A STUDY OF LINEAR & QUADRATIC EQUATION WITH THEIR SOLVING METHOD AND DEVELOPED PROGRAM WITH IMPLEMENTATION USING C++: "EQUATION SOLVER" AS MATHEMATICAL APPLICATION

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Abstract

Equation Solver is as unique as other innovative topics, because this program helps to solve the different types of equation and mainly focuses on linear and quadratic equations. Students who deal with the subject of mathematics can use this program, to input their desired value or the variables given as per the option and get their solutions instantly. This will save time in terms of topics conveniently and solve the equations mandatorily for student and programmers. Solving many problems in mechanics, engineering, medicine requires the efficient solving of linear Quadratic equations. In many cases, such systems are very complex with a large number of linear equations& quadratic equations, which are symmetric positive defined (SPD). This paper is focused on improving the computational efficiency of the solver dedicated for the linear and quadratic system based on incomplete and symmetric positive defined equations by using preconditioning technique incomplete modern set of processor instructions and quadratic factorization. Application of these techniques allows us to fairly reduce the computational time, number of iterations of conventional algorithms and improve the speed of calculations.

Keywords*: conveniently, equation, innovative, iterations, preconditioning, symmetric*.

I. Introduction

1.1 What are linear & quadratic equations?

Linear and quadratic are based on the algebraic aspect in mathematics which deals with make aspects of education like mechanical engineering, civil engineering and as follows. This mechanism helps for solving of difficult mathematical algebraic equation with smart way and eases saving the time taken by the user, space allocated and memory used. Linear and quadratic equations are mandatorily asked to be solved and are implemented in most of the entrance exam related to.

1.2 Linear and Quadratic equation solving method

1.2.1 What are types of unknowns in linear equations.?

This program is a brief explanation and depends on the concept of linear and quadratic equations. The linear equations are rectified further in three categories, they are:

a. **One unknown:** Equation which have only one unknown unassigned constant variable associated with a declared variable are known as equations with one unknown,

For example: ax+b=c

b. **Two unknowns:** Equations with two unassigned constant variables associated with two declared variables are known as equations with two unknowns.

For example: ax+by +c=O

c. **Three unknowns:** Equations which have three unknowns associated with all the three unassigned

constant variables associated with three declared variables are known as equations with three unknowns.
For example: ax+by+cz=0

1.2.2 Quadratic Equation

The quadratic equations are rectified further, they are in the form of:
$ax^2 + bx + c = 0$ where $a \neq 0$
The form $ax^2+bx+c=0$ is called the standard Form of a quadratic equation. Solution using the Quadratic Formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Factoring is useful only for those quadratic equations which have whole numbers. When you encounter quadratic
equations that cannot be easily factored out, use the quadratic formula to find the value of x:
In some cases, you encounter repeated rational solutions. And to prove of you have the right values of you use the discriminant which gives you information about the nature of the solutions to the equation. Based on the expression b^2-4ac, which is under the radical in the quadratic formula it can be found in the equation. $ax^2 + bx + c = 0$
l. When the discriminant is equal to O, the equation has repeated rational solutions.
2. When the discriminant is positive and a perfect square, the equation has two distinct rational solutions.
3. When the discriminant is positive but not a perfect square, the equation has two irrational solutions.
4. When the discriminant is negative, the equation has two complex number solutions.

II. Equation Solving Methodology

2.1 Linear Equation Solving Method:

Linear equations are associated with algebraic equation in which each term is either a constant or the product of a constant and a single variable. A simple example of a linear equation with only one variable, x, may be written in the form: ax+b=0, where a and b are constants and a is not equal to 0. The constants may be numbers, parameters, or even non-linear functions of parameters may be depending on the problem.
Linear equations can have one or more variables. An example of a linear equation with three variables, x, y, and z, is given by: ax + by + cz + d = 0, where a, b, c, and d are constants and a, b, and c are non-zero. Linear equations occur frequently in most subareas of mathematics and especially in applied mathematics. While they arise quite naturally when modeling many phenomena, they are particularly useful since many non-linear equations may be reduced to linear equations by assuming that quantities of interest vary to only a small extent from some "background" state. An equation is linear if the sum of the exponents of the variables of each term is one.
Equations with exponents greater than one are non-linear. An example of a non-linear equation of two variables is ax + by = 0, where a and b are constants and a is not equal to 0. It has two variables, x and y, and is non-linear because the sum of the exponents of the variables in the first term, ax and by is two.
This article considers the case of a single equation for which one searches the real solutions. All its content applies for complex solutions and, more generally for linear equations with coefficients and solutions in any field.

