SOEN 6481

Software Requirement Specifications

Golden Ratio

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Contents

1 Abstract

Golden Ratio is denoted by the Greek letter Phi (ϕ), the value is 1.6180339887 approximately.It has unique and mystifying properties,researchers and mathematicians have been studied about the Golden Ratio.Renaissance architects, artists and designers also studied on this interesting topic, documented and employed the Golden section proportions in eminent works of artifacts, sculptures, paintings and architectures. The Golden Ratio also known as Golden Proportion is considered as the most pleasing to human visual sensation and not limited to aesthetic beauty but also be found its existence in natural world through the body proportions of living beings, the growth patterns of many plants, insects and also in the model of enigmatic universe. [2]

2   Acknowledgement

I would like to express my sincere gratitude and appreciation to my Professor Pankaj Kamthan, for providing relevant lecture notes,guidance and suggestions throughout Deliverable 1 for the project.

Moreover, I would also like to thank my group mates who helped me during the course of the project and made this time joyful.

3 Problem 1: Introduction

Golden Ratio, first depicted and described by Euclid in the golden age of Greek Knowledge, discusses about a fundamental characteristics in the number theory. A number is said to be in a Golden Ratio if their ratio is found to be same as the ratio of their sum to the larger of the two. The Greek letter ϕ is used as the symbol of Golden Ratio. The value of ϕ is 1.61803398875. The number itself is irrational. The term "Golden" has been used as it is considered to be aesthetically pleasing and examples of the ratio can be drawn from the nature itself.

In terms of mathematics, the Golden Ratio can be described in many different ways. However, for the sake of simplicity, we must start from the first description of the ratio, as depicted by Euclid, the line segment theory. It goes in this way-
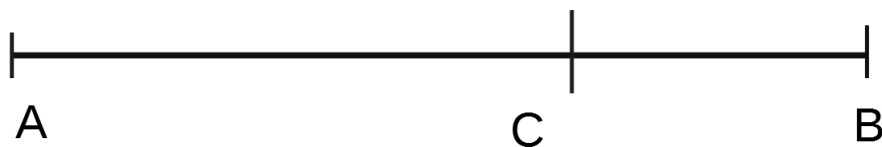
As can be seen from the image, length of AB is greater than that of AC and AC is greater than CB. if $AC : CB$ is equals to $AB : AC$, then we can conclude that the line has been cut in a Golden Ratio. [1].

4 Problem 2:Interview

Interviewee- Niloy Eric Costa

Q1. What are you researching on?
A1. I am working on Interactive Data Visualization.

Q2. Are there any other fields in Computer Science or Mathematics you are interested in?
A2. In the field of Mathematics I'm interested in Geometry and Number Systems and in the field of Computer Science I'm interested in Data Visualization, Database Systems and Data Mining.

Q3. Have you heard of any irrational constants in Mathematics?
A3. I have researched on some irrational constants like π,e,Khinchins Constant (K).

Q4. What do you know about Golden Ratio,Φ ?
A4. Well to explain it.Two quantities are in the golden ratio if their ratio is the same as the ratio of their sum to the larger of the two quantities. For quantities a and b such that $a > b > 0$,

$$(a + b)/a = a/b$$

Q5. Do you know when we celebrate phi day?
A5. Haha. Yeah, 18th June.

Q6. Phi is named after a Greek sculptor; do you know his name?
A6. Yes, Phidias.

Q7. Do you know any other names golden ratio is known by?
A7. Yes.It is known by the Golden Mean, Phi, the Divine Section, The Golden Cut, The Golden Proportion, The Divine Proportion, and tau(t).

Q8. How do you derive the value of golden ratio?
A8. By using the quadratic equation $x^2 - x - 1 = 0$

Q9. Can you tell us about any applications of Golden Ratio?

A9. The golden ratio is used mostly in the Geometry to create designs that are in proportions and are pleasing to the eye. It is not used as such in Mathematics directly but even the ratio of consecutive numbers in fibonacci series are close to the golden ratio.

Q10. Can you describe some uses of Golden Ratio in architecture and art?

A10. The Great Pyramids of Gaza, Parthenon in Athens, Michelangelo's The Creation of Adam on the ceiling of the Sistine Chapel and Da Vinci's Mona Lisa are some of the famous examples that use the Golden Ratio.

