Time Efficient Equations to Solve Calculations of Five Using Recursion Method

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Abstract— In this paper, shortest method to solve calculations of number ending with five have been presented. Many facts related to the calculation are proposed through which the entire calculation gets reduced to the level of an eye blink. There are many methods in Vedic Mathematics to multiply any two numbers. They are time consuming since they are not specifically meant for numbers ending with five. This describes the method to find the cube of a number ending with five accurately and very fast. It even describes the shortest method to solve the multiplication of two numbers ending with five. By using these formulas, calculations involving two numbers ending with five can be easily solved. This method can be also used in the field of math coprocessors in computer. This algorithm is tested in matlab(2012a version) . This method can be implemented on vlsi chip for faster multiplication.

Keywords— Vedic Mathematics, Multiplier,vlsi,digital logic.

INTRODUCTION

We have been doing some of the things in our life since grade 1. Unfortunately we are unable to understand the origin of those basics. One of those basic things is calculations involving numbers ending with five. We have been finding cubes of number ending with five for long but never know the fact that the answer can end only in four different numbers. Similarly we are unaware of many facts which have been reflected in this paper. No matter how big the numbers are; this formula holds good for all the numbers ending with five. There are many methods in Vedic Mathematics to multiply any two numbers. They are time consuming since they are not specifically meant for numbers ending with five. These formulas for the first describe the method to find the answer to any kind of calculation involving numbers ending with five in one step. This method led to the evolution of method to multiply N numbers in one step i.e. multiplying three or more numbers in one step. This can be developed into a math coprocessor by designing the algorithm. This reduces time, area and power in math coprocessor.

TO FIND THE CUBE OF A NUMBER ENDING WITH FIVE

There are quite a few methods to find the square of number ending with five. What if we want to find the cube of a number ending with five? Either you can find the square of the number and again multiply the square with number itself or you can apply Universal Multiplication Equation twice. Both the methods are two step process which is time consuming and chances of committing mistake is more. This drawback can be overcome by using Recursion formula. In this method the two step calculation has been reduced to one step which is faster than any other method. The simple formula to find the cube of a number ending with five is

$$\frac{X(4X^2+6X+3)}{4} \qquad (1)$$

This equation can be used only for numbers ending with five i.e. (X5). To find the cube of a number ending with five, we substitute the value of X in Eq. (1). The answer obtained from the Eq. (1) forms the first part and to get the final answer, we just write the answer obtained from Eq. (1) followed by one of the numbers from Table 1. based on the remainder. To start with we need to follow some steps:

1. Take any number of the form (X5).

   Example → $(85)^3$
   Here X=8
2. Substitute the value of X in the equation to get the first part of the answer.

   Example →

$$\frac{X(4X^2+6X+3)}{4}$$

$$=\frac{8\times(4\times(8)^2+6\times8+3)}{4}$$

$$=\frac{8\times(4\times64+6\times8+3)}{4}$$

$$=\frac{8\times(256+48+3)}{4}$$

$$=\frac{8\times304}{4}$$

=304×2

=614

3. Ignore the decimal part and consider only the whole number part.
4. Second part of the answer is obtained by remainder basis.
5. Divide X by 4. Check for the remainder.

Remainder	Answer
0	125
1	375
2	625
3	875

Table 1. Recursive remainder

6. When any number is divided by 4, you get remainder only as 0,1,2,3.

   Example → when 8 is divided by 4 you get the remainder as 0.

7. Check the table for the second part of the answer. Check for the answer corresponding to zero.

So the second part of the answer is 125.

Therefore, the final answer is 614125

- $(995)^3$

Here X=99

Substituting the value of X in the equation

$$\frac{X(4X^2+6X+3)}{4}$$

$$= \frac{99\times(4\times(99)^2+6\times99+3)}{4}$$

$$= \frac{99\times(4\times9801+6\times99+3)}{4}$$

$$= \frac{99\times(39204+594+3)}{4}$$

$$= \frac{99\times39801}{4}$$

=24075×39801

= 985074.75

So the first part of the answer is 985074.

(Point no.9 is being illustrated here.

Divide 99 by 4. We get the remainder as 3.

Check the remainder table to get the second part of the answer and check the answer corresponding to remainder 3 in the table.

So the second part of the answer is 875.

Therefore, the final answer is 985074875.

If the decimal part of the first part of the answer and the remainder is observed, some relation could be found in them, which is given in table 2.

