Collected papers
of

Lord Soumadeep Ghosh

Volume 16

My heuristic for finding a real root of the quintic equation

Soumadeep Ghosh

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Abstract

In this paper, I describe my heuristic for finding a real root of the quintic equation.

Introduction

It's true that unlike the quadratic, the cubic and the quartic equations, the general quintic equation cannot be solved algebraically in terms of a finite number of additions, subtractions, multiplications, divisions, and root extractions, as rigorously demonstrated by Abel (see Abel's impossibility theorem) and Galois. However, the general quintic equation can be solved in terms of Jacobi Theta functions as described at `https://mathworld.wolfram.com/QuinticEquation.html`.

This paper is not about the general solution to the quintic equation as the general solution to the quintic equation is too cumbersome and computationally expensive for practical use. In practice, the quintic equation is solved by numerical methods like Newton-Raphson iteration. In this paper, I describe my heuristic for finding a real root of the quintic equation.

My heuristic for finding a real root of the quintic equation

For the quintic equation

$$ax^5 + bx^4 + cx^3 + dx^2 + ex + f = 0$$

whenever

$$b^4 + 3ab^2c - 2a^2bd + a^3e \neq 0$$

my heuristic for finding a real root of the quintic equation is to use the initial guess

$$x_0 = \frac{a^2be - a^3f - ab^2d + b^3c}{b^4 + 3ab^2c - 2a^2bd + a^3e} - \frac{b}{a}$$

for Newton-Raphson iteration.

The End

3 modern explosives found in the world
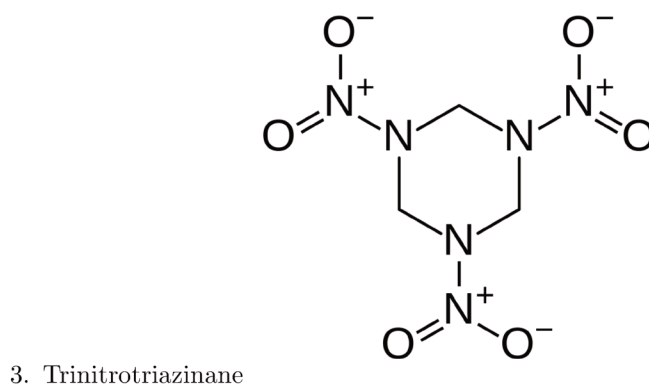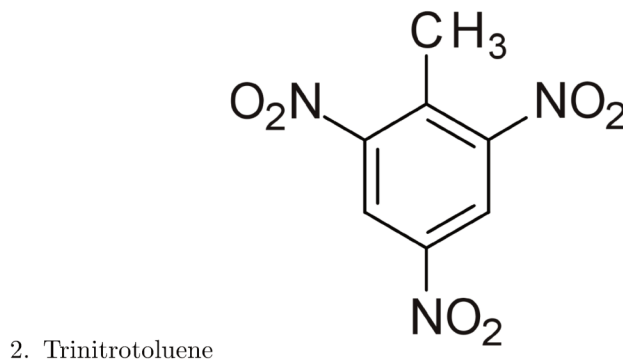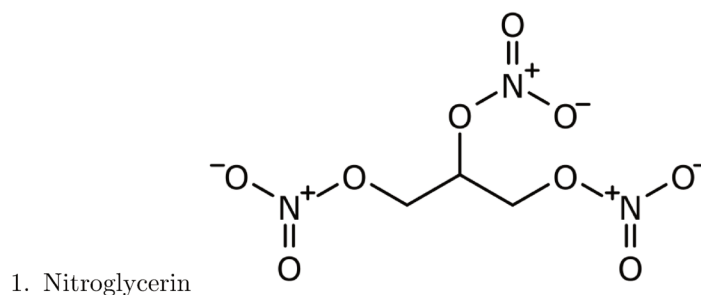
Soumadeep Ghosh

Kolkata, India

Abstract

In this paper, I describe 3 modern explosives found in the world. The paper ends with "The End"

Introduction

Explosive made from gunpowder, sulphur and carbon has been used since antiquity. But the modern age has seen the production and use of modern explosives. In this paper, I describe 3 modern explosives found in the world.

