PROJECT DELIVERABLE-I
SUMMER 2019
SOEN 6481

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Table of Contents

PROBLEM 1. Give a brief description of your number, including the characteristics that make it unique.

SOLUTION 1. In mathematics, two quantities are in the **silver ratio** (also **silver mean** or **silver constant**) if the ratio of the sum of the smaller and twice the larger of those quantities, to the larger quantity, is the same as the ratio of the larger one to the smaller one (see below). This defines the silver ratio as an irrational mathematical constant, whose value of one plus the square root of 2 is approximately 2.4142135623.
The silver ratio is denoted by δ_S.
The relationship described above can be expressed algebraically:

$$\frac{2a + b}{a} = \frac{a}{b} \equiv \delta_S$$

$$2 + \frac{a}{b} = \frac{a}{b} \equiv \delta_S$$

The Ratio between the Pell sequence tends towards the Silver Ratio:

0 1 2 5 12 29

$P_n = 2P_{n-1} + P_{n-2}$

Divide both the side by P_{n-1}

$$Pn/Pn - 1 \ = \ 2\,Pn - 2/Pn - 1$$

If we solve the equation, we get

$$\delta_S \ = \ \sqrt{2} \ + \ 1$$

PROBLEM 2. Rationalize briefly the choice of your interviewee. Prepare interview questions together and conduct an interview of a potential user.

SOLUTION 2. The interviewees of the interview are the software engineers. Those who are completed their bachelor's or master's or pursuing it. The rationale of selecting them is there integrity, predisposition, past experience and understanding that can influenced the information obtained. The respondent interviewed are having strong knowledge of the underlying domain as they come from the same background and their past experience also show that they are more aware about the mathematical numbers, functions and operations. The respondents may provide a better knowledge of the underlying domain because they are the student of science and had studied physics and mathematics where these kinds of numbers are frequently used.

User Interview Questions:

First interview
1. Why you use calculator.

   Answer: For fast solution to the problems.

2. How often you use the calculator.

   Answer: As a professor, I use the calculator when I am teaching my students and clearing their doubt in big calculations.

3. What kind of feature you want to have in the calculator?

   Answer: As a professor, I like scientific calculators as it contains all the functionality.

4. Do you prefer basic calculator or scientific calculator?

   Answer: Scientific calculator.

5. What kind of user interface requirements you have?

   Answer: Its button should be big enough to be easily used. The display also should be bright enough.

6. What kind of expectations you have from the calculator?

   Answer: It provide an accurate answer quickly.

7. What is the different between the rational and irrational numbers?

   Answer: The number which can be written in the form of p/q is rational number and which cannot be written in the form p/q are irrational number.

8. Can you please give a brief explanation about the silver ratio?

   Answer: Given two numbers *a* and *b* with *a* > *b*, the ratio a/b is the silver ratio if it equals to the ratio of the sum of the smaller *b* and twice the larger *a* to the larger number *a*

9. Can you please give the example silver ratio where it is used?

   Answer: In architecture and designing building.

10. Do you please give me an example of silver ratio used with another mathematical forms?

    Answer: The silver ratio and Pell numbers
            The silver rectangle and the silver spiral.

11. Do you have ever used Silver Ratio for any of your work, apart from studies.

    Answer: Not exactly, but yes, I have been teaching this to many of my students of architectural background for 8 years and have helped some of them with their final projects where this ratio was used extensively.

Second interview

1. Why you use calculator.

   Answer: To calculate the number fast and efficiently.

2. How often you use the calculator.

   Answer: Whenever I have the one and there is a need for calculation.

3. What kind of feature you want to have in the calculator?

   Answer: As I am an engineer, I like scientific calculators because of its functionality and availability of all the mathematical operations in a single device.

4. Do you prefer basic calculator or scientific calculator?

   Answer: Scientific calculator.

5. What kind of user interface requirements you have?

   Answer: It should be simple and easy to use; the button should be big enough to be easily used.

6. What kind of expectations you have from the calculator?

   Answer: It gives accurate answers with precision.