2.2 Quadratic Equation Solving Method:

Quadratic equations deal with equations having the form where x represents an unknown, and a, b and c represent known numbers such that a is not equal to 0. If a=0, then the equation is a linear, not quadratic. The numbers and c are the coefficients of the equation, and may be distinguished by calling them, respectively, the quadratic coefficient, the linear coefficient and the constant or free term. The quadratic equation involves only one unknown, it is called "univariate". The quadratic equation only contains powers of x that are non-negative integers, and therefore it is a polynomial equation, and in American English as factoring and In other varieties of English as
factorizing, by completing the square, by using the quadratic formula, or by graphing. Solutions to problems equivalent to the quadratic equation were known in the late centuries.

III. Literature Review

For the knowledge of linear & quadratic equation. I have referred several books of 9th, 1 0th and engineering standards. The study was drawing my interest thoroughly to the algebraic concepts which are hard to study and understand. Algebra exists for a reason other than lowering a high school student's grade point average. Systems of linear equations, or a set of equations with two or more variables, are an essential part of finding solutions with only limited information, which happens to be exactly what algebra is. As a required part of any algebra student's life, it is best to understand how they work, not only so an acceptable grade is received, but also so one day the systems can be used to actually find desired information with ease [1]. There are three main methods of defining a system of linear equations. One way is called a consistent, independent solution. This essentially means that the system has one unique, definite solution. In this situation on a graph, a set of two equations and two variables would be solved as one single point where two lines intersect. It is much the same with three variables and three equations. The only difference is that the point is an intersection of three planes instead of two lines [2].

Additionally, there are situations where a system of linear equations could be described as consistent, dependent. These systems of linear equations have an infinite number of solutions where a general solution is used to substitute one or two variables for one other selected variable, and solves the other unknown variable or variables in terms of that selected one. Graphically when this system of linear equations is solved for two equations and two variables, the result is lines that coincide, or lay on top of each other, making any point on that line true for the system. A system with three equations and three variables would yield an answer that shows the three planes intersecting on a line or overlaying each other [3]. When the system yields three planes intersecting on a line, all points on the line would make the systems true, and when planes coincide, all points on the coincidental planes would be correct when placed in the system for the variables.

A final case exists with systems of linear equations where the system can be classified as inconsistent, independent. This classification means that the system has no solution or that there is not a single point where all the lines or planes intersect [4]. In this case, with two variables and two equations, the lines are parallel, never intersecting at one point. When the system is three variables and three equations, no solution means that the three planes do not touch at all, or there is not one point where all three planes intersect. Systems of linear equations with two or three variables have specific rules and steps to solving the variables. As a great way of finding additional information when only presented with limited sources, knowing how to decipher these systems of linear equations can, indeed, be very useful [5]. Algebra can be a difficult part of high school, but understanding the essential parts of algebra and understanding what it is about are the keys to success.

IV. Propose Enhancement

3.1 Working Architecture: Equation solver Program flow

In this application (C++ program), five main options are there. First three options are of linear equation with one unknown, linear equation with two unknown and linear equation with three unknowns. Then the fourth option is about the quadratic equation. Then the last option for exiting the software. In every equational selection at the top there is a sample equation is given so it will be easy for user to add the parameters. This application/program makes easier to solve quadratic and linear equation. The solution for quadratic equation is also able to find the root value.