3 modern explosives found in the world

1. Nitroglycerin

2. Trinitrotoluene

3. Trinitrotriazinane

The End

Determinants of small matrices

Soumadeep Ghosh

Kolkata, India

Abstract

In this paper, I describe determinants of small matrices. The paper ends with "The End"

Introduction

Determinants of matrices are useful to solve linear systems. In this paper, I describe determinants of small matrices.

Determinant of a 2 x 2 matrix

$$\begin{vmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \end{vmatrix} = a_{1,1}a_{2,2} - a_{1,2}a_{2,1}$$

Determinant of a 3 x 3 matrix

$$\begin{vmatrix} a_{1,1} & a_{1,2} & a_{1,3} \\ a_{2,1} & a_{2,2} & a_{2,3} \\ a_{3,1} & a_{3,2} & a_{3,3} \end{vmatrix} = -a_{1,3}a_{2,2}a_{3,1} + a_{1,2}a_{2,3}a_{3,1} + a_{1,3}a_{2,1}a_{3,2} - a_{1,1}a_{2,3}a_{3,2} - a_{1,2}a_{2,1}a_{3,3} + a_{1,1}a_{2,2}a_{3,3}$$

Determinant of a 4 x 4 matrix

$$\begin{vmatrix} a_{1,1} & a_{1,2} & a_{1,3} & a_{1,4} \\ a_{2,1} & a_{2,2} & a_{2,3} & a_{2,4} \\ a_{3,1} & a_{3,2} & a_{3,3} & a_{3,4} \\ a_{4,1} & a_{4,2} & a_{4,3} & a_{4,4} \end{vmatrix} = a_{1,4}a_{2,3}a_{3,2}a_{4,1} - a_{1,3}a_{2,4}a_{3,2}a_{4,1} - a_{1,4}a_{2,2}a_{3,3}a_{4,1} + a_{1,2}a_{2,4}a_{3,3}a_{4,1}+$$

$$a_{1,3}a_{2,2}a_{3,4}a_{4,1} - a_{1,2}a_{2,3}a_{3,4}a_{4,1} - a_{1,4}a_{2,3}a_{3,1}a_{4,2} + a_{1,3}a_{2,4}a_{3,1}a_{4,2} + a_{1,4}a_{2,1}a_{3,3}a_{4,2} - a_{1,1}a_{2,4}a_{3,3}a_{4,2}-$$

$$a_{1,3}a_{2,1}a_{3,4}a_{4,2} + a_{1,1}a_{2,3}a_{3,4}a_{4,2} + a_{1,4}a_{2,2}a_{3,1}a_{4,3} - a_{1,2}a_{2,4}a_{3,1}a_{4,3} - a_{1,4}a_{2,1}a_{3,2}a_{4,3} + a_{1,1}a_{2,4}a_{3,2}a_{4,3}+$$

$$a_{1,2}a_{2,1}a_{3,4}a_{4,3} - a_{1,1}a_{2,2}a_{3,4}a_{4,3} - a_{1,3}a_{2,2}a_{3,1}a_{4,4} + a_{1,2}a_{2,3}a_{3,1}a_{4,4} + a_{1,3}a_{2,1}a_{3,2}a_{4,4} - a_{1,1}a_{2,3}a_{3,2}a_{4,4}-$$

$$a_{1,2}a_{2,1}a_{3,3}a_{4,4} + a_{1,1}a_{2,2}a_{3,3}a_{4,4}$$

The End

Adjoints of small matrices

Soumadeep Ghosh

Kolkata, India

Abstract

In this paper, I describe adjoints of small matrices. The paper ends with "The End"

Introduction

Adjoints of matrices are useful to solve linear systems. In this paper, I describe adjoints of small matrices.