7. What is the different between the rational and irrational numbers?

   Answer: A rational number is a number that can be expressed as a fraction (ratio) in the form p/q where p and q are integers and q is not zero. An irrational number cannot be expressed as a fraction with integer values in the numerator and denominator.

8. Can you please give a brief explanation about the silver ratio?

   Answer: if the ratio of the sum of the smaller and twice the larger of those quantities, to the larger quantity, is the same as the ratio of the larger one to the smaller one. This gives the ratio of irrational number.

9. Can you please give the example silver ratio where it is used?

Answer: In architecture and designing building. It is used in building skyscraper like Tokyo sky tree and Japanese temples.

10. Do you please give me an example of silver ratio used with another mathematical forms?

Answer: The silver ratio and Pell numbers.
The silver rectangle and the silver spiral.
The silver ratio and the octagon.

11. Do you have ever used Silver Ratio for any of your work?

Answer: Yes, many a times. Firstly, I had used this number during my final year   project. And afterwards, I have been using this great ratio in many of the architectural designs of buildings and temples. Recently, I got an opportunity in Japan to design a Japanese temple and in that venture this number was almost used in every calculation.

Third interview
1. Why you use calculator.

    Answer: For quick calculation.

2. How often you use the calculator.

    Answer: During my study time and during the exams.

3. What kind of feature you want to have in the calculator?

    Answer: I would like to have all the scientific functionality in my calculator to easily solve the hard-mathematical problems quickly.

4. Do you prefer basic calculator or scientific calculator?

    Answer: scientific calculator.

5. What kind of user interface requirements you have?

    Answer: Big display with large button to simply type the numbers and operator.

6. What kind of expectations you have from the calculator?

    Answer: Provide right answers.

7. What is the different between the rational and irrational numbers?

    Answer: The number in the form of p/q are rational and which is not are irrational number.

8. Can you please give a brief explanation about the silver ratio?

    Answer:
    $$\frac{2a + b}{a} = \frac{a}{b} \equiv \delta_S$$

    This is the equation for the silver ratio where δ_S is the silver ratio.

9. Can you please give the example silver ratio where it is used?

Answer: in building architecture and designs.

10. Do you please give me an example of silver ratio used with another mathematical forms?

Answer: The silver ratio and Pell numbers.
The silver spirals.

11. Do you have ever used Silver Ratio for any of your work?

Answer: Not yet. But yeah, I am planning to do a final project on Design and construction of Skyscraper. In that I will be using Silver ratio to great extent.

PROBLEM 3. Persona template.

SOLUTION 3.

Name: Gurpreet Kour

Email: gurpreetkour2016@gmail.com

Gender: Female

Age: 30

Profession: Professor

Skill level: High

User story: Gurpreet Kour is professor in Punjab educational department. She is highly educated and also involve in many research related activities. She also teaches the student in the university and also guide them with their thesis and all. So, she deals with lots of calculation during her teaching and office hours.

Wish

1. Needs a calculator.
2. To get accurate and quick result.

Motivation:

1. To help students in their studies
2. Calculation speed

Pain Points:

1. Too much time spend on calculation.
2. Getting fewer option on calculator.

Name: Tirth Ahluwalia

Email: Tirthwalia10@gmail.com

Gender: Male

Age: 26

Profession: Civil Engineer

Skill level: High

User story: Tirth Ahluwalia is Civil Engineer. Completed his master's in civil engineering from Concordia university. He had done his bachelors from DAV University. He had two years of experience in SOMA PVT. LTD where he worked as a civil Engineer. He is dealing with construction project where he has to do lots of calculation including golden ratio and silver ratio. So, he needs a calculating device which give him accurate results quickly.

Wishes:

1. Fast calculating device
2. Clarity of information

Motivation:

1. Professionalism
2. Reputation

Pain Points:

1. Wastage of time
2. Easy to make mistake when calculation done manually
3. Usage of paper

Name: Rupali Kaur

Email: rupalidhalla@gmail.com

Gender: Female

Age: 28

Profession: PhD Student

Skill level: Intermediate

User story: User story: Rupali Dhalla is a PhD student in Punjab Technical University. She is very good in subjects like physics, chemistry and mathematics. She is doing research and needs to do lots of calculations.