Q11. The ancient Egyptians used the golden ratio in their pyramids. At that time, the golden was known to them by another name, do you know the name?

A11. The Sacred Ratio.

Q12. Do you know about any other fields golden ratio is claimed to appear?

A12. The golden ratio is claimed to appear in many fields, such as cosmology, theology, arts, architecture, botany and others.

Q14.Would you like to include Irrational constants like Golden ratio in the calculator?

A14. Yes. I would prefer it, as I would work with Golden Rectangle in the future.

5 Problem 3: Persona

Problem 3

Niloy Eric Costa
MSc Candidate

Gender : Male

Age : 27 years

Email: niloyeric-costa@gmail.com

Country: Canada

Skills

Experience

Niloy Eric Costa is a MSc candidate in Computer Science at York University. His supervisor is Manos Pappagelis and he is a member of the Data Mining Lab. He works in Interactive Data Visualization. He is an experienced Cyber security consultant with hands on experience on PAM systems and SIEM Systems with in-depth understanding of Telecommunications industry

Interest

His research interests includes Data Visualization, Database Systems, Data Mining. He is familiar with Golden Ratio. He is open to work with Golden Ratio in future if required.

Likes|Dislikes

He is a member of the Data Mining Lab. He loves to research on mathematical constants and reads articles on them.

Business Values

He is interested on working with different irrational constants. He is wiling to work on Golden Ratio in near future and he needs a calculator that uses Golden Ratio.

Figure 1: Persona
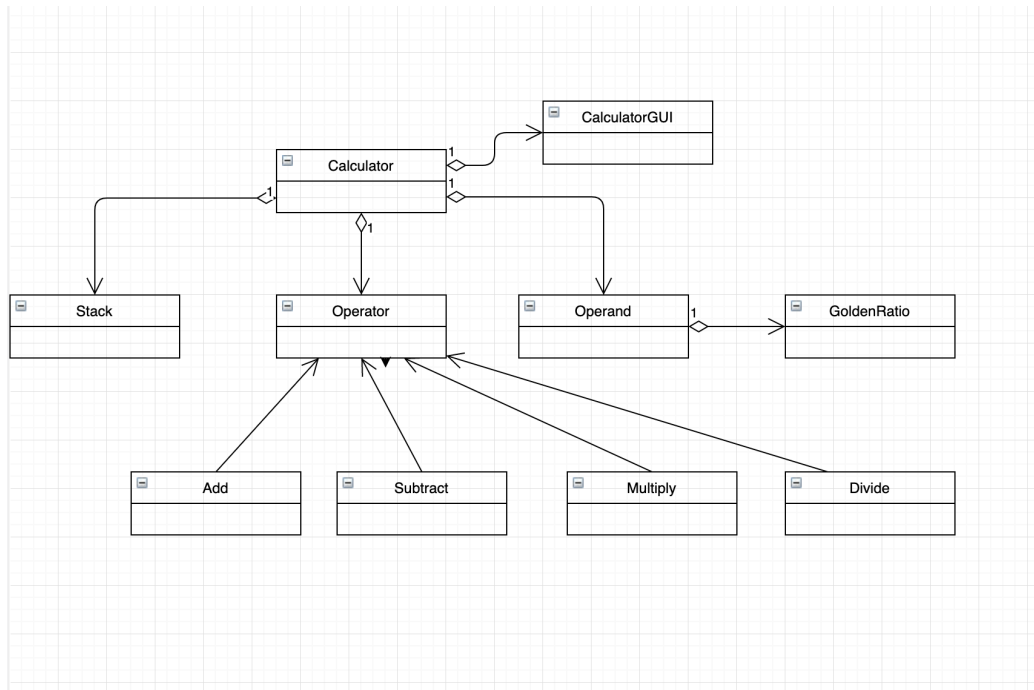
6 Problem 4: Domain Model

Figure 2: Domain Model

6.1 Domain Model Description

Concept Name	Calculator
Description	It is a basic calculator which takes input in GUI from user and looks for Operands and Operators.

Concept Name	CalculatorGUI
Description	It is Graphical User Interface. The user interacts with the GUI and gives inputs and it displays the output. It has aggregation relation with Calculator

Concept Name	Operator
Description	It is a class to identify the operators. It has aggregation relation with the calculator.