Adjoint of a 2 x 2 matrix

$$adj \begin{pmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \end{pmatrix} = \begin{pmatrix} a_{2,2} & -a_{1,2} \\ -a_{2,1} & a_{1,1} \end{pmatrix}$$

Adjoint of a 3 x 3 matrix

$$adj \begin{pmatrix} a_{1,1} & a_{1,2} & a_{1,3} \\ a_{2,1} & a_{2,2} & a_{2,3} \\ a_{3,1} & a_{3,2} & a_{3,3} \end{pmatrix} = \begin{pmatrix} a_{2,2}a_{3,3} - a_{2,3}a_{3,2} & a_{1,3}a_{3,2} - a_{1,2}a_{3,3} & a_{1,2}a_{2,3} - a_{1,3}a_{2,2} \\ a_{2,3}a_{3,1} - a_{2,1}a_{3,3} & a_{1,1}a_{3,3} - a_{1,3}a_{3,1} & a_{1,3}a_{2,1} - a_{1,1}a_{2,3} \\ a_{2,1}a_{3,2} - a_{2,2}a_{3,1} & a_{1,2}a_{3,1} - a_{1,1}a_{3,2} & a_{1,1}a_{2,2} - a_{1,2}a_{2,1} \end{pmatrix}$$

Adjoint of a 4 x 4 matrix

$$adj \begin{pmatrix} a_{1,1} & a_{1,2} & a_{1,3} & a_{1,4} \\ a_{2,1} & a_{2,2} & a_{2,3} & a_{2,4} \\ a_{3,1} & a_{3,2} & a_{3,3} & a_{3,4} \\ a_{4,1} & a_{4,2} & a_{4,3} & a_{4,4} \end{pmatrix} = \begin{pmatrix} b_{1,1} & b_{1,2} & b_{1,3} & b_{1,4} \\ b_{2,1} & b_{2,2} & b_{2,3} & b_{2,4} \\ b_{3,1} & b_{3,2} & b_{3,3} & b_{3,4} \\ b_{4,1} & b_{4,2} & b_{4,3} & b_{4,4} \end{pmatrix}$$

where

$$b_{1,1} = -a_{2,4}a_{3,3}a_{4,2} + a_{2,3}a_{3,4}a_{4,2} + a_{2,4}a_{3,2}a_{4,3} - a_{2,2}a_{3,4}a_{4,3} - a_{2,3}a_{3,2}a_{4,4} + a_{2,2}a_{3,3}a_{4,4}$$

$$b_{1,2} = a_{1,4}a_{3,3}a_{4,2} - a_{1,3}a_{3,4}a_{4,2} - a_{1,4}a_{3,2}a_{4,3} + a_{1,2}a_{3,4}a_{4,3} + a_{1,3}a_{3,2}a_{4,4} - a_{1,2}a_{3,3}a_{4,4}$$

$$b_{1,3} = -a_{1,4}a_{2,3}a_{4,2} + a_{1,3}a_{2,4}a_{4,2} + a_{1,4}a_{2,2}a_{4,3} - a_{1,2}a_{2,4}a_{4,3} - a_{1,3}a_{2,2}a_{4,4} + a_{1,2}a_{2,3}a_{4,4}$$

$$b_{1,4} = a_{1,4}a_{2,3}a_{3,2} - a_{1,3}a_{2,4}a_{3,2} - a_{1,4}a_{2,2}a_{3,3} + a_{1,2}a_{2,4}a_{3,3} + a_{1,3}a_{2,2}a_{3,4} - a_{1,2}a_{2,3}a_{3,4}$$

$$b_{2,1} = a_{2,4}a_{3,3}a_{4,1} - a_{2,3}a_{3,4}a_{4,1} - a_{2,4}a_{3,1}a_{4,3} + a_{2,1}a_{3,4}a_{4,3} + a_{2,3}a_{3,1}a_{4,4} - a_{2,1}a_{3,3}a_{4,4}$$

$$b_{2,2} = -a_{1,4}a_{3,3}a_{4,1} + a_{1,3}a_{3,4}a_{4,1} + a_{1,4}a_{3,1}a_{4,3} - a_{1,1}a_{3,4}a_{4,3} - a_{1,3}a_{3,1}a_{4,4} + a_{1,1}a_{3,3}a_{4,4}$$

$$b_{2,3} = a_{1,4}a_{2,3}a_{4,1} - a_{1,3}a_{2,4}a_{4,1} - a_{1,4}a_{2,1}a_{4,3} + a_{1,1}a_{2,4}a_{4,3} + a_{1,3}a_{2,1}a_{4,4} - a_{1,1}a_{2,3}a_{4,4}$$