Wishes:

1. Fast processing device
2. Right answers

Motivation:

1. Intellectual challenge
2. Being appreciated

Pain Points:

1. Spend too much time on single problem.
2. Have to work late due to big calculation.
3. Lack of time

PROBLEM 4: Using UML, construct a problem domain model for your project.

SOLUTION 4:

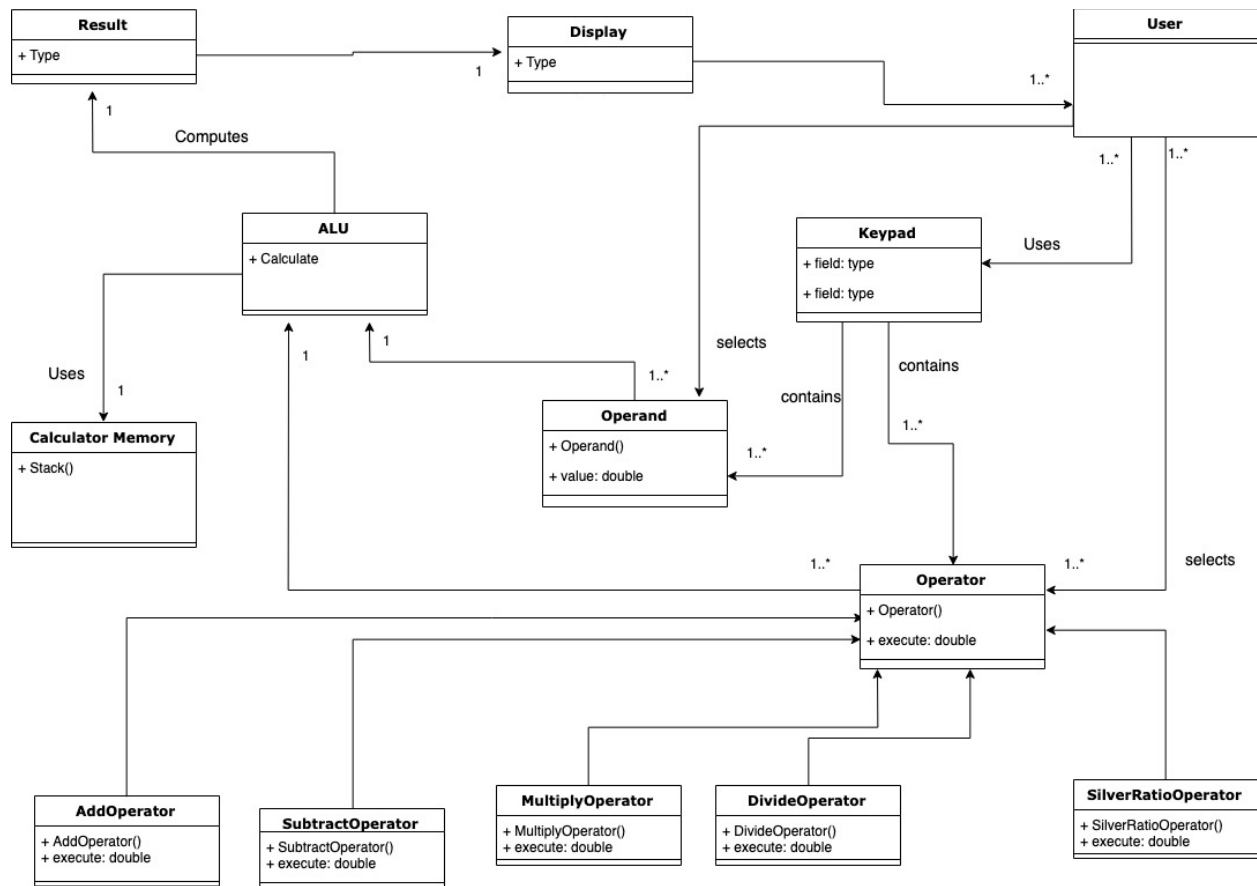| Concept 1	Concept 2	Relationship
User	Keypad	User uses keypad
Keypad	Operand	Keypad have operand
Keypad	Operator	Keypad have operator
Operand	ALU	Operand gets to ALU
Operator	ALU	Operator gets to ALU
ALU	Results	ALU calculates result
User	Display	User see the result on Display