V. GUI of Equation Solver

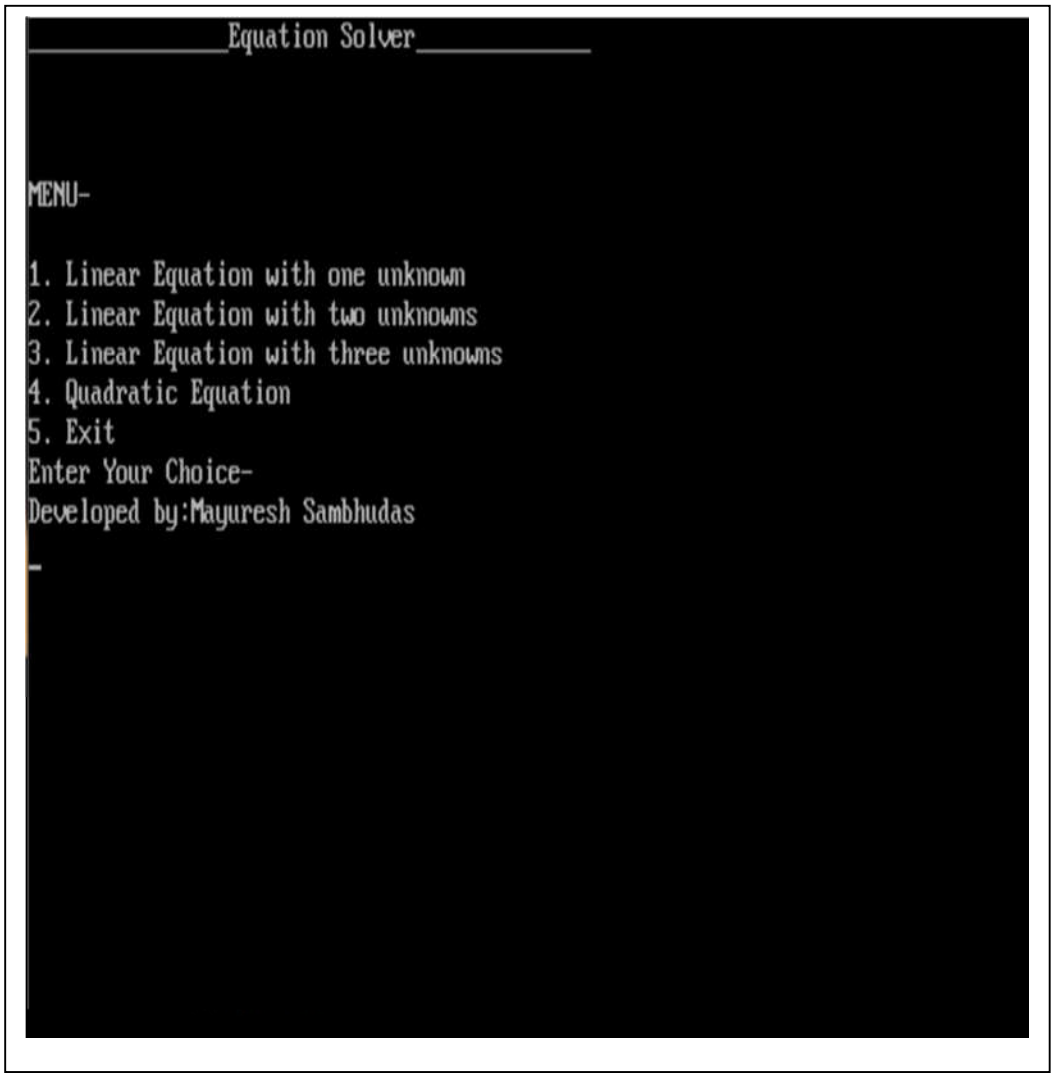

Fig.1.0 Menu Screen- Equation Solver

Fig.2.0 Linear Equation input for one unknown

Fig.3.0 Linear Equation input for two unknowns

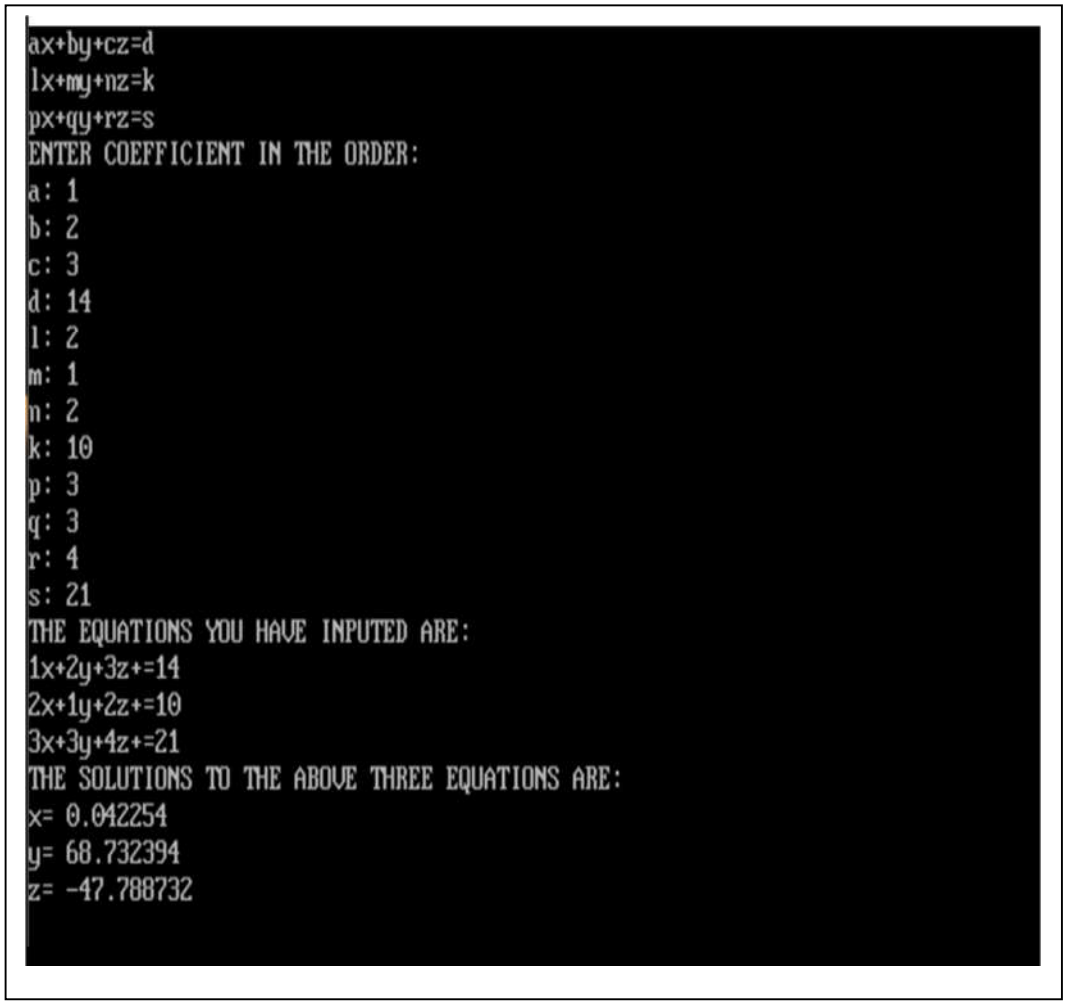

Fig.2.0 Linear Equation input for three unknowns

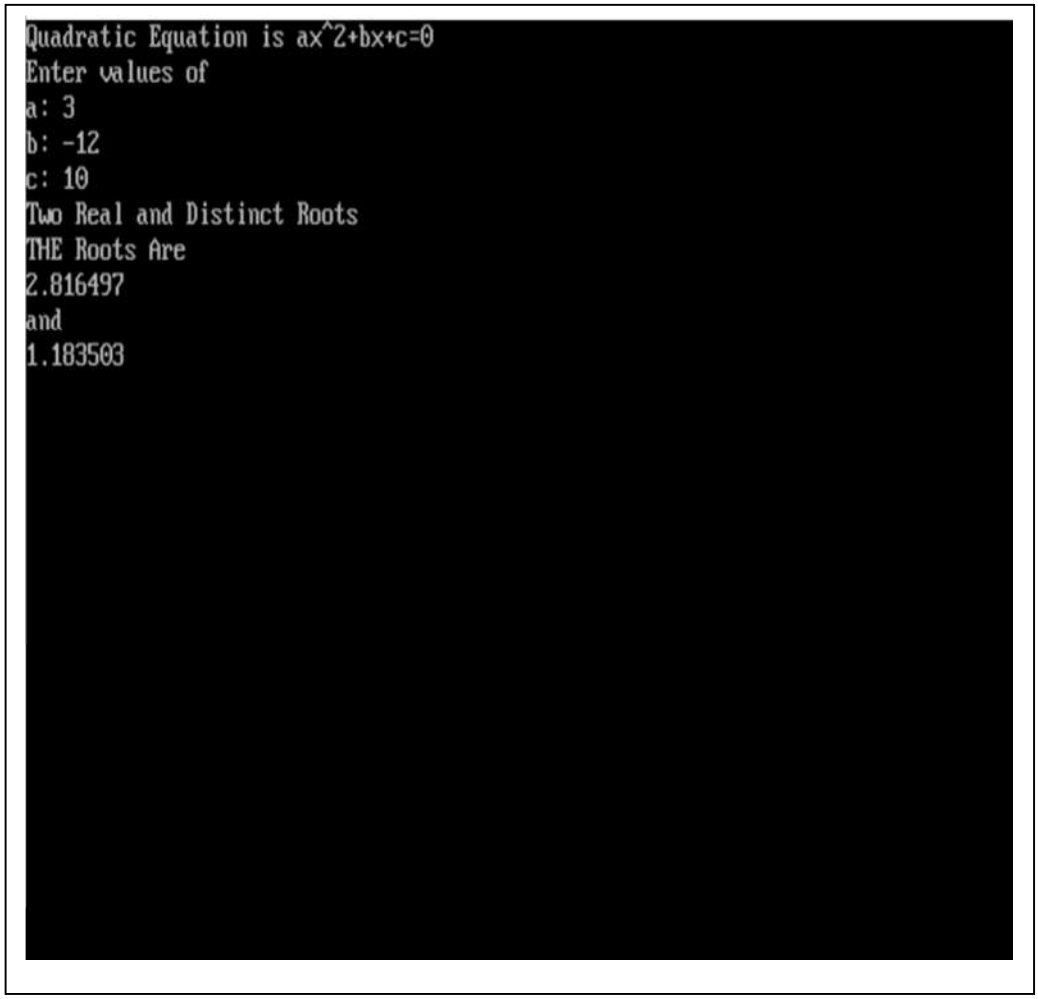

Fig.2.0 Quadratic Equation input

VI. Conclusion

The above project relies on the principles of mathematics and is better and innovative than other projects of the same kind because it is being addressed in a new way containing all the parameters of linear and quadratic equation and is easy and smart way to learn and implement on it. This system covers mostly all of the content in a menu tabular to select your desired option and collect your output value without any complications. This helps the user to reduce the time taken, saves lots of effort and memory used by the program is less which makes it mostly best in time and space complexity.

VII. Recommendation

The developed application as “Equation Solver” is use full for mathematics domain which is part of linear algebra. The scope for further study its to solve all types of equations, that are recommendation for new researcher using this paper.

VIII. ACKNOWLEDGEMENT

It gives me a great pleasure and immense enthusiasm to present this innovative topic of mini project report on" EQUATION SOLVER", which is the result of unwavering support, expert guidance and focused directions of my guide Prof. Parmeshwari Aland, Prof. Abhijit Powar and Dr. Amol Kasture to whom I express my deep sense of gratitude and humbly thank them for their valuable guidance throughout the presentation work. The success of this mini project has throughout depended upon an exact blend of hard work and unending co-operation and guidance, extended to me by the superiors at our college. Furthermore, I am indebted to our Head of Department, Prof. Abhijit Powar whose constant encouragement and motivation inspired me to do my best, Last but not the least, I sincerely thank to my colleagues, the staff and all others who directly or indirectly helped us and made numerous suggestions which have surely improved the quality of my work and made my project more innovative.

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