Holistic Complete Determinant

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Abstract- **In this research monograph, an algorithm to compute Determinants in a Holistic and Complete manner is presented.**

Index Terms- **Determinant**

I. INTRODUCTION

Cramer was the first to formulate the central idea of a Determinant in the middle of the eighteenth century. Later, Cauchy further refined it. This was followed by further refinements of this idea by Spottiswoode, Cayley, Sylvester and Hermite. Brioschi, Bellavitis and Baltzer also contributed substantially to the development of this idea. [1]

II.DETERMINANTS OVERVIEW

A good overview of Determinants can be found from the following website
https://en.wikipedia.org/wiki/Determinant
Also, a detailed analysis of Determinants can be found in [1] and [2].

III.ESTABLISHMENT OF THE HOLISTIC COMPLETE DETERMINANT MODEL

The notion of a Holistic Complete Determinant is presented using the example of a 3x3 Determinant. For a matrix of size 3X3, say

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

we know the general formula for determinant of size 3X3 is given by

$$\det(A) = a_{11}(a_{22}a_{33} - a_{23}a_{32}) - a_{12}(a_{21}a_{33} - a_{23}a_{31}) + a_{13}(a_{21}a_{32} - a_{22}a_{31})$$

We re-write it in the fashion

$$\det(A) = a_{11}a_{22}a_{33} - a_{11}a_{23}a_{32} - a_{12}a_{21}a_{33} + a_{12}a_{23}a_{31} + a_{13}a_{21}a_{32} - a_{13}a_{22}a_{31}$$

We again re-write using a rule that in any term the indexes must be in ascending order

$$\det(A) = a_{11}a_{22}a_{33} - a_{11}a_{23}a_{32} - a_{12}a_{21}a_{33} + a_{12}a_{23}a_{31} + a_{13}a_{21}a_{32} - a_{13}a_{22}a_{31}$$

Luckily, in this case, we did write so.
We now inspect the first indexes of every element in the product term forming each term and second indexes of every element in the product term forming each term and so on so forth for all the 6 terms.
We list them as shown below:

Term		First Element Of The Product Term	Second Element Of The Product Term	Third Element Of The Product Term	Sign
$a_{11}a_{22}a_{33}$		Positions			
	First Index	1	2	3	+
	Second Index	1	2	3	+
$-a_{11}a_{23}a_{32}$	First Index	1	2	3	+
	Second Index	1	3	2	-
$-a_{12}a_{21}a_{33}$	First Index	1	2	3	+
	Second Index	2	1	3	-
$a_{12}a_{23}a_{31}$	First Index	1	2	3	+
	Second Index	2	3	1	+
$a_{13}a_{21}a_{32}$	First Index	1	2	3	+
	Second Index	3	1	2	+
$-a_{13}a_{22}a_{31}$	First Index	1	2	3	+
	Second Index	3	2	1	-

Table 1: Signs Analysis

We can note from the above table that whenever, we are not going along the consecutive order of indexes (i.e., cyclic order), we get a negative sign.

The number of Product Terms considered in the Standard Determinant are only 6. However, we can form number of Product Terms for a 3x3 Determinant with 9 elements. The sum of all these Product Terms with their thusly computed Signs is considered by the author as the value of a Holistic Complete Determinant.

In the above stated fashion, one can compute the Holistic Complete Determinant of any sized Determinant.

IV.CONCLUSIONS

One can note that such a Holistic Complete Determinant computed thusly gives us realistic Eigen Values when used in Eigen Value Problems. Also, one can hyper-refine Spectral (Quantum) Eigen Value Theory using this concept of Holistic Complete Determinant.

ACKNOWLEDGMENT

REFERENCES

[1] Muir, Thomas. The Theory of Determinants In The Historical Order of Development. London, Macmillan & Co. Ltd, 1906.

[2] Hall, H.S. & Knight, S.R. Higher Algebra, G. K. Publishers Pvt Limited, 1897. ISBN 8183552811, 9788183552813

[3] https://en.wikipedia.org/wiki/Determinant

[4] Bagadi, R. (2016). Holistic Complete Determinants. PHILICA.COM Article number 625. ISSN 1751-3030.