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Menghitung Determinan Suatu Matriks Ordo $n \times n, n \geq 3$ Menggunakan Metode Kondensasi CHIO Berbantu Excel dan MATLAB

Ratna Dwi Christyanti[1],St. Syahdan[2],Chuzaimah[3]
[1,2,3]Program Studi Matematika Universitas Kaltara
r_christyanti@yahoo.com

Abstract— *Determinants are a function of the set of square matrices to the set of real numbers. The determinant of the matrix A denote | A | or det (A). In this discussion method used to solve the determinant of a matrix is the Chio Condensation method. The Chio Condensation Method is one method that can be used to evaluating the determinant of the order matrix $n \times n, n \geq 3$ determinant in terms of $(n-1) \times (n-1)$ with $a_{11} \neq 0$. Calculating the determinant of the matrix $n \times n, n \geq 3$ with Chio Condensation method will be easier if it is assisted excel and Matlab.*

Keywords—Determinant of matrix, Chio Condensation method.

1. PENDAHULUAN

Matriks adalah suatu susunan bilangan berbentuk segi empat. Bilangan-bilangan dalam susunan itu disebut entri atau elemen dalam matriks tersebut. Setiap elemen menunjukkan kolom dan baris tertentu. Misalkan $A = (a_{ij})$ merupakan suatu matriks dengan elemen a_{ij}. Banyaknya baris dan kolom suatu matriks menunjukkan ukuran dari matriks yang dinamakan ordo matriks. Beberapa jenis matriks diantaranya adalah matriks persegi, matriks nol, matriks segitiga atas atau bawah, matriks skalar, matriks diagonal, matriks invers dan matriks identitas. Jika banyaknya kolom dan baris sama maka matriks tersebut dikatakan matriks persegi [1],[4],[5].

Setiap matriks bujur sangkar A mempunyai suatu besaran skalar yang disebut determinan. Determinan adalah nilai real yang dihitung berdasarkan nilai-nilai elemen-elemennya, menurut rumus tertentu yang ditulis dengan simbol $\det(A)$ atau $|A|$. Beberapa metode yang digunakan yaitu ekspansi kolom mengalikan minor dengan komponen kolom matriks. Minor suatu matriks adalah matriks bagian (sub matriks) yang diperoleh dengan menghilangkan elemen-elemen pada baris ke-i dan kolom ke-j. Kofaktor merupakan minor bertanda yang diperoleh dari hasil perkalian minor dengan satu angka yang besarnya $(-1)^{i+j}$ dimana i dan j menunjukkan baris dan kolom matriks yang diekspansi [1],[4],[5].

Metode kondensi merupakan suatu proses reduksi pada determinan matriks dengan suatu aturan tertentu. Seiring perkembangan didunia pendidikan dan komputerisasi telah banyak ditemukan program untuk menyelesaikan determinan matriks yang memiliki ordo yang besar. Oleh karena itu, pada penelitian ini akan dikaji tentang metode kondensasi Chio yang digunakan untuk menentukan determinan matriks ordo $n \times n, n \geq 3$. Penyusutan ordo determinan matriks $n \times n$ menjadi $(n-1) \times (n-1)$ akan digunakan untuk menentukan determinan matriks. Kondensasi Chio merupakan salah satu metode yang dapat digunakan untuk menentukan determinan matriks ordo $n \times n$ untuk $n \geq 3$, dengan membentuk determinan matriks ordo $(n-1) \times (n-1)$ dan digunakan elemen a_{11} sebagai faktor pengalinya [2],[3].

Sifat-sifat determinan yang digunakan pada proses operasi baris elementer yakni menukarkan baris atau kolom sangat berperan penting dalam menentukan determinan matriks. Hal ini diperlukan untuk mengubah nilai elemen $a_{11} \neq 0$ yang merupakan syarat dari kondensasi Chio. Masalah yang dibahas dalam penelitian ini adalah mengkaji cara menentukan nilai determinan matriks dengan metode kondensasi Chio untuk matriks ordo $n \times n, n \geq 3$. Penelitian ini menggunakan matriks persegi $n \times n, n \geq 3$ dengan syarat elemen $a_{11} \neq 0$. Apabila nilai elemen $a_{11} = 0$, maka dilakukan proses operasi baris atau kolom yaitu menukarkan baris atau kolom pada determinan matriks untuk mengubah $a_{11} \neq 0$. Selanjutnya disubstitusikan ke dalam persamaan kondensasi Chio dan dilakukan proses kondensasi sehingga membentuk determinan matriks ordo $(n-1) \times (n-1)$. Proses kondensasi ini akan terus dilanjutkan sampai membentuk determinan matriks ordo 2×2 sehingga diperoleh determinan matriks ordo $n \times n$.