Table 1: Relevant relation between concepts

Figure 1: Domain Model

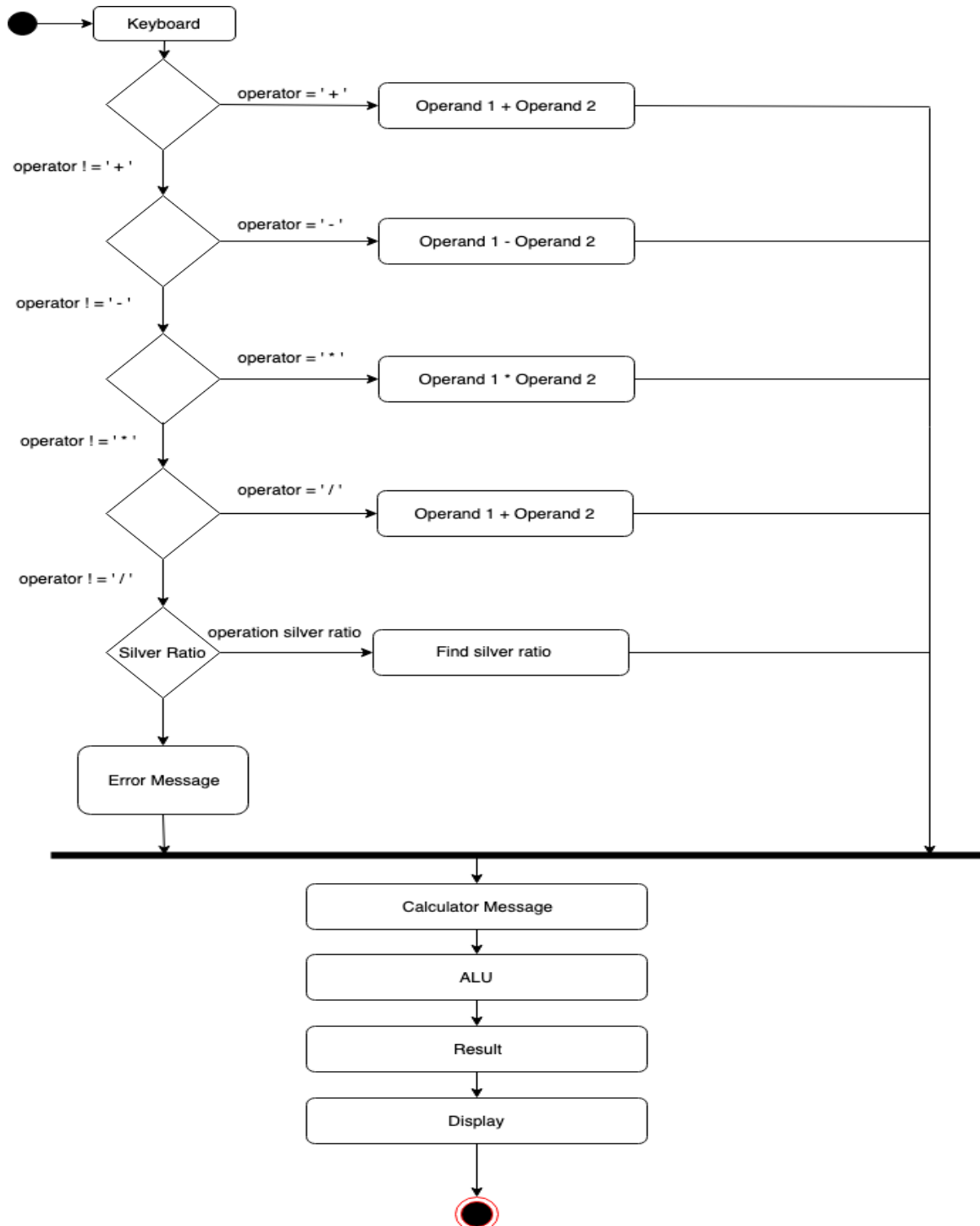# PROBLEM 