Concept Name	Golden Ratio
Description	It extends Operand and is an irrational number. The value is 1.618

Concept Name	Addition, Subtraction, Multiply, Divide
Description	These extends the operator and add, subtract, multiply and divide operands

Concept Name	Stack
Description	It stores the numbers used and the results

7 Problem 5

7.1 Use Case Diagram
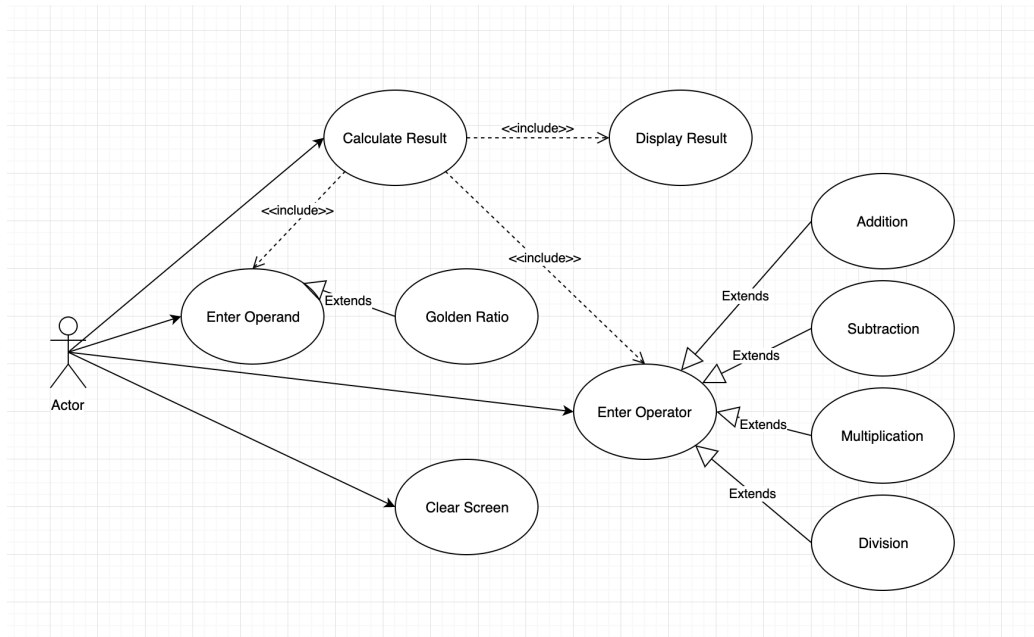
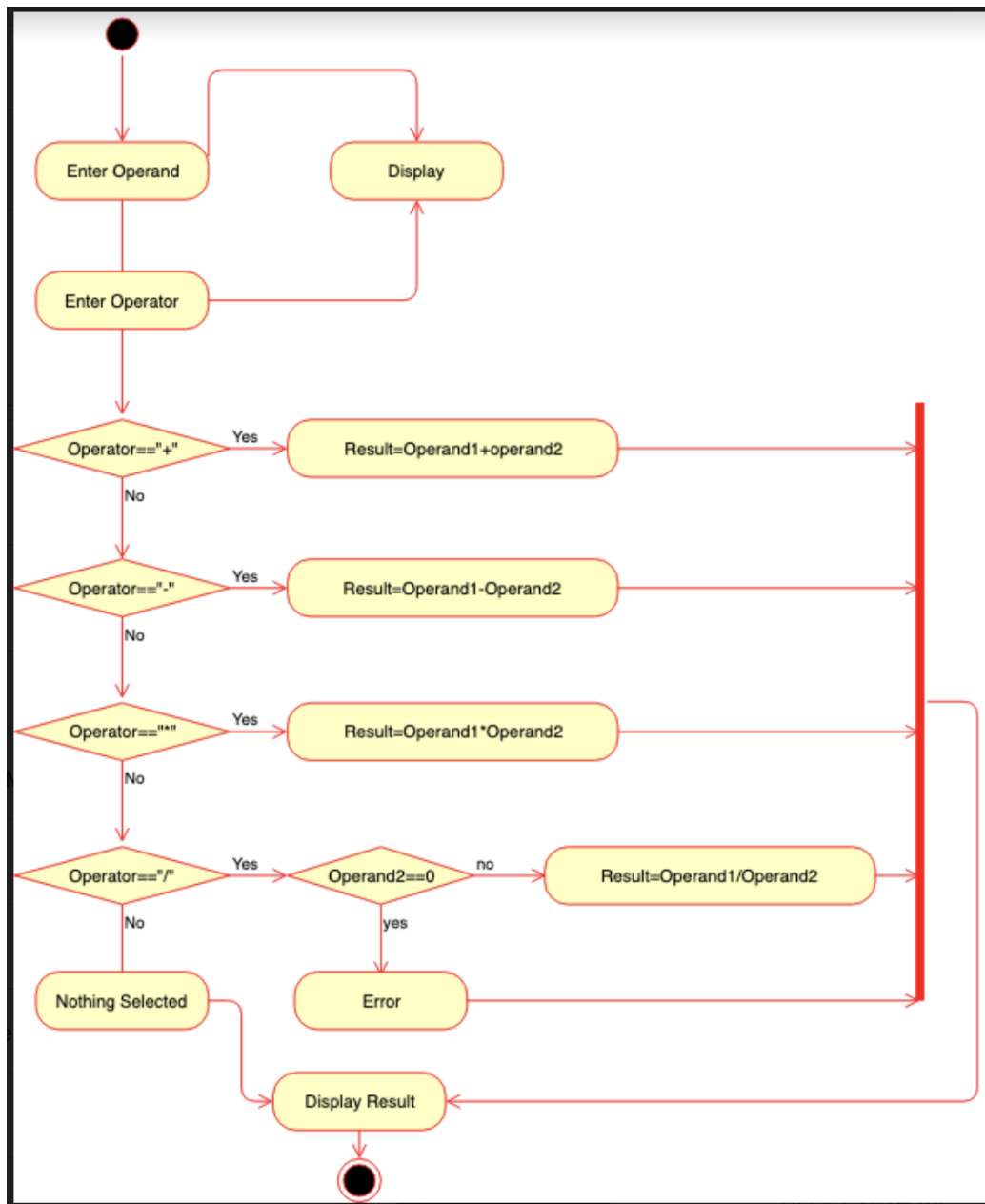Figure 3: Use Case diagram
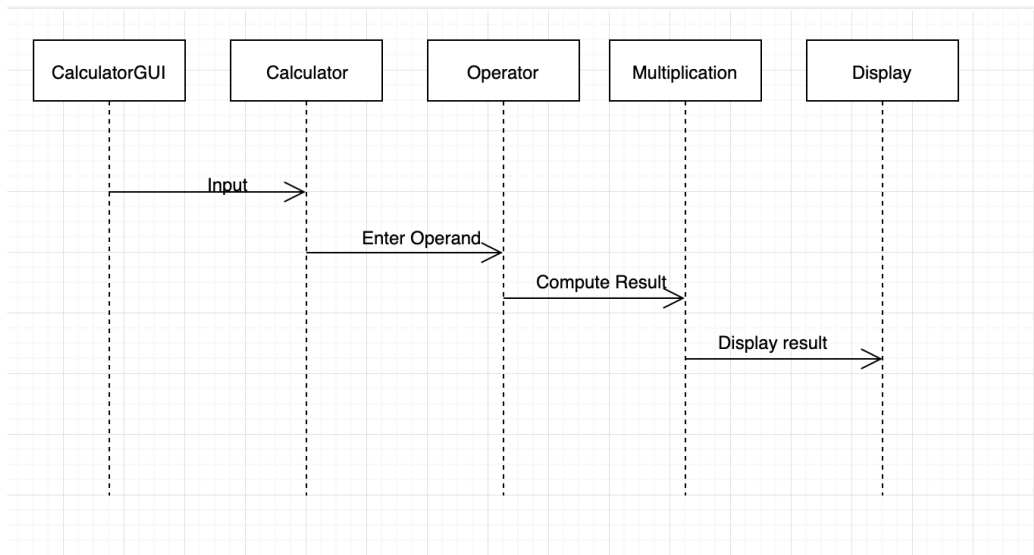
7.2   Activity Diagram