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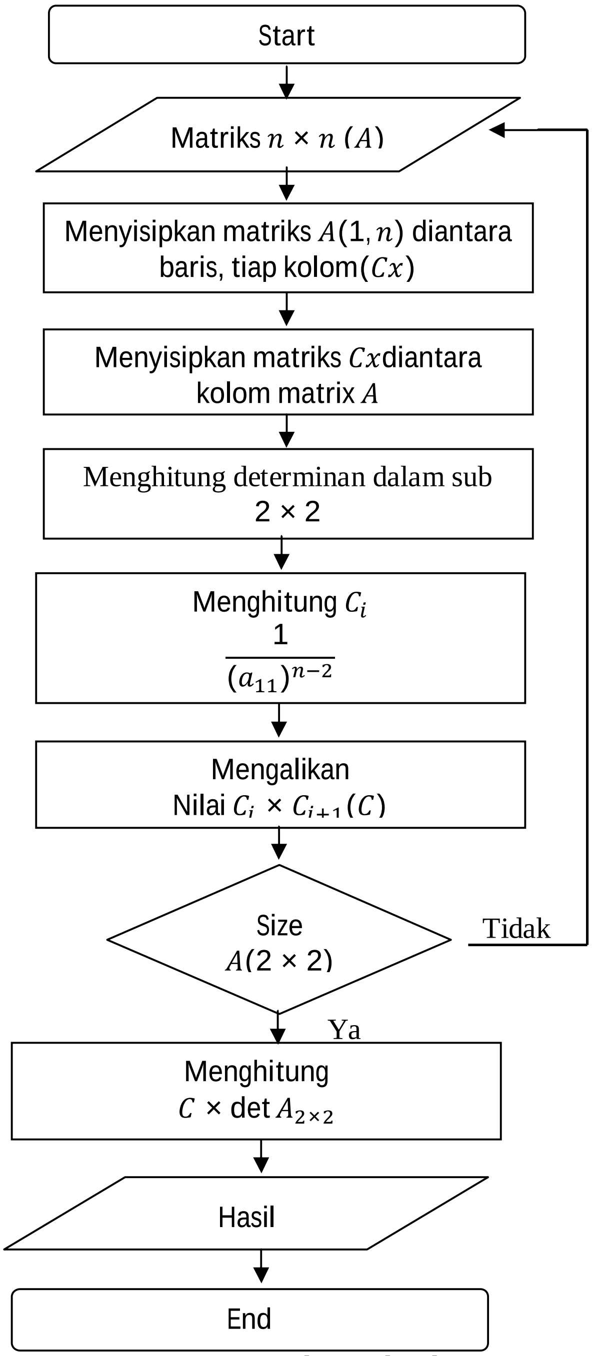
2. METODOLOGI

Di bawah ini merupakan metodologi penelitian yang di buat dalam bentuk *Flowchart*



Gambar 1 Flowchart

3. HASIL DAN PEMBAHASAN

3.1 Penyelesaian Determinan Matriks Persegi Menggunakan Metode Kondensasi Chio

Menghitung determinan suatu matriks menggunakan metode kondensasi Chio dengan cara mengkondensasikan (menyusutkan) ordo determinan matriks $n \times n$ menjadi determinan matriks ordo $(n-1) \times (n-1)$, dengan $a_{11} \neq 0$. Proses kondensasi ini menyajikan determinan yang dicari menjadi sub-sub determinan berordo 2×2 menggunakan elemen matriks baris ke-1 dan kolom ke-1 sebagai titik tolaknya.

Berikut ini akan dijelaskan mengenai pembuktian metode kondensasi Chio untuk sebarang matriks persegi A.

Teorema 3.1

Jika

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{bmatrix},$$

maka

$$\det(A) = \frac{1}{{a_{11}}^{n-2}} \begin{vmatrix} \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{21} & a_{23} \end{vmatrix} & \cdots & \begin{vmatrix} a_{11} & a_{1n} \\ a_{21} & a_{2n} \end{vmatrix} \\ \begin{vmatrix} a_{11} & a_{12} \\ a_{31} & a_{32} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{31} & a_{33} \end{vmatrix} & \cdots & \begin{vmatrix} a_{11} & a_{1n} \\ a_{31} & a_{3n} \end{vmatrix} \\ \vdots & \vdots & \ddots & \vdots \\ \begin{vmatrix} a_{11} & a_{12} \\ a_{n1} & a_{n2} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{n1} & a_{n3} \end{vmatrix} & \cdots & \begin{vmatrix} a_{11} & a_{1n} \\ a_{n1} & a_{nn} \end{vmatrix} \end{vmatrix}.$$

Bukti:

Diberikan matriks $A_{n\times n}$ yaitu

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & a_{24} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & a_{34} & \cdots & a_{3n} \\ a_{41} & a_{42} & a_{43} & a_{44} & \cdots & a_{4n} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & a_{n4} & \cdots & a_{nn} \end{bmatrix}.$$

