

# ALGORITHMS USING VEDIC MATHEMATICS

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VEDIC MATHEMATICS

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## Acknowledgement

The project “**Algorithms using Vedic Mathematics**” is the result of persistent efforts which helped us to bring out the creativity in us to the fore. During the period that has gone into executing this project we have interacted with a number of people who have guided us through various stages of the project. We take this opportunity to express our gratitude to them, whose guidance helped us bridge the gap between our academic knowledge and the requirements of the industry.

I express my profound thanks to our Prof. **Mr. Sandeep Bhide** who in bits and pieces has given great moral support and has acted as the nuts and bolts to the bridge of successful completion of our project.

Finally we express our heartfelt gratitude to our parents without whose prayers and efforts the completion of this work was not possible.

Last but not least, we like to feel indebted to the powerful almighty for providing us with all the patience and strength to complete the project on time.

Place: Pune

## INTRODUCTION

What does the word “VEDIC MATHEMATICS” mean????

- Vedic mathematics - a gift given to this world by the ancient sages of India. A system which is far simpler and more enjoyable than modern mathematics.
- The simplicity of Vedic Mathematics means that calculations can be carried out mentally though the methods can also be written down. There are many advantages in using a flexible, mental system. Pupils can invent their own methods, they are not limited to one method. This leads to more creative, interested and intelligent pupils.
- Vedic Mathematics refers to the technique of Calculations based on a set of 16 Sutras, or aphorisms, as algorithms and their upa-sutras or corollaries derived from these Sutras. Any mathematical problems (algebra, arithmetic, geometry or trigonometry) can be solved mentally with these sutras. Vedic Mathematics is more coherent than modern mathematics.

The word “Vedic” is derived from the Sanskrit word “Veda”. ”Veda” itself means knowledge and anything “Vedic” literally means knowledge based power-house.

Generally people always think of something related to Vedas and Shlokas or even something related to the language “Sanskrit” .....

Well the word “VEDIC” has definitely originated from the language Sanskrit and also it is related to the Vedas and Shlokas.....

What is the first impression of a person when he hears the word “VEDIC”???? Well its for sure that he will be definitely thinking of some ancient age process and will be scared too...But its not so.... Those who really want to know what does this word mean then they really doesn't need to learn the Vedas and Sutras although some of its applications do come into picture....

To start with, there are four types of Vedas namely:-

- 1) The Rig Veda
- 2) The Yajur Veda
- 3) The Sama Veda
- 4) The Atharva Veda

In addition to these Vedas mentioned above they do have four Upavedas(Sub-Vedas), they are mentioned respectively below as:::---

- 1) The Ayurveda → Related to medical sciences
- 2) The Dhanurveda → Related to archery and other military sciences
- 3) The Gandharvaveda → Related to the science and art of Dance/Music
- 4) The Sthapatyaveda → Related to engineering, architecture, science etc.  
Mathematics is considered to be a part of this sub-veda

VEDIC MATHEMATICS

## The Main Sutras.

Sutra	Translation
एकाधिकेन पूर्वेन	By one more than the one before.
निखिलं नवतश्चरमं दशतः	All from 9 and the last from 10.
लघ्वर्तियग्भ्यामं	Vertically and Cross-wise
परावर्त्य योजयेत्	Transpose and Apply
शून्यं साम्यसमुच्चये	If the Samuccaya is the Same it is Zero
आनुरूप्ये शून्यं अन्यत्	If One is in Ratio the Other is Zero
संकलन व्यवकलनाभ्यां	By Addition and by Subtraction
पूरणापूरणाभ्यां	By the Completion or Non-Completion
चलनकलनाभ्याम्	Differential Calculus
यावदूनं	By the Deficiency
व्यष्टिसमष्टिः	Specific and General
शेषाण्यडेन चरमेण	The Remainders by the Last Digit
सोपान्त्यदयमन्त्यं	The Ultimate and Twice the Penultimate
एकन्यूनेन पूर्वन	By One Less than the One Before
गुणितसमुच्चयः	The Product of the Sum
गुणकसमुच्चयः	All the Multipliers

## The Sub Sutras

Sub sutra	Translation
आनुरूप्येण	Proportionately
शिष्यते शेषसंज्ञः	The Remainder Remains Constant
आधमाधेनान्त्यमन्त्येन	The First by the First and the Last by the Last
केवलैः समकं गुण्यात्	For 7 the Multiplicand is 143
वेष्टनम्	By Osculation
यावदूनं तावदुनं	Lessen by the Deficiency
यावदूनं तावदूनीकृत्य वर्गं च योजयेत्	Whatever the Deficiency lessen by that amount and set up the Square of the Deficiency
अन्त्ययोर्दशकेऽपि	Last Totalling 10
अन्त्ययोरेव	Only the Last Terms
समुच्चयगुणितः	The Sum of the Products
लोपनस्थापनाभ्यां	By Alternative Elimination and Retention
विलोकनं	By Mere Observation
गुणितसमच्चयः समुच्चयगुणितः	The Product of the Sum is the Sum of the Products
ध्वजाड	On the Flag

## Theory

***Transpose and Apply*** would describe the reversing that we often use in our thinking. We look at something from the other person's point of view; we feel compassion; we 'change our mind' and do the opposite of what we were going to do. It makes sense as a cosmic principle as we see plants grow and then die away, the sun rises and sets. In one of Aesop's fables a bird was trying to drink from a jug but could not reach down to the level of the water. After a while instead of struggling to get his head down far enough the bird went and got some stones which he dropped into the jug until the level had risen enough for him to drink the water.

***By One More than the One Before*** is also easy to see as a principle: everywhere we see things that follow on from, or are created out of, other things, due to the lawful nature of the universe. The Sutra expresses how one idea naturally leads to another: just by resting the mind on an idea another idea arises. This can happen sub-consciously when our mind wanders from one thought to another (sub-Sutra) or it can be a deliberate conscious choice to develop an idea. So, given a square you know that it has four right angles, and seeing someone walking towards you, you expect to pass them shortly.