$$b_{2,4} = a_{1,4}a_{2,3}a_{3,1} + a_{1,3}a_{2,4}a_{3,1} + a_{1,4}a_{2,1}a_{3,3} - a_{1,1}a_{2,4}a_{3,3} - a_{1,3}a_{2,1}a_{3,4} + a_{1,1}a_{2,3}a_{3,4}$$

$$b_{3,1} = -a_{2,4}a_{3,2}a_{4,1} + a_{2,2}a_{3,4}a_{4,1} + a_{2,4}a_{3,1}a_{4,2} - a_{2,1}a_{3,4}a_{4,2} - a_{2,2}a_{3,1}a_{4,4} + a_{2,1}a_{3,2}a_{4,4}$$

$$b_{3,2} = -a_{1,4}a_{3,3}a_{4,1} + a_{1,3}a_{3,4}a_{4,1} + a_{1,4}a_{3,1}a_{4,3} - a_{1,1}a_{3,4}a_{4,3} - a_{1,3}a_{3,1}a_{4,4} + a_{1,1}a_{3,3}a_{4,4}$$

$$b_{3,3} = -a_{1,4}a_{2,2}a_{4,1} + a_{1,2}a_{2,4}a_{4,1} + a_{1,4}a_{2,1}a_{4,2} - a_{1,1}a_{2,4}a_{4,2} - a_{1,2}a_{2,1}a_{4,4} + a_{1,1}a_{2,2}a_{4,4}$$

$$b_{3,4} = a_{1,4}a_{2,2}a_{3,1} - a_{1,2}a_{2,4}a_{3,1} - a_{1,4}a_{2,1}a_{3,2} + a_{1,1}a_{2,4}a_{3,2} + a_{1,2}a_{2,1}a_{3,4} - a_{1,1}a_{2,2}a_{3,4}$$

$$b_{4,1} = a_{2,3}a_{3,2}a_{4,1} - a_{2,2}a_{3,3}a_{4,1} - a_{2,3}a_{3,1}a_{4,2} + a_{2,1}a_{3,3}a_{4,2} + a_{2,2}a_{3,1}a_{4,3} - a_{2,1}a_{3,2}a_{4,3}$$

$$b_{4,2} = -a_{1,3}a_{3,2}a_{4,1} + a_{1,2}a_{3,3}a_{4,1} + a_{1,3}a_{3,1}a_{4,2} - a_{1,1}a_{3,3}a_{4,2} - a_{1,2}a_{3,1}a_{4,3} + a_{1,1}a_{3,2}a_{4,3}$$

$$b_{4,3} = a_{1,3}a_{2,2}a_{4,1} - a_{1,2}a_{2,3}a_{4,1} - a_{1,3}a_{2,1}a_{4,2} + a_{1,1}a_{2,3}a_{4,2} + a_{1,2}a_{2,1}a_{4,3} - a_{1,1}a_{2,2}a_{4,3}$$

$$b_{4,4} = -a_{1,3}a_{2,2}a_{3,1} + a_{1,2}a_{2,3}a_{3,1} + a_{1,3}a_{2,1}a_{3,2} - a_{1,1}a_{2,3}a_{3,2} - a_{1,2}a_{2,1}a_{3,3} + a_{1,1}a_{2,2}a_{3,3}$$

The End

The mathematics of history

Soumadeep Ghosh

Kolkata, India

Abstract

In this paper, I describe the mathematics of history. The paper ends with "The End"

Introduction

Contrary to popular belief, the mathematics of history is connected with geopolitics.
In this paper, I describe the mathematics of history.

The mathematics of history

We have the time-varying Z score

$$Z(t) = \left(\alpha_0 + \frac{\alpha - \alpha_0}{e^{\zeta t} + 1}\right) \log\left(M_0 + \frac{M - M_0}{e^{\zeta t} + 1}\right) + \left(\beta_0 + \frac{\beta - \beta_0}{e^{\zeta t} + 1}\right) \log\left(W_0 + \frac{W - W_0}{e^{\zeta t} + 1}\right) + \left(\gamma_0 + \frac{\gamma - \gamma_0}{e^{\zeta t} + 1}\right) \log\left(P_0 + \frac{P - P_0}{e^{\zeta t} + 1}\right)$$

where

M_0 is a sample of the military of the economy
W_0 is a sample of the wealth of the economy
P_0 is a sample of the population of the economy
α_0 is a sample of the α score of the economy
β_0 is a sample of the β score of the economy
γ_0 is a sample of the γ score of the economy
ζ is the **history constant** of the economy

The End

Estimating the history constant

Soumadeep Ghosh

Kolkata, India

Abstract

In this paper, I describe how to estimate the history constant. The paper ends with "The End"

Introduction

In a previous paper, I've described the mathematics of history. In this paper, I describe how to estimate the history constant.