5: Using UML, construct two different views of a use case model.
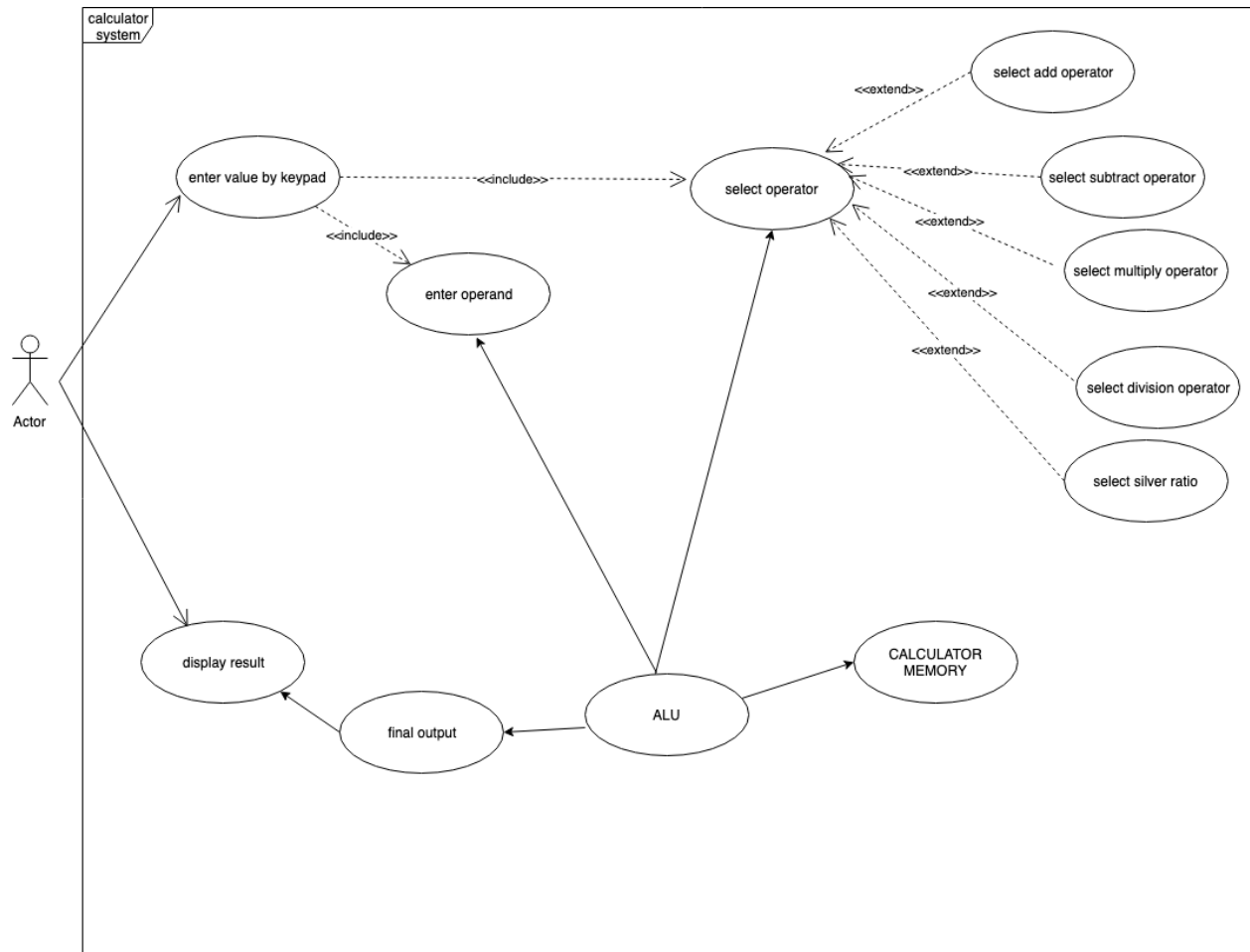