The sutra ***By Addition and by Subtraction*** refers to the mental process of comparison. In comparing two things we look for similarities (addition) and differences (subtraction) between them. Addition involves bringing things together into the same group, and observing similarities involves noting those qualities which the two things have in common (i.e. can be grouped together). In subtraction we observe those qualities which differ in the two things. Shown two photographs of the same person taken ten years apart we notice similarities (we recognize common features which we mentally group together) and we notice differences (the person is taller, has different hair colour etc.). This is a very common mental technique. As a natural phenomenon we see that the forces of nature continually throwing things together and separating them.

The sutra ***Vertically and Crosswise*** can be related to decision making and evaluation. In assessing something we weigh up all its aspects, perhaps giving strengths to each of them and then finally coming to a decision by summing all these results. For example, in deciding at what time to leave home for a meeting we may consider traffic, weather, how long it takes to prepare, implications of being late and so on. We assess the importance of each one and sum them, rather like multiplying pairs of numbers and adding the results, as we do in Vertically and Crosswise multiplication. This is also a very common mental process. As a principle of nature it seems to describe how everything is interconnected.

***All from Nine and the Last from Ten***. Here we first need to interpret nine and ten in more general terms in order to understand them as more general entities. In the generation of whole numbers from number one each new digit is one more than the previous one and is more complex than the previous one. In a sense nine is the most complex digit as the next number, ten, is one with zero (i.e. 10). Ten represents a new unity, a new order of unity and it contains the previous nine

numbers. Nine is the stage just before unity is reached. So the Sutra describes repeated non-unity, followed by unity. In following this sentence, for example, all the parts of it are absorbed before the full comprehension of the meaning of the sentence and we know at each step that we are moving towards a unity. All the parts are like nines, they are all short of the unity sought, but together they lead to a new unity, ten.

In fact if we look we see this principle operating everywhere. A house is built: the foundations are laid, the walls go up, the water pipes are put in etc. and the final result, ten, is the house. A plant grows until it reaches its fulfillment in its flower and its seed. We listen to someone and each point that is made is understood after hearing the words that make up the point being expressed. And each point may itself be leading to a further idea so that the same principle may apply on different levels. Whenever a new unity is realized there were steps that led to it. The same mental activity will be recognized in the way we sometimes continually think about something in order to try to understand it or to come to terms with it.

The Sutra refers to the reaching of a new state. So understanding, comprehension, realisation, enlightenment etc. all express this. A ball rolls along a table top, but when it reaches the edge it goes into a different state. Then it falls until it reaches an obstacle when it again changes its state of motion. We may see parallels in our own life.

***If the Samuccaya is the same it is Zero.*** The word 'samuccaya' has several meanings we are told, but usually it can be interpreted as total' or 'combination'. So we may say '*If the Total is the Same it is Zero*'. Sometimes it is the sameness of something that is significant. We do not realise that the clock was ticking until it stops. A word constantly repeated becomes meaningless. As long as things are as normal (the same) we do not register them (it is zero). In a Sherlock Holmes story Sherlock Holmes points out to Dr Watson that the fact that the dog **did not** bark is significant (it meant that the dog knew the intruder). If walking to a place by a different route to the normal one has no advantage we are not inclined to take that route. We ignore what is irrelevant or what we prefer not to see. We 'put it out of our mind'.

***If One is in Ratio the other One is Zero.*** We can put our mind onto anything we like. We choose our opinions and beliefs and so ignore contrary views. We choose a meal from a menu, we select certain beliefs that we choose to hold, discarding all others. A country chooses a leader, he speaks and acts for the people (he is in ratio) the others need do nothing. We make an assumption or we take a stand. We frequently decide to take something as true/given (in ratio) and proceed on this assumption, leaving other possibilities aside (equal to zero) for the moment. When looking for a blue sock among a drawer full of socks we can mentally tell our mind to see only blue. (The word 'ratio' comes from a Latin word that means 'reason').

***By the Completion or Non-Completion.*** Sometimes we can see a whole even though the whole is not there. Three-quarters of a circle immediately gives the impression of a full circle. We see symmetry in the beauty of a flower even though perfect symmetry is not there. When we 'jump to a conclusion' we see, or think we see, some idea. We complete the whole. So, someone is speaking and we know what they are saying before they finish saying it. The detective pieces together what has happened by a series of clues. We say "I get the picture".

Completion implies non-completion, both are there together. We may deliberately leave something incomplete, we may wish to indicate something without actually saying it: it can be implied.

**Differential Calculus.** Calculus is all about change and motion, which are fundamental to creation. Mentally we may imagine the effect of changing something (while keeping other things constant); we can conduct ‘thought experiments’. We may consider the effect if a tree continues to grow, if interest rates continue to rise, if the rain doesn’t stop, what it might be like to jump on the moon and so on.

**By the Deficiency.** We often see how things fall short of an ideal. Differences from the norm stand out. We examine something we have made and see its shortcomings for example. These shortcomings are then the focus of our attention. (Looking for faults may be valuable in a car mechanic but not in a personal relationship).

It is the deficiencies or excesses that stand out and get noticed. We are interested in how much we are driving above or below the speed limit or whether we have thanked someone enough, or overdone it. A wrong note in a piece of music stands out.

**Specific and General.** This relates to the mental process of generalization from the specific, which we do all the time. In fact this is just what we have been doing with the Vedic Sutras in this paper: we take the idea of, say, addition and subtraction in the mathematical sense and look for a more abstract meaning of those words. Then we can look for mental processes that use this more abstract meaning: which is going from general to specific. Metaphors use this Sutra: when we say “leave no stone unturned” or “food for thought” it is the general quality that has been described by means of something concrete that has that quality.

We can use this technique for interpreting dreams because a dream may be a specific formulation of a general worry or concern: we may examine the essence of the dream and look for examples in the life of the dreamer of how that essential quality may manifest.

**The Remainders by the Last Digit.** Everything in the world is being continually modified by the things around it. We have ideas and sets of ideas about things and one observation or thought can lead to the whole structure being modified.

We can regard the ideas we have already as the remainders and the latest idea is the last digit that operates on those ideas and modifies them. For example, we learn something about someone and that modifies our opinion of them. Driving a different car to the usual one or treating someone differently because they are in an emotional state, we have to adapt our habits to cope with the change.