Remainder	Decimal
0	0
1	0.25
2	0.5
3	0.75

Table 2. Recursive Remainder

If we observe this table, we can obtain the second part of the answer through decimal basis also. It can be used as a verification technique. There is no method to find the cube of a number directly but this equation provides direct result.The main advantage of this equation is that the 3 digit calculation has been reduced to a 2 digit calculation, 4 digit calculation has been reduced to 3 a digit calculation which increases the accuracy and speed.If we need to find the cube of the number ending with 5in a traditional school way, we need to find the square of the number, then again we need to multiply the square with the same number which is time consuming and there are chances of going wrong.We have been finding the cube of a number ending with 5 since class 3 or 4. We might never have observed the fact that a cube of a number ending with 5 can only end with 125, 375, 625, and 875. Hence this equation reveals the fact that cube of number can end only with 125, 375, 625, and 875.

MULTIPLICATION OF TWO NUMBERS ENDING WITH 5

This part of the paper describes the method to multiply two numbers ending with five. This calculation could be even solved using Universal Multiplication Equation but is not as efficient as Recursion method and chances of committing mistake is more. The complexity can be reduced by using recursion method. The simple method to find the product of two numbers ending with 5 is

$$\frac{2XY + X + Y}{2} \qquad (2)$$

This equation can be used only for two numbers ending with five i.e. (X5) and (Y5). The values of X and Y are substituted in Eq. (2). The answer obtained from Eq. (1) is clubbed with 25 or 75 to get the final answer. To start with we need to follow some steps:

1. The multiplication should be of the form X5×Y5.
2. X and Y are two numbers ending with 5.

Example →135×165

Here X=13 and Y=16
or
X=16 and Y=13
Commutative property holds good.

3. Substitute the values of X and y in the above equation to get the first part of the answer.

Example→

$$= \frac{2\times16\times13+16+13}{2}$$

$$= \frac{2\times208+16+13}{2}$$

$$= \frac{416+29}{2}$$

$$= \frac{445}{2}$$

=222.5

4. Ignore the decimal part and take the whole number as the answer of the first part.
5. Take the difference of X and Y.

Example → 16-13=3
Which is odd.

6. It is not necessary that you need to take difference of 16 and 13. It is enough if you just take the difference of 6 and 3, which is 3! Our aim is not to find the difference but only to find the last digit of the difference and to judge whether it is odd or even. It is satisfied by the last digit of X and Y.

7. If the difference is even then the second part of the answer is 25 else 75.

Example → here the difference is odd so the answer will end with 75. If the difference had been even then the answerwould have ended with 25.

Therefore, the final answer is 22275.

Here, again the 3 digit calculation has been reduced to a 2 digit calculation, 4 digit calculation has been reduced to 3 a digit calculation which increases the accuracy and speed.

Suppose you get a question where you need to multiply two numbers ending with 5.

Example →you get a question where you need to multiply 4525×854465 and you have options as

a) 3866454165 b) 3866454135

c) 3866454185 d) 3866454125

This equation can be extended specifically for the multiplication of any number ending with five with 25. This could be even solved by the above given method. But the using the extended method, multiplication could be done faster and efficient. Since this method is very simple, it is been illustrated through an example.

1.Take a calculation of the form 25×(X5)

Example →25×85

Here X=8

2.Divide X by 4 to get the first part of the answer.

Example → $\frac{8}{4}$ =2

3.Second part of the answer is obtained by remainder rule.

Remainder	**Answer**
0	125
1	375
2	625
3	875

Table 3. Recursive remainder

Example → $\frac{8}{4}$ leaves remainder as 0 .

4. Check Table 3, corresponding to reminder 0 to get the second part of the answer.

So the second part of the answer is 125.

Therefore, the final answer is 2125.

- 25×1234567895

Here X=123456789

Divide 123456789 by 4.

So the first part of the answer is 30864197

Dividing 123456789 by 4 leaves remainder 1.

From Table 3.the second part of the answer is 375, since the remainder is 1 and the answer corresponding to 1 is 375.

Therefore, the final answer is 30864197375,which is even out of the calculator's limit.

Hence from this method we come to know that 25 multiplied by any number ending with five can end only with 125, 375, 625 and 875.

25×5 =0125 25×15 =0375 25×25 =0625 25 ×35 =0875

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25×45 =1125	25×55=1375	25×65 =1625	25×75 =1875
25×85 =2125	25×95 =2375	25×105=2625	25×115=2875
25×125=3125	25×135=3375	25×145=3625	25×155=3875

CONCLUSION

It can be concluded that the "Time Efficient Equation to Solve Calculations of Five Using Recursion" is an efficient method of multiplication because there is no equation to multiply two numbers. We generally multiply numbers using traditional method which is time consuming and there are chances of making mistakes unlike this equation. Not only in the field of calculation but also in the field of math coprocessor,vlsi it has a wide application for its efficiency. Results can be synthesized by using this method and can be compared with the results of array multiplier and booth multiplier. This equation can be used to developed applications for faster and efficient output.

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