Figure 2: Activity Diagram
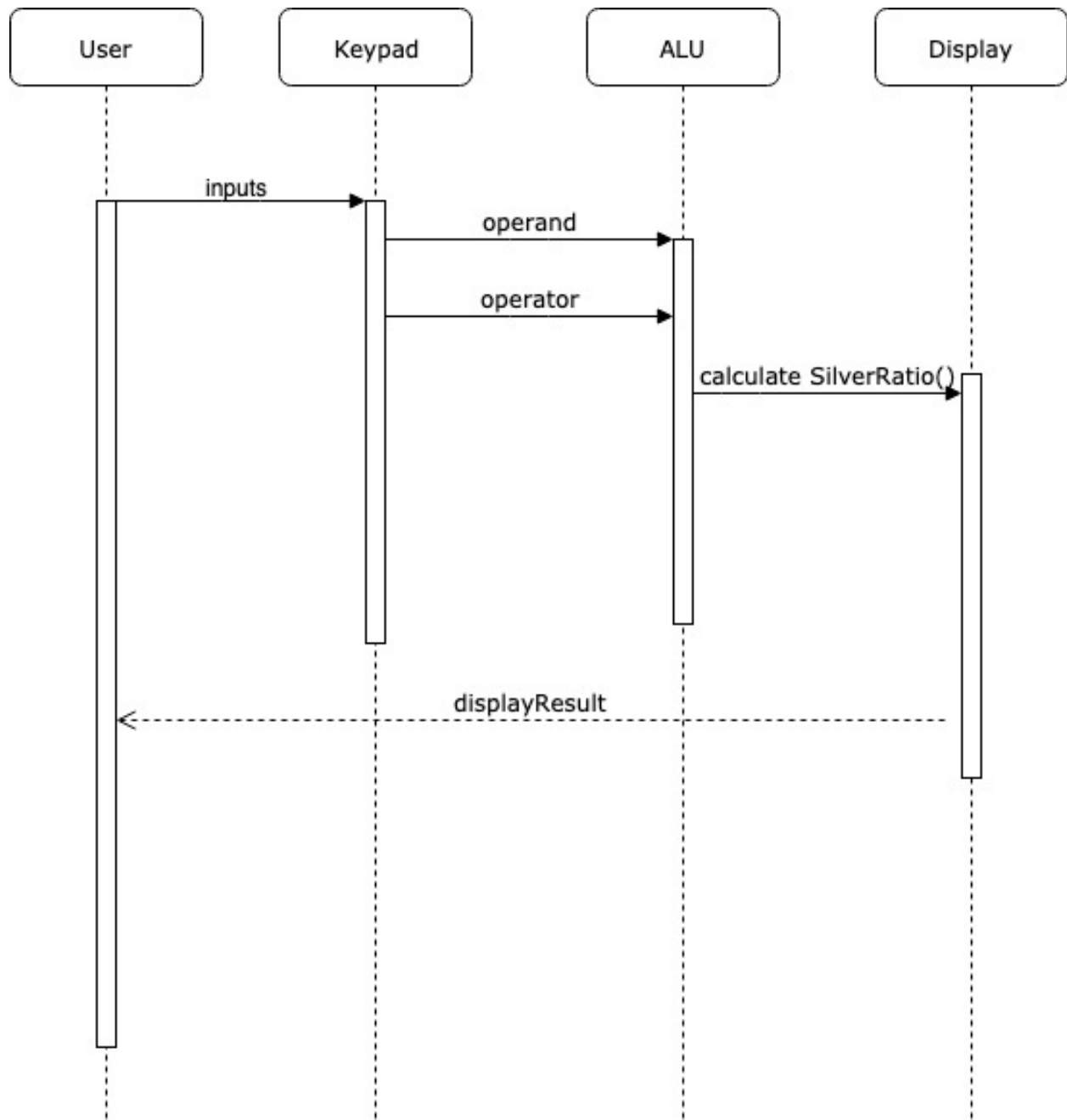
Figure 3: UML Use Case Model