We also set up more permanent structures in the mind that apply for a lifetime. As we get older we can get more ‘set in our ways’, it is more difficult to adapt, to change our way of doing things. We say ‘You can’t teach an old dog new tricks’.

**The Ultimate and Twice the Penultimate.** In nature we often see that one thing triggers another: warm, wet weather causes seeds to germinate for example. The mind may act habitually in a certain way in response to a certain stimulus. One idea (the ultimate) may trigger a reaction, a

stronger set of ideas already fixed in the mind (the penultimate). I want to say something to a certain person when I see him; the sight of that person triggers the memory. At the time I decided to speak to that person I conditioned my mind to react when that person is sighted. One idea takes over from another. It is because the fixed ideas are stronger and take over that they count twice. We can use this to our advantage by alerting the mind to be selective in some way. Mother hears baby cry in spite of all the other sounds; she has conditioned her mind to be alerted to that sound. When we say 'it rings a bell' an internal idea has been awakened by something outside. The saying 'Once bitten, twice shy' also involves this idea.

***By One Less than the One Before.*** Sometimes we stand back and take an objective look at a situation. We may be struggling with some problem and decide that it is time to look at the bigger picture or perhaps we are feeling the pressure of too many commitments and think it is time to step back, relax and take a fresh look. Here you are in this room, in this country, on this planet etc.

This is the reverse of the Sutra *By One More than the One Before* (which describes deduction) and it also relates to the mental process of induction where a conclusion is reached based on a number of instances. For example the child sees objects fall to the ground when they are released and so naturally thinks that the next object released will fall. This has the same quality of stepping back.

***The Product of the Sum.*** Sometimes we have to assimilate several ideas and draw a result, or product, from them. 'Sum' suggests bringing some ideas together, and 'product' is a result that follows from this – it is the product of the sum. It is the overall impression. Bring a lot of men together and you have a crowd or an army: the whole is more than the sum of the parts.

***All the Multipliers.*** Sometimes we need to summarize a number of things. The final speaker at a conference brings together all the ideas that have been aired and discussed. You are saying goodbye to someone after a meeting and bring to your mind the important points from the meeting that are relevant in order to say the appropriate things.

These interpretations of the Sutras may or may not be on the right lines; and even if they are on the right lines considerable revision may be necessary. This is because the mind is very subtle and the Sutras seem to merge together at some points. Hopefully others will be able to extend and modify these ideas.

#### → **16sutras and sub-sutras (table)**

For comparing algorithms and code

“VEDIC MATHEMATICS” is closely related to all the four above mentioned Vedas.  
In short we can say that the Vedas and the Sutras are the hole and sole of vedic mathematics...

“VEDIC MATHEMATICS” helps us to solve a number of problems. Nowadays a number of researches have been undertaken to obtain the best benefit of it.

### ADVANTAGES

- 1) Helps to solve calculations much faster and in much easier way.  
By adopting this method there is no need to know the multiplication tables of two digits and so on.
- 2) Most of the arithmetic calculations which takes much time can now be solved just by using the “VEDIC” way.
- 3) Requires less number of lines in a page too.
- 4) One can even go to the digits of 50 or more than that after the decimal point depending upon the user requirements more efficiently and accurately..
- 5) It is the most beneficial way to crack the competitive examinations.

Researches are still been carried on to reveal most of the facts of Vedic mathematics.

It is more efficient and accurate compared to the normal “ABACUS” method which we use in our daily lives.

In C language or any other computer programming language there is a limitation on the range of numbers eg. In C Language

- 1) Data type “integer” has range from -32768 to +32767
- 2) Data type “real” has range from -3.4e38 to +3.4e38
- 3) Data type “long integer” has range from -2147483648 to +2147483647
- 4) Data type “char” has range from -128 to +127
- 5) Data type “unsigned char has range from 0 to 255
- 6) Data type “double” has range from -1.7e308 to +1.7e308

7) Data type “long double” has range from  $-1.7e4932$  to  $+1.7e4932$

Though the data types “double” and “long double” has a long range of numbers but it occupies more amount of space compared to the “character” data type.

For instance the data type “double” requires 8 bytes whereas the data type “character” requires only 1 byte.

So the question now arises as to how to allocate less memory with a long range of data type??

Well what we have actually tried to show is that “we can allocate less memory with a long range of data item.””

Using “VEDIC MATHEMATICS” we can decrease the Time Complexity and also the Space Complexity of a program.

As a result we can actually increase the processor speed and decrease the processor space.

VEDIC MATHEMATICS

## **APPLICATIONS**

- 1) It can be used in processor to fasten up the speed.
- 2) It can be used in aerodynamics where decimal places up to any number of digits are required.
- 3) It can be used in banking.
- 4) Can be beneficial in AUTO CAD/CAM.
- 5) It can be used in Astronomy.

VEDIC MATHEMATICS

## Operations

### MULTIPLICATION

The multiplication which we use in our daily lives is generally based on the modern mathematics or you can even say that it is actually based on the “ABACUS METHOD”.

Well how does a C compiler “actually” calculates the multiplication method or rather we can also say that what is the secret behind the “\*” sign in our normal calculators or in the computers.

Well, the following is been illustrated below:::

For eg.

If we want to multiply 45 and 67 denoted by

$$\begin{array}{r} 45 \\ *67 \end{array}$$

Well in a C compiler it calculates

```
As:::.....for(i=0;i<67;i++)
    {
        Sum=Sum+45;
    }
```

In short it will multiply 45 ,67 times.....or which ever is the second number we multiply a number by that many times.

Hence it uses 67 steps to complete this multiplication process.