Figure 4: Activity diagram
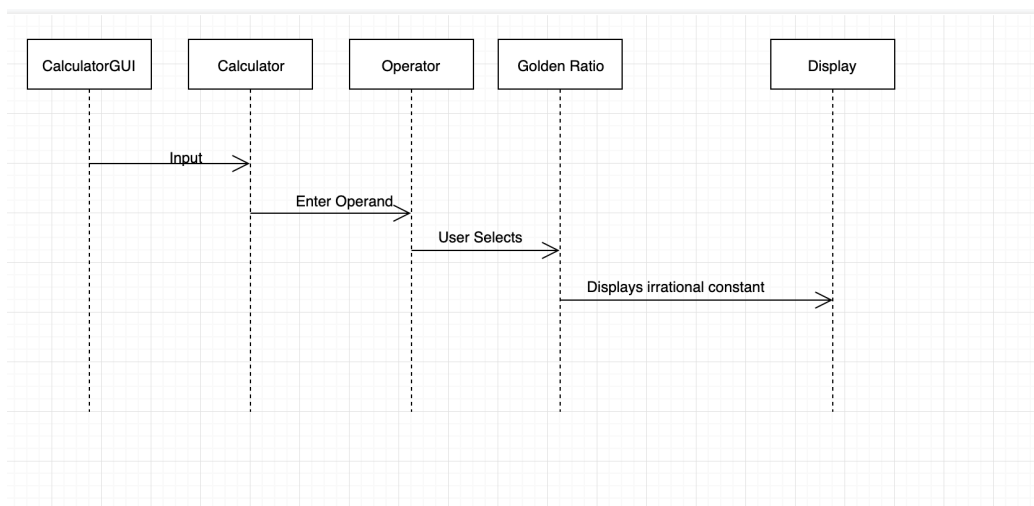
7.3 Scenario

Figure 5: Sequence Diagram

Figure 6: Sequence Diagram with Golden Ratio

8 Problem 6

8.1 User Stories

User Story	User Statement	Estimates	Constraints	Priority
US01	The user can enter the shortest number and obtain the largest number which satisfies Golden Ratio.	3 d	A > 0	HIGH
US02	The user can enter two positive operands and obtain the result of sum of these two.	1 d	A > 0, B > 0	HIGH
US03	The user can enter two positive operands and obtain the result of subtraction of these two.	1 d	A > 0, B > 0	HIGH
US04	The user can enter two positive operands and obtain the result of multiplication	1 d	A > 0, B > 0	HIGH
US05	The user can enter two positive operands and obtain the result of division	1 d	A > 0, B > 0	HIGH
US06	The user can clear the screen for for entering new operands	1 d	NONE	LOW

8.2   Acceptance Criteria for User Story

1. User Story 1: When User enters one operand and then selects Golden Ratio, it will display a number larger than the operand which satisfies Golden Ratio.

2. User Story 2: When User enter two operands and selects Operator Addition, it will display the result of the sum.

3. User Story 3: When User enter two operands and selects Operator Subtraction, it will display the result of the subtraction.

4. User Story 4: When User enter two operands and selects Operator Multiplication, it will display the result of the multiplication.

5. User Story 5: When User enter two operands and selects Operator Division, it will display the result of the division.

6. User Story 6: When User wants to clear the screen, it will clear the screen.

9 Problem 7: Traceability Matrix

Number	User Story	Sources
1	US01	In Use Case diagram: Enter Operand, Golden Ratio
2	US02	In Use Case diagram:Enter Operator, Addition
3	US03	In Use Case diagram:Enter Operator, Subtraction
4	US04	In Use Case diagram:Enter Operator, Multiplication
5	US05	In Use Case diagram:Enter Operator, Division
6	US06	In Use Case diagram:Clear Screen

Glossary

Khinchin's constant- For almost all real numbers x, coefficients a_i of the continued fraction expansion of x have a finite geometric mean that is independent of the value of x and is known as Khinchin's constant.

References

[1] Mario Livio. *The golden ratio: The story of phi, the world's most astonishing number.* Broadway Books, 2008.

[2] Amir A. Shafie Md. Akhtaruzzaman*. *Geometrical Substantiation of Phi, the Golden Ratio and the Baroque of Nature, Architecture, Design and Engineering.* International Journal of Arts 2011; 1(1): 1-22, 2011.