Figure 4: Sequence Model for calculating silver ratio

System	Calculator
Identifier	UC-1
Name	Keypad
Summary	The user can enter the number using keypad
Priority	5
Pre-condition	1. The user should be active 2. Know how to use calculator 3. Knowledge of operator and operand
Post-condition	1. Result on the screen
Primary actor	User
Secondary actor	ALU
Trigger	The user wants to use calculator
Main Scenario	1. The user knows the equation to solve 2. Enter the equation 3. Get the result
Open issue	User enter wrong operand (e.g. 0)

Table 2:Use case scenario for Keypad

System	Calculator
Identifier	UC-2
Name	Display
Summary	The user sees the value entered by keypad and see the calculated result.
Priority	5
Pre-condition	The user enters the value in calculator
Post-condition	Result on the screen
Primary actor	User
Secondary actor	ALU
Trigger	The user enters the value
Main Scenario	1. The user knows the equation 2. The user enters the value 3. Result is shown on the screen
Open issue	User enter wrong operand (e.g. 0)

Table 3: Use case scenario for Display

System	Calculator
Identifier	UC-3
Name	operand
Summary	The user enters the operand according to the equation they want to solve.
Priority	4
Pre-condition	The user enters the operand in the equation
Post-condition	The result is on the screen
Primary actor	User
Secondary actor	ALU
Trigger	The user enters the valid equation (operand and operator)
Main Scenario	The user enters the valid equation (operand and operator)
Open issue	

Table 4: Use case scenario for Operand

System	Calculator
Identifier	UC-4
Name	Operator
Summary	The user enters the operator according to the equation they want to solve.
Priority	4
Pre-condition	The user enters the operator in the equation
Post-condition	The result is on the screen
Primary actor	User
Secondary actor	ALU
Trigger	The user enters the valid equation (operand and operator)
Main Scenario	The user enters the valid equation (operand and operator)
Open issue	

Table 5: Use case scenario for Operator

System	Calculator
Identifier	UC-5
Name	ALU
Summary	Calculates the equation enter by the user and send the result on the screen
Priority	4
Pre-condition	The user enters the value
Post-condition	Calculate the result and show on the display
Primary actor	User
Trigger	The user enters the value
Main Scenario	1. The user enters the equation 2. Check for the right operator 3. Check for the right operand 4. Calculate the value 5. Send value to the display 6. Display result
Open issue	Wrong answer, error message

Table 6: Use case scenario for ALU

System	Calculator
Identifier	UC-6
Name	Calculator memory
Summary	Used to store the value entered by the user
Priority	4
Pre-condition	The user enters the value
Post-condition	Use the value for calculation and show the desired result
Primary actor	User
Secondary actor	ALU
Trigger	The user enters the value and ask for result
Main Scenario	1. The user enters the equation 2. Check for the right operator and operand 3. Store the value in the memory 4. Calculation the value by ALU 5. Store the result in the memory 6. Send value to the display Display result
Open issue	Error message

Table 7: Use case scenario for Calculator memory

System	Calculator
Identifier	UC-7
Name	Silver Ratio
Summary	calculate the ratio between two number
Priority	5
Pre-condition	1. Input from the users
Post-condition	2. Calculated ratio shown on the screen
Primary actor	User
Secondary actor	ALU
Trigger	The user presses the silver ratio button to calculate the ratio between two number.
Main Scenario	1. The user enters the two inputs 2. Press the silver ratio button 3. ALU calculates the ratio 4. Result shown on the screen