The method which we have used uses the Sutra of

### VERTICALLY AND CROSSWISE

e.g. 1.

$$503*432.$$

$$\begin{array}{r} 503 \\ \times 432 \\ \hline \end{array}$$

$$\begin{aligned} & 20 / (0 + 15) / (10 + 0 + 12) / (0 + 9) / 6 \\ & = 20 / 15 / 22 / 9 / 6 \\ & = 217296. \end{aligned}$$

Steps:

- 1) R.H.S. =  $3 \times 2 = 6$ .
- 2) Next Left part =  $(0 \times 2) + (3 \times 3) = 9$ .
- 3) Next Left part =  $(5 \times 2) + \{0 \times 3\} + (3 \times 4) = 22$ .
- 4) Next Left part =  $(5 \times 3) + (0 \times 4) = 15$ .
- 5) L.H.S. =  $5 \times 4 = 20$ .

e.g. 2. **48\*736.**

Here you will see how to multiply a 2 X 3 digit number. Just prefix a Zero before the 2 digit Numb

$$\begin{array}{r} 048 \\ \times 736 \\ \hline \end{array}$$

$$\begin{aligned} & 0 / (0 + 28) / (0 + 12 + 56) / (24 + 24) / 48 \\ & = 0 / 28 / 68 / 48 / 48 \\ & = 35328. \end{aligned}$$

Steps:

- 1) R.H.S. =  $8 \times 6 = 48$ .
- 2) Next Left part =  $(4 \times 6) + (8 \times 3) = 48$ .
- 3) Next Left part =  $(0 \times 6) + (4 \times 3) + (8 \times 7) = 68$ .
- 4) Next Left part =  $(0 \times 3) + (4 \times 7) = 28$ .
- 5) L.H.S. =  $0 \times 7 = 0$ .

We will now study example of multiplying 5X5 digit numbers.

e.g.1. **12304\*56789.**

$$\begin{array}{r} 12304 \\ * 56789 \end{array}$$

$$5/16/34/40/66/66/55/32/36 = \mathbf{698731856.}$$

Steps:

- 1) Remember that a 5 X 5 digit problem will have 9 parts.
- 2) R.H.S. = Multiply both the Units place digits. Here  $4*9 = 36$ .
- 3) Next Left Part=Units & Tens. Here  $(0*9)+(4*8) = 0+32 = 32$ .
- 4) Next Left Part = Units, Tens & Hundreds. Here  $(3*9) + (0*8) + (4*7) = 27 + 0 + 28 = 55$ .
- 5) Next Left Part = Units, Tens, Hundreds & Thousands. Here  $(2*9) + (3*8) + (0*7) + (4*6) = 18 + 24 + 0 + 24 = 66$ .

**Up to this point we are following the same method as for 4 X 4 digits.**

- 6) Now, taking all the digits of the given number, we multiply as shown by the guiding lines in the diagram above. In this case  $(1*9) + (2*8) + (3*7) + (0*6) + (4*5) = 66$ .

**Now comes the process of elimination.**

- 7) Next Left Part = Eliminating the Units place digits, we only multiply the Tens, Hundreds, Thousands & the Ten Thousands place digits.
- 8) Next Left Part = Eliminate the Units & Tens place digits and multiply only the Hundreds Thousands & the Ten Thousands place digits.
- 9) Next Left Part = Eliminate the Units, Tens & Hundreds place digits and multiply only Thousands & the Ten Thousands place digits.
- 10) L.H.S. = Eliminate the Units, Tens, Hundreds & Thousands place digits and multiply;\* the Ten Thousands place digits.

Now from each part only the units place digit will be taken as the answer and the rest<sup>1</sup> carried over and ADDED to the next left part. Follow the Thumb Rule and there will be no difficulty in dealing with such problems.

VEDIC MATHEMATICS

## DIVISION:

The division which we have been taught since childhood is far much longer compared to the vedic way. For eg. If we want to divide 10 by 5 i.e.  $10/5$  what we do is subtract 5 from 10 ,2 times. Hence we get 2 as the quotient and 0 as the remainder.

Another eg.

If we want to divide 50 by 7 i.e.  $50/7$  what a normal C complier does using the “ABACUS” method is shown by the following code:-

```
Taking d=50 and c=7  cnt =0; //cnt =quotient
                    while(d>c)
                    {
                        d=d-c;
                        cnt++;
                    }

                    Quotient=cnt;
                    Remainder=d;
```

**Hence here it take steps = quotient.**

in the above example it takes 7 steps to complete the whole division process.

**But using “Vedic mathematics” we can complete this division process in only 2 steps.**

Hence by implementing an algorithm using the pure “VEDIC” way we can definitely speed up the processor speed and lessen the memory space.

**While designing the algorithm for “division” process of course by using “VEDIC” mathematics we have used the sub-sutra called as ” Dhvajanka(in sanskrit)” OR “On the Flag”**

*e.g 1*     $55889/32$ .

The unit's place digit of the divisor is known as the "Flag Digit". Here the Flag Digit is 2 of 32. The ten's place digit is the divisor. Here 3 of 32.

We place a colon just before the last digit of the dividend. Here the colon is placed just before 9, as illustrated in the diagram below.

There's a "R" with an arrow which indicates that the remainder is written on that line and the "Q" with an arrow indicates that the Quotient is written on the last line. Now we start the actual Division.

2	5	5	8	8	:	9	0	0	0
3R->	/	2	2	2	2	1	1		
Q->	1	7	4	6.	5	3	1		

4. We read the next dividend as 25. As shown by a small parallelogram in the above diagram. (The present Remainder and the next digit of the main number). We call this the Modified Dividend or in short MD.

There's a sequence of repeated steps from here on and understanding this SEQUENCE is the ultimate aim in learning the method of division.

From all MDs we have to subtract the product of the just derived Q digit and the Flag digit and then divide the remaining number by the divisor 3. Meaning, the present MD is 25. We have to subtract the product of the present Q digit and flag digit.  $25 - (1 * 2) = 23 + 3$ .

5. MD  $25 - (1 * 2) = 23 + 3$ ,  $Q = 7$  &  $R = 2$ . Write the Q & R at the appropriate places.  
(Refer diagram above).

6. Next MD  $28 - (7 * 2) = 14 + 3$ ,  $Q = 4$  &  $R = 2$ . Write the Q & R at the appropriate places.

7. Next MD  $28 - (4 * 2) = 20 + 3$ ,  $Q = 6$  &  $R = 2$ . Write the Q & R at the appropriate places.

When we write the remainder under the colon before the last digit of the main number, it indicates that we have to place a decimal point after the just derived Q digit.

