is real number.

- **ID** :FR7
  Type :Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description : When any base value of b is raised to the power of x=0, the function's b^x portion must return the value 1.
  Rationale : For instance: 11 raised to the power 0 gives 1.

- **ID** :FR8
  Type :Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description : When base value b=0 is raised to any exponent value, the b^x portion of the function must return 0.

Rationale : For instance, 0 raised to the power 11 yields 0.

Non-Functional Requirements

- **ID** :NFR1
  Type :Non-Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description :An error message should be informative and relevant to the user.
  Rationale : The user should be able to resolve simple problems on their own by understanding error message to enhance usability.

- **ID** :NFR2
  Type :Non-Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description :The command line interface ought to be user-friendly.
  Rationale : The system should be simple for the user to operate.

- **ID** :NFR3
  Type :Non-Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description :The outcome must be accurate.
  Rationale : To enhance the accuracy of system. It is inappropriate to display incorrect ouptut to the user.

- **ID** :NFR4
  Type :Non-Functional

Version Number :1.0
Owner : Avneet
Priority : High
Difficulty : Easy
Description :There should be no more than 5 seconds of calculation time.
Rationale : In order to improve the performance of the system.

- **ID** :NFR5
  Type :Non-Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description : System should be maintainable for the duration of its anticipated lifetime and able to accommodate new requirements in response to stakeholders' changing needs.
  Rationale : Since future changes to software systems are inevitable. Maintainable systems are therefore simpler to alter.

- **ID** :NFR6
  Type :Non-Functional
  Version Number :1.0
  Owner : Avneet
  Priority : High
  Difficulty : Easy
  Description : The system should be developed using widely used and standardised language.
  Rationale : Java is used to build a system which is platform independent hence make the system portable.

3 Algorithm

3.1 Pseudocode

3.2 Description

3.3 Advantages and Disadvantages

Bibliography

[1] Zill, D. G., & Wright, W. S. (2011). Calculus: Early transcendentals. Jones and Bartlett Publishers.

[2] Rock, N. M. (2007). Standards driven math. student standards handbook. Team Rock Press.

[3] Exponential growth and decay - virtuallearningacademy.net. (n.d.). Retrieved August 3, 2022, from https://virtuallearningacademy.net/VLA/LessonDisplay/Lesson6156/MATHALGIIBU17Exponential_Decay.pdf