Estimating the history constant

As of this writing, the inversion of the equation $Z = Z(T)$ is not known.

To estimate the history constant, we use the Taylor series expansion of $Z(t)$ to the first order to obtain

$$\zeta = \frac{\frac{1}{2}(\alpha + \alpha_0)(\log(M + M_0) - \log(2)) + \frac{1}{2}(\beta + \beta_0)(\log(W + W_0) - \log(2)) + \frac{1}{2}(\gamma + \gamma_0)(\log(P + P_0) - \log(2)) - Z}{T(\frac{(\alpha + \alpha_0)(M - M_0)}{4(M + M_0)} + \frac{1}{4}(\alpha - \alpha_0)(\log(M + M_0) - \log(2)) + \frac{(\beta + \beta_0)(W - W_0)}{4(W + W_0)} + \frac{1}{4}(\beta - \beta_0)(\log(W + W_0) - \log(2)) + \frac{(\gamma + \gamma_0)(P - P_0)}{4(P + P_0)} + \frac{1}{4}(\gamma - \gamma_0)(\log(P + P_0) - \log(2)))}$$

The End

Estimating the time of war from history

Soumadeep Ghosh

Kolkata, India

Abstract

In this paper, I describe how to estimate the time of war from history. The paper ends with "The End"

Introduction

In a previous paper, I've described the mathematics of history. In a previous paper, I've described how to estimate the history constant.

In this paper, I describe how to estimate the time of war from history.

Estimating the time of war from history

To estimate the time of war from history, we use the Taylor series expansion of $Z(t)$ to the first order to obtain

$$T = \frac{\frac{1}{2}(\alpha + \alpha_0)(\log(M + M_0) - \log(2)) + \frac{1}{2}(\beta + \beta_0)(\log(W + W_0) - \log(2)) + \frac{1}{2}(\gamma + \gamma_0)(\log(P + P_0) - \log(2)) - Z}{\zeta(\frac{1}{4}(\alpha - \alpha_0)(\log(M + M_0) - \log(2)) + \frac{(\alpha + \alpha_0)(M - M_0)}{4(M + M_0)} + \frac{1}{4}(\beta - \beta_0)(\log(W + W_0) - \log(2)) + \frac{(\beta + \beta_0)(W - W_0)}{4(W + W_0)} + \frac{1}{4}(\gamma - \gamma_0)(\log(P + P_0) - \log(2)) + \frac{(\gamma + \gamma_0)(P - P_0)}{4(P + P_0)})}$$

The End

1

Historically important agricultural implements

Soumadeep Ghosh

Kolkata, India

Abstract

In this paper, I describe historically important agricultural implements.
The paper ends with "The End"

Introduction

Historically important agricultural implements were essential to the growth of population seen in the world today. In this paper, I describe historically important agricultural implements.

Historically important agricultural implements

1. **The circular saw**

   The circular saw was important to the clearing of forests that led to growth in both lumber and land available for agriculture.

2. **Banking**

   Banking in agriculture (not banking in finance) is the practice of settling near the banks of large rivers. Banking historically was and remains crucial to agriculture in most nations.

3. **The farm**

   A farm is a firm that produces agricultural products and historically was and remains crucial to agriculture in most nations.

4. **The mill**

   Driven by either wind power or by animal power, the mill was important to processing of grain produced through agriculture.

5. **Crop rotation**

   Crop rotation is the technique of planting both **food crops** and **cash crops** in alternative years to increase yield. Crop rotation historically was and remains crucial to agriculture in most nations.