8. Next MD  $29 - (6 * 2) = 17 + 3$ ,  $Q = 5$  &  $R = 2$ . Write the Q & R at the appropriate places.

Now as the main number has no other digits we just take zeroes in place of the main number,

9. Next MD  $20 - (5 * 2) = 10 + 3$ ,  $Q = 3$  &  $R = 1$ .

10. Next MD  $10 - (3 * 2) = 4 + 3$ ,  $Q = 1$  &  $R = 1$ .

We can either continue or stop depending on the required number of digits after the decimal point.

### **DIVISION with 3 digit Divisors**

e.g. 1,

$$48659 / 432.$$

- \*• Most calculations and the method remains the same with a slight change.
- \*" First and foremost note that the unit's and the ten's place digits of the divisor 432 are written as the Flag Digits. Meaning you now need to know the multiplication table of and not 432!
- \*• Secondly, since there are 2 digits as Flag digits, we put the colon before 2 digits of the main number.
- \*• Thirdly, the Quotient always starts with a Zero.
- \*• The most important change From all MDs we have to subtract the product of the latest two Q digits Crosswise multiplied by the Flag digits. Hence we always start the Q with a Zero. /

$$\begin{array}{r|l}
 432 & 865:590 \\
 4 & \\
 \hline
 & 0112629
 \end{array}$$

4. Next MD  $35 - (1 * 2) + (2 * 3) = 35 - 08 = 27 + 4$ ,  $Q = 6$  &  $R = 3$ .

Now as we write the present remainder 3, under the second last digit of the main number (in the colon part), we have to place a decimal point in the Quotient part & only then continue.

5. Next MD  $35 - (2 * 2) + (6 * 3) = 35 - 22 = 13 + 4$ ,  $Q = 2$  &  $R = 5$ . (Rule 1 applied).

6. Next MD  $59 - (6 * 2) + (2 * 3) = 59 - 18 = 41 + 4$ ,  $Q = 9$  &  $R = 5$ . (Rule 2 applied).

Now if you have to stop make sure that the Crosswise products of the latest two Q digits & flag digits, can be subtracted from the Next MD 50. Meaning ->

7. Next MD  $50 - \{2 * 2\} + (9 * 3) = 50 - 31$  is possible, hence we can stop.

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### Addition:

In 'C' language if u wants to ADD two numbers then first of all we have to specify data-types of both the numbers.

The data-types which are there in C language or in any other language have some specific range for eg. In C language if we go beyond the certain range then the C compiler gives a value which actually is a wrong value. But actually it is the concept of "STACK OVERFLOW".

```
Ex -> 983733838  
      +838373737
```

Considering both the number's data type as integer in C, when we run this we get some value as output which is not the correct one. It is actually stack overflow i.e. value out of range.

Take for instance the data-type "integer" which has range from -32768 to +32767. If we specify any number beyond this range then it is bound to give an error.....

But is it possible to go beyond a specified range?  
The answer is "yes we can".

Is it possible to reduce the space by a given data-type?  
Yes it is possible.

**Instead of using the data-type "double" which has an enough range but it occupies 8 bytes of memory we can reduce it considerably to 1 byte.**

Now taking the best benefit of the above method we can add n numbers and now there is no specific range for it.

```
Ex -> 983733838  
      +838373737
```

Our code is designed in such a way that we have stored these numbers's data type as character which takes 1 byte. When we run this program it gives output as 1822107575.  
So this takes less space and it can perform addition of any range of numbers.

### **SUBTRACTION :**

In 'C' language if u wants to SUBTRACT two numbers then first of all we have to specify data-types of both the numbers.

The data-types which are there in C language or in any other language have some specific range for e.g. In C language if we go beyond the certain range then the C compiler gives a value which actually is a wrong value. But actually it is the concept of "STACK OVERFLOW".

Ex -> 983733838  
-838373737

Considering both the number's data type as integer in C, when we run this we get some value as output which is not the correct one. It is actually stack overflow i.e. value out of range.

Take for instance the data-type "integer" which has range from -32768 to +32767.  
If we specify any number beyond this range then it is bound to give an error.....

But is it possible to go beyond a specified range?  
The answer is "yes we can".

Is it possible to reduce the space by a given data-type?  
Yes it is possible.

**Instead of using the data-type "double" which has an enough range but it occupies 8 bytes of memory we can reduce it considerably to 1 byte.**

Now taking the best benefit of the above method we can subtract n numbers and now there is no specific range for it.

Ex -> 983733838  
-838373737

Our code is designed in such a way that we have stored these numbers's data type as character which takes 1 byte. When we run this program it gives output as 145360101.  
So this takes less space and it can perform subtraction of any range of numbers.

But by using VEDIC MATHEMATICS we can perform subtraction in such a way which is very easy to understand. The name of the method which we have used for subtraction is known as

The 'SUDHA' Sutra is applicable where the larger digit is to be subtracted from the smaller digit. Let us go to the process through the examples.

#### **Procedure:**

- i) If the digit to be subtracted is larger, a dot ( sudha ) is given to its left.
- ii) The purak of this lower digit is added to the upper digit or purak-rekhank of this lower digit is subtracted.

e.g. 1.

$$\begin{array}{r}
 9\ 4\ 0\ 0\ 3 \\
 -\cdot 2\ \cdot 9\ \cdot 5\ \cdot 9\ 6 \\
 \hline
 6\ 4\ 4\ 0\ 7
 \end{array}$$

Steps:

- 1) 3 minus 6 is not possible. 6 is 4 away from ten.
- 2) Therefore,  $3 + 4 = 7$ .
- 3) A dot to the next left digit (near 9) so as to read it as 10.
- 4) 0 minus 10 is not possible. 10 is 0 away from ten.
- 5) Therefore,  $0 + 0 = 0$ .
- 6) A dot to the next left digit (near 5) so as to read it as 6.
- 7) 0 minus 6 is not possible. 6 is 4 away from ten.
- 8) Therefore,  $0 + 4 = 4$ .
- 9) A dot to the next left digit (near 9) so as to read it as 10.
- 10) 4 minus 10 is not possible. 10 is 0 away from ten. Therefore,  $4 + 0 = 4$ .
- 11) A dot to the next left digit (near 2) so as to read it as 3.
- 12) 9 minus 3, is POSSIBLE. Therefore,  $9 - 3 = 6$ .
- 13)

Well, so far we have studied how to subtract any number from Perfect Base Numbers, as well as general subtraction i.e. any number from any number. But, all the 10 examples studied had all its TOP digits Lesser Than ( $<$ ) the respective Bottom digits. What happens if we have a Create<sup>1</sup> digit in

4	2	7	4
-·1	9	·3	7
2	3	3	7

e.g.2.