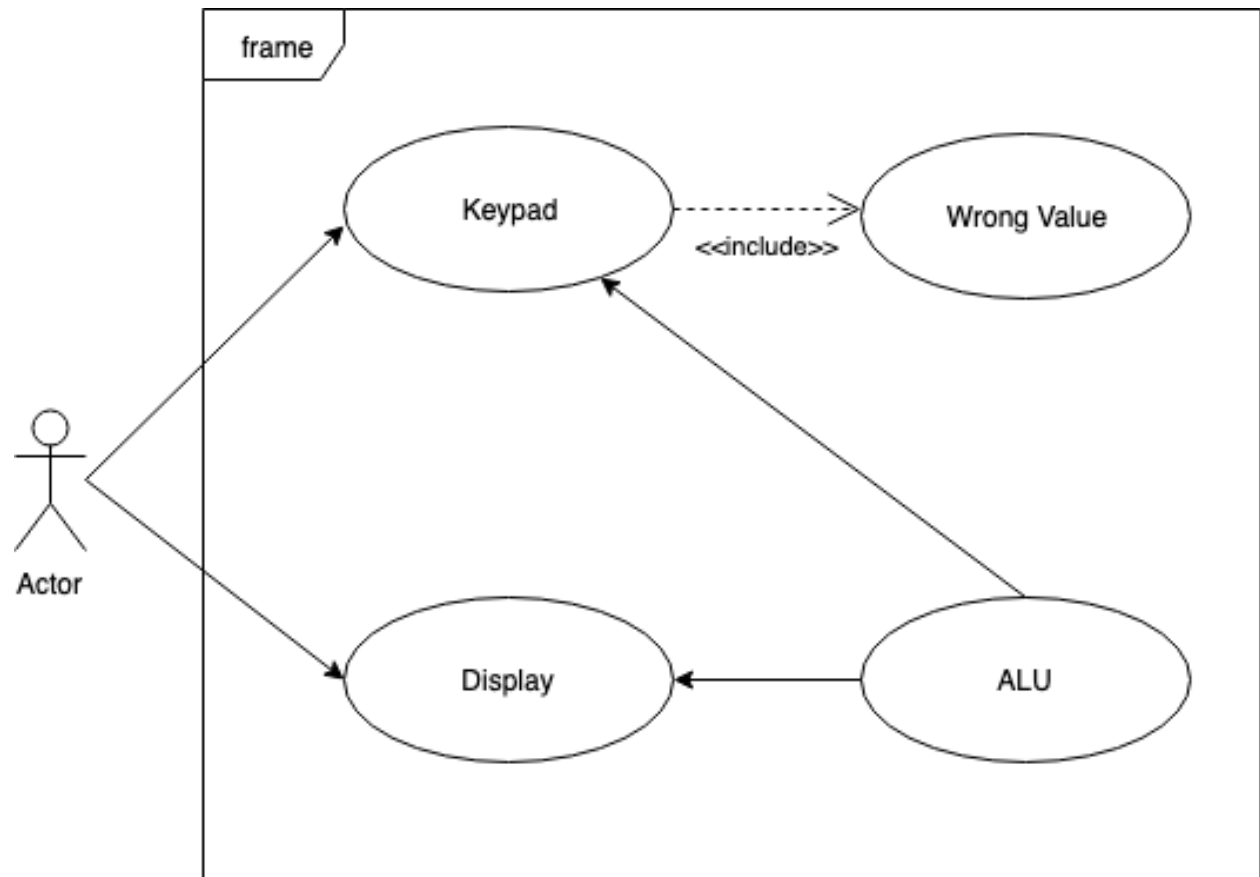*Table 8: Use case scenario for Silver ratio*

Negative Use Case Model:

Figure 5: Negative Use Case Model

System	Calculator
Identifier	NUC-1
Name	Wrong value
Summary	Give the wrong input
Priority	3
Pre-condition	Input from the users
Post-condition	Error message shown on the machine
Primary actor	User
Secondary actor	ALU
Trigger	The user presses the silver ratio button to calculate the ratio between two number.
Main Scenario	1. The user enters the two inputs 2. Press the silver ratio button 3. a > b (the value of a is greater than b) 4. Error message on the screen

Table 9: Use case Scenario for wrong value

References:

[1]https://en.wikipedia.org/wiki/Silver_ratio

[2]http://mathworld.wolfram.com/SilverRatio.html

[3]https://www.researchgate.net/publication/288496866_Variations_on_a_Theme_of_the_Silver_Ratio

[4] https://www.math.uh.edu/~shanyuji/History/2016/2016-2-3.pdf

[5] https://www.researchgate.net/
[6]http://users.encs.concordia.ca/~kamthan/courses/soen-6481/use_case_modeling_introduction.pdf
[7] http://users.encs.concordia.ca/~kamthan/courses/soen-6481/interviews_introduction.pdf
[8] http://users.encs.concordia.ca/~kamthan/courses/soen-6481/use_case_modeling_introduction.pdf