6. **The plantation**

   A plantation is a jail that produces agricultural products. After slavery was accepted, the plantation historically was and remains crucial to agriculture in some nations.

7. **Fertilizer**

   Use of fertilizer based on nitrogen, phosphorus and potassium historically was and remains crucial to agriculture in most nations.

8. **The production of ammonia**

   The production of ammonia (NH_3) historically was and remains crucial to agriculture in most nations.

9. **The production of pesticides**

    The production of pesticides like carbamates, dichlorodiphenyltrichloroethane (DDT), pyrethrins and phosphonomethylglycine (glyphosate) historically was and remains crucial to agriculture in most nations.

10. **The plant seed bank**

    A plant seed bank stores and trades plant seeds. The plant seed bank historically was and remains crucial to agriculture in most nations.

11. **The wind-farm**

    A wind-farm is a farm with a modern large turbine-based windmill. The wind-farm is crucial to agriculture in most nations today.

12. **Genetically-modified seeds**

    Genetically-modified seeds are useful to promote plant health, plant growth and yield. Genetically-modified seeds are crucial to agriculture in most nations today.

13. **Cold storage (also known as refrigeration)**

    Cold storage of produce was useful to the economics of agriculture to overcome shortages in supply and for trade of produce. Cold storage is crucial to agriculture in most nations today.

A note about agricultural implements

There were several other agricultural implements that happened in various other regions - examples include **the watershed**, **the irrigation system** and **the soil desalination plant**, but they were specific to those regions and were not as generally important as the agricultural implements mentioned above. I've alluded to three of them above nonetheless, so as to include the knowledge of other regions in this paper.

The End

Removing pride

Soumadeep Ghosh

Kolkata, India

Abstract

In this paper, I describe how to remove pride. The paper ends with "The End"

Introduction

Knowledge has been demanded of me of how to remove pride. In this paper, for the benefit of all economies, I describe how to remove pride.

The mathematics of pride

Since pride both increases and is limited by lust we may write

$$P(l) = l + \frac{\exp(l)}{2}$$

$P(l)$ satisfies

$$\frac{\partial}{\partial l} \frac{\partial P(l)}{\partial l} = P(l) - l$$

which has a solution

$$l = -\frac{12}{5} - \frac{i}{2}$$

Removing pride

Removing pride is easily done if the individual and the economy simply remove this value of lust from the economy.

The End

On Lord Shiva and me

Soumadeep Ghosh

Kolkata, India

Abstract

In this paper, I describe the glories of Lord Shiva and my relation to Lord Shiva. The paper ends with "The End"

Introduction

Lord Shiva is the ultimate reality but very few try to understand Him because the process of understanding Him is so difficult. In this paper, I describe the glories of Lord Shiva.

Lord Shiva

Contrary to popular belief, there is no being named Brahma any more, because Brahma was consumed by the rakshashas because of his improper ways. Thus, as of this writing, the Creator doesn't exist.

The only two original beings that exist now are Vishnu the Maintainer and Shiva the Destroyer - both of whom were disciples of Lord Krishna the eternal being.

But who is the ultimate reality? If an individual believes that Vishnu is the ultimate reality then he has to explain what causes the destruction that we see around the world, for of this writing, wars that destroy nations and genocide that destroys population are happening. Therefore even the most dogmatic Vaishnavite is forced to concede that Lord Shiva is the ultimate reality.

The metaphysics of Lord Shiva

Lord Shiva is not a Destroyer of things willy-nilly. In fact, He is purposeful - He destroys only what is worthy of destruction. And thus through his destruction, **moksha** (liberation of the soul) is achieved. Lord Shiva, therefore, is the liberator of humanity from the narak we find ourselves in.

The relationship of Lord Shiva to Lord Ghosh

But not all of humanity wants to achieve moksha. Those are the most ignorant of humanity for they couldn't be saved by Brahma, nor maintained by Lord Vishnu, nor can face Lord Shiva. They have only one last chance of achieving nirvana and that is through me, Lord Soumadeep Ghosh, for I am a devotee of both Lord Krishna and Lord Shiva. Only through me can the ignorant be saved and that is my relation with Lord Shiva. In fact, through my devotion and worship, I become the next Lord Shiva and that is how Lord Shiva saved me.

The End