Steps:

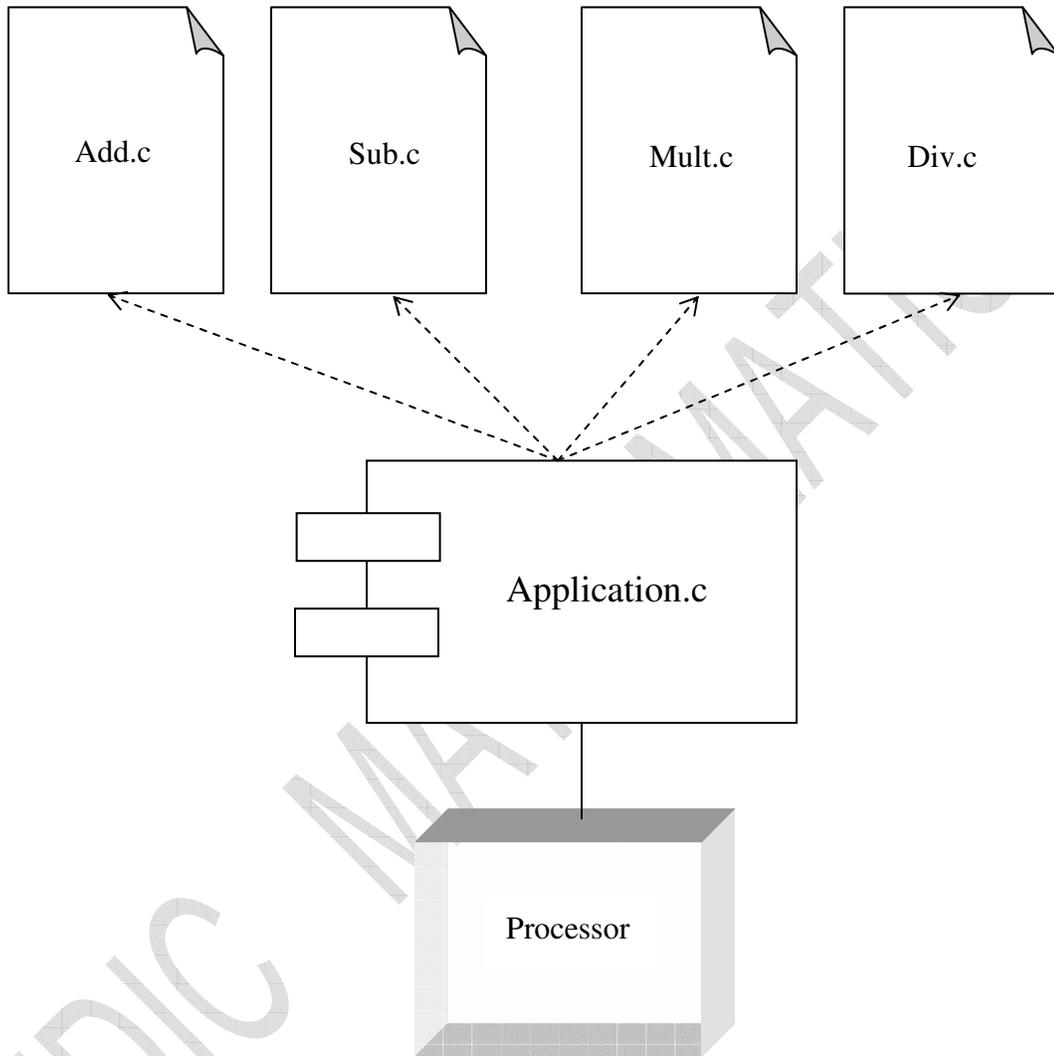
4 minus 7 is not possible. 7 is 3 away from ten.

- 1) Therefore,  $4 + 3 = 7$ .
- 2) Therefore, a dot to the next left digit (near 3) so as to read it as 4.
- 3) Here 7 minus 4, IS POSSIBLE.
- 4) Therefore, Direct Subtraction. DO NOT FIND THE DIFFERENCE OF 4 FROM 10.
- 5) Therefore,  $7 - 4 = 3$ .
- 6) Hence NO DOT near the next left digit.
- 6) Whenever & wherever DIRECT SUBTRACTION is Possible, we don't have to put a DC to the next left digit.
- 7) 2 minus 9 is not possible. 9 is 1 away from ten.
- 8) Therefore,  $2 + 1 = 3$ .
- 9) A dot to the next left digit (near 1) so as to read it as 2.
- 10) 4 minus 2, is POSSIBLE. Therefore,  $4 - 2 = 2$ .
- 11)

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## Diagrams

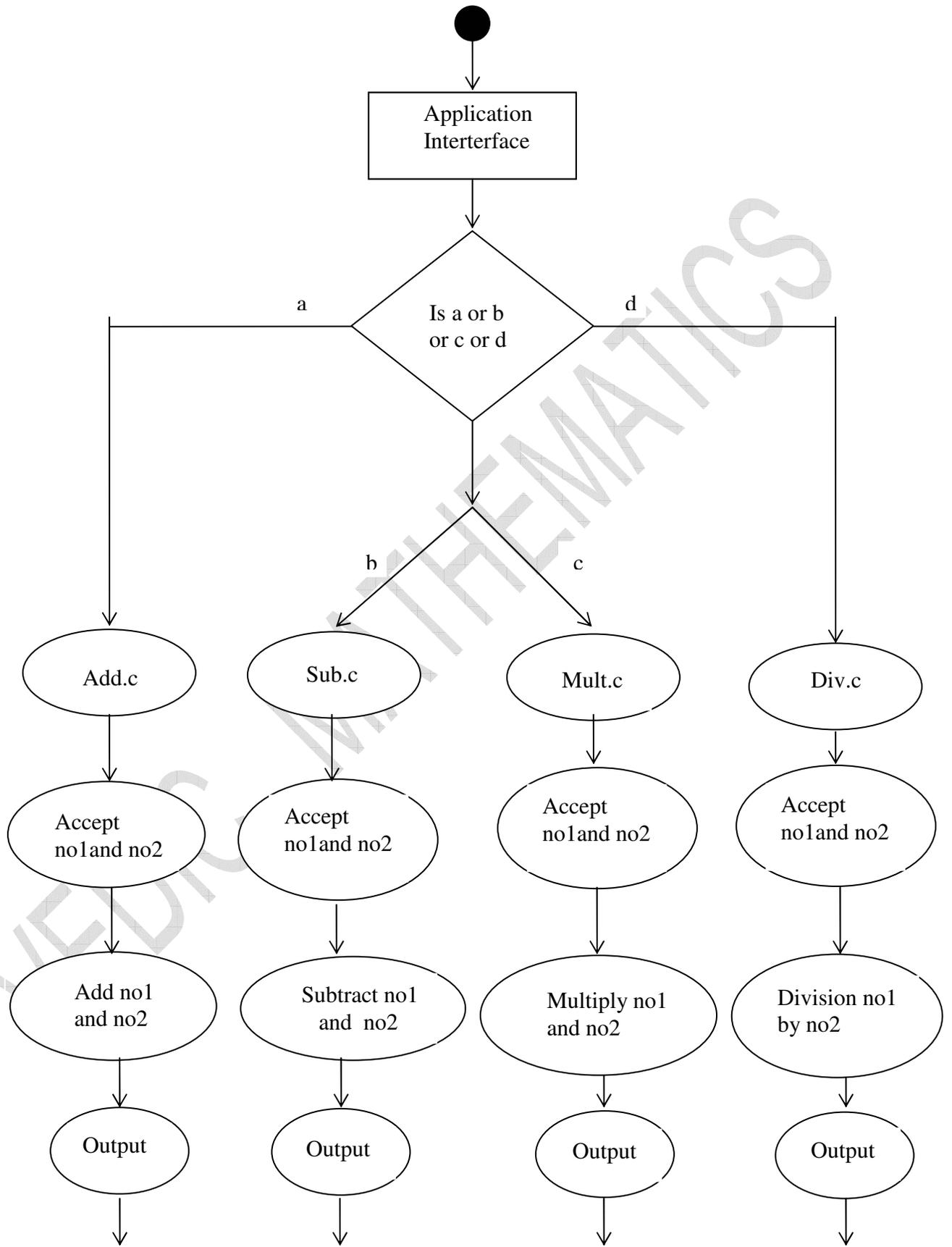
### DEPLOYMENT DIAGRAM:



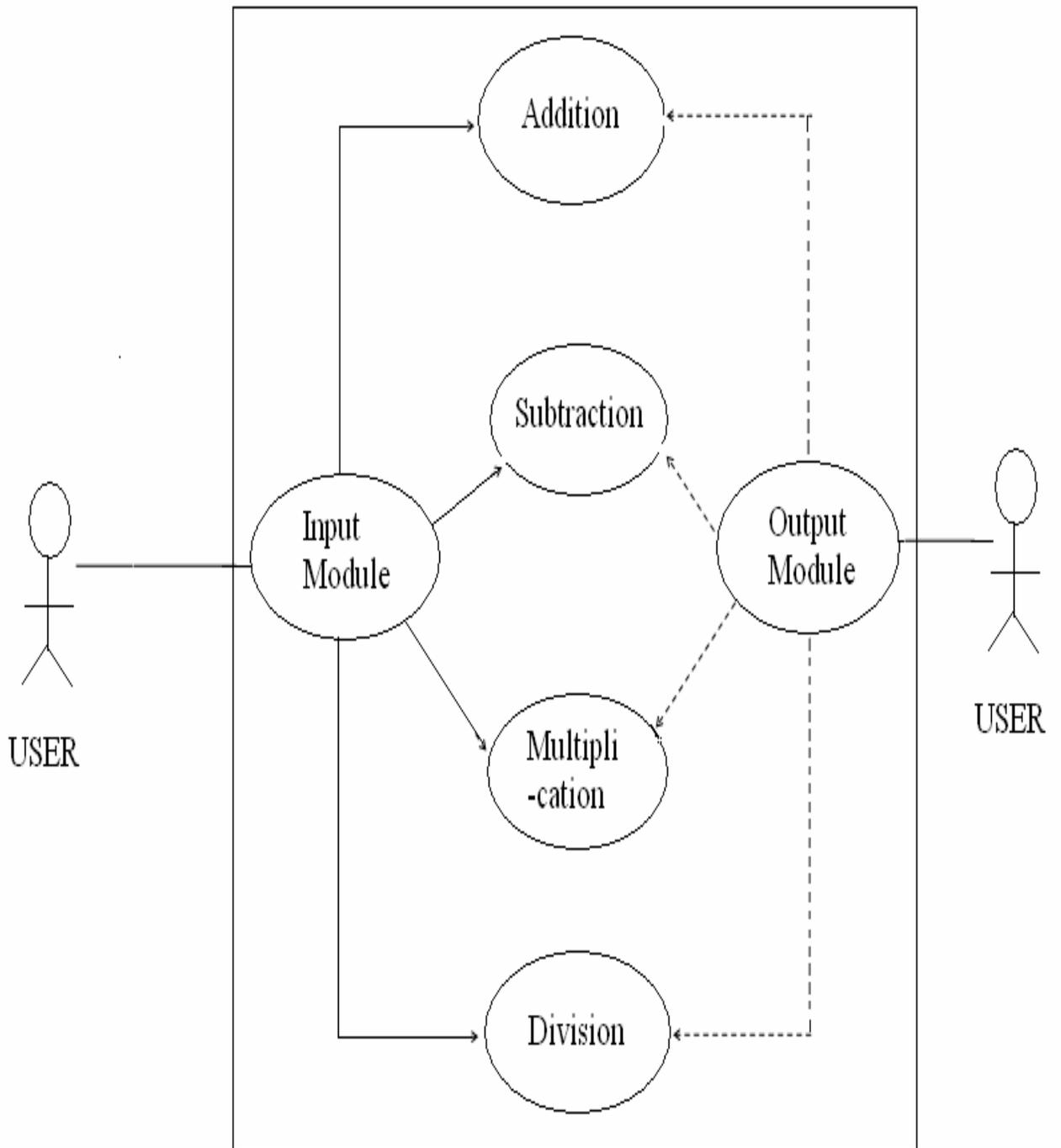
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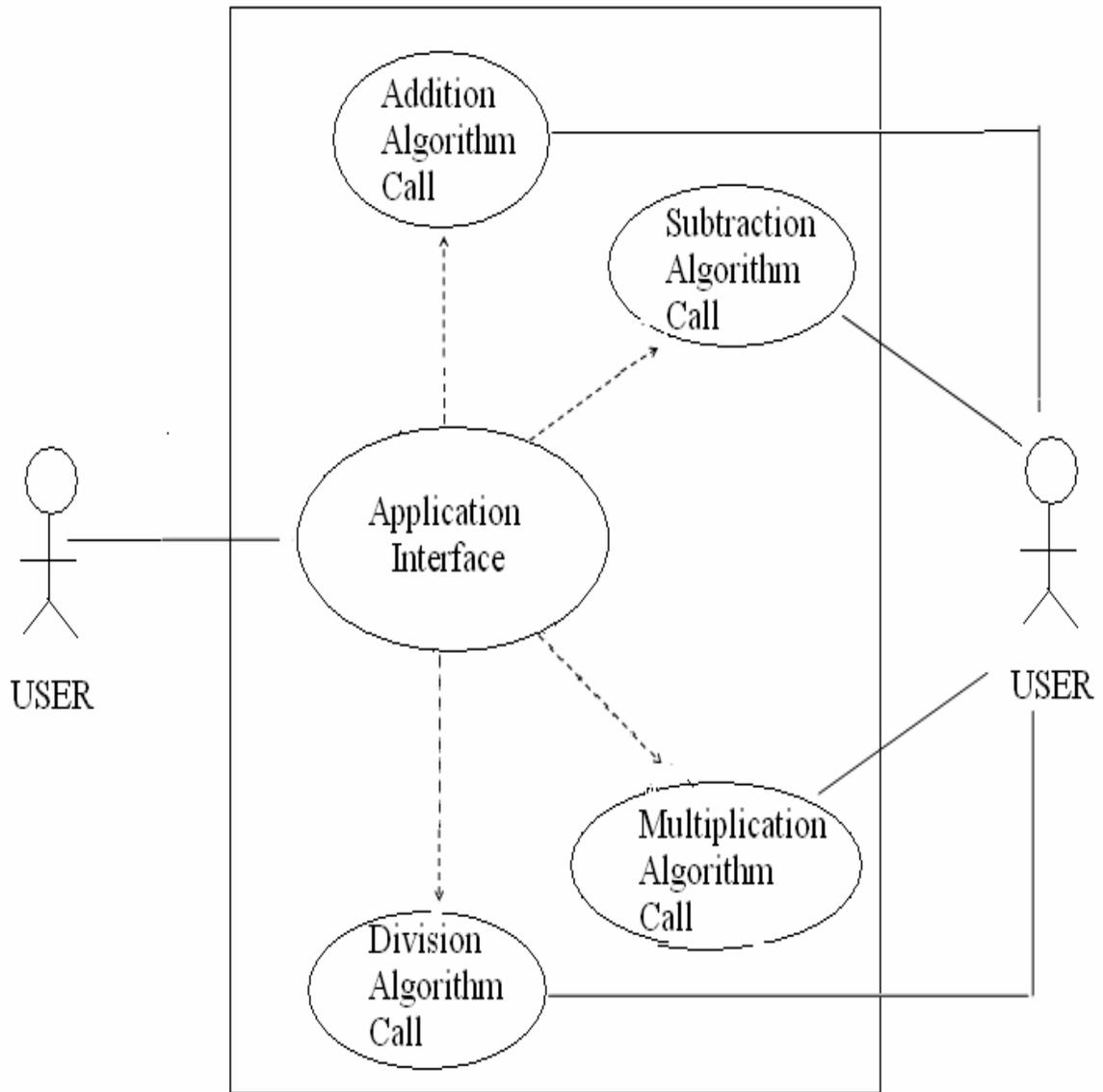
**Activity Diagram:**

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**Use Case Diagram:**





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## **Testing Techniques**

### **White Box Testing**

In this the structure of a program is taken into consideration. The objective of this testing is to ensure each and every line of the code is tested. It is also called logic driven structural testing. The tester drives test data from an examination of program logic and structure. White box testing was carried out regularly by inserting the specific input values to check for all validation possible and all code modules was tested line wise to check if the required output is obtained.

## System Requirements

### Hardware:

- Processor : Pentium (1) or more for optimum performance i.e. 400 MHz
- RAM : Recommended minimum 128 MB.
- Hard Disk : Minimum 6 GB
- Keyboard : 101 Key Keyboard

### Software:

- Windows 98/NT/2000/XP/Linux.
- C Compiler.

## **Feasibility Study**

The feasibility study is a major factor that contributes to the analysis of the system. The consideration of the system analyst whether to design a particular system or not depends on its feasibility study on this system is divided into the following three areas:

### **ECONOMIC FEASIBILITY:**

Economic Feasibility is concerned with the cost incurred for development and implementation of the software, the maintenance of the software and the benefits derived from it. The hardware and software required for this software is already available. The cost involved is that of coding, implementing and maintaining the software. Hence the software is economically feasible.

### **TECHNICAL FEASIBILITY:**

As the software is coded in C programming language. The minimum desirable requirement is Pentium machine. The computer must be running MS-DOS, Windows operating system, or Linux necessary to run the system. It needs the C compiler to run the software. As the hardware and necessary software for designing and implementation of the system is already available, the system is technically feasible.

### **OPERATIONAL FEASIBILITY:**

Since the software is intended at making the operations easy and faster, the user must have the knowledge of windows environments, the fundamental knowledge of the computer, and C compiler. The software is intended at providing a high level of abstraction to the user so that even a lay man is able to use it efficiently. Since all these requirements are very easy genuine the software is operationally feasible.

## **Bibliography**

Amazing Mathematics ( Book on Vedic Mathematics) – Sandeep Bhide.

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