Determinan matriks A dengan metode kondensasi Chio adalah

$$\det(A) = \begin{vmatrix} a_{11} & a_{12} & a_{13} & a_{14} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & a_{24} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & a_{34} & \cdots & a_{3n} \\ a_{41} & a_{42} & a_{43} & a_{44} & \cdots & a_{4n} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & a_{n4} & \cdots & a_{nn} \end{vmatrix}$$

$$= \begin{vmatrix} a_{11}.1 & a_{11}.\frac{a_{12}}{a_{11}} & a_{11}.\frac{a_{13}}{a_{11}} & a_{11}.\frac{a_{14}}{a_{11}} & \cdots & a_{11}.\frac{a_{1n}}{a_{11}} \\ a_{21} & a_{22} & a_{23} & a_{24} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & a_{34} & \cdots & a_{3n} \\ a_{41} & a_{42} & a_{43} & a_{44} & \cdots & a_{4n} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & a_{n4} & \cdots & a_{nn} \end{vmatrix}$$

$$= a_{11} \begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ a_{21} & a_{22} & a_{23} & a_{24} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & a_{34} & \cdots & a_{3n} \\ a_{41} & a_{42} & a_{43} & a_{44} & \cdots & a_{4n} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & a_{n4} & \cdots & a_{nn} \end{vmatrix}$$

$$= a_{11} \begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ a_{21} - a_{21}.1 & a_{22} - a_{21}.\frac{a_{12}}{a_{11}} & a_{23} - a_{21}.\frac{a_{13}}{a_{11}} & a_{24} - a_{21}.\frac{a_{14}}{a_{11}} & \cdots & a_{2n} - a_{21}.\frac{a_{1n}}{a_{11}} \\ a_{31} - a_{31}.1 & a_{32} - a_{31}.\frac{a_{12}}{a_{11}} & a_{33} - a_{31}.\frac{a_{13}}{a_{11}} & a_{34} - a_{31}.\frac{a_{14}}{a_{11}} & \cdots & a_{3n} - a_{31}.\frac{a_{1n}}{a_{11}} \\ a_{41} - a_{41}.1 & a_{42} - a_{41}.\frac{a_{12}}{a_{11}} & a_{43} - a_{41}.\frac{a_{13}}{a_{11}} & a_{44} - a_{41}.\frac{a_{14}}{a_{11}} & \cdots & a_{4n} - a_{41}.\frac{a_{1n}}{a_{11}} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} - a_{n1}.1 & a_{n2} - a_{n1}.\frac{a_{12}}{a_{11}} & a_{n3} - a_{n1}.\frac{a_{13}}{a_{11}} & a_{n4} - a_{n1}.\frac{a_{14}}{a_{11}} & \cdots & a_{nn} - a_{n1}.\frac{a_{1n}}{a_{11}} \end{vmatrix} \quad \begin{matrix} \\ b_2 - a_{21}.b_1 \\ b_3 - a_{31}.b_1 \\ b_4 - a_{41}.b_1 \\ \\ b_n - a_{n1}.b_1 \end{matrix}$$

$$= a_{11} \begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ 0 & \frac{1}{a_{11}}(a_{22}a_{11} - a_{21}a_{12}) & \frac{1}{a_{11}}(a_{23}a_{11} - a_{21}a_{13}) & \frac{1}{a_{11}}(a_{24}a_{11} - a_{21}a_{14}) & \cdots & \frac{1}{a_{11}}(a_{2n}a_{11} - a_{21}a_{1n}) \\ 0 & a_{32} - a_{31}.\frac{a_{12}}{a_{11}} & a_{33} - a_{31}.\frac{a_{13}}{a_{11}} & a_{34} - a_{31}.\frac{a_{14}}{a_{11}} & \cdots & a_{3n} - a_{31}.\frac{a_{1n}}{a_{11}} \\ 0 & a_{42} - a_{41}.\frac{a_{12}}{a_{11}} & a_{43} - a_{41}.\frac{a_{13}}{a_{11}} & a_{44} - a_{41}.\frac{a_{14}}{a_{11}} & \cdots & a_{4n} - a_{41}.\frac{a_{1n}}{a_{11}} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n2} - a_{n1}.\frac{a_{12}}{a_{11}} & a_{n3} - a_{n1}.\frac{a_{13}}{a_{11}} & a_{n4} - a_{n1}.\frac{a_{14}}{a_{11}} & \cdots & a_{nn} - a_{n1}.\frac{a_{1n}}{a_{11}} \end{vmatrix}$$

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$$= a_{11}.\frac{1}{a_{11}}\begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ 0 & a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ 0 & a_{32}-a_{31}.\frac{a_{12}}{a_{11}} & a_{33}-a_{31}.\frac{a_{13}}{a_{11}} & a_{34}-a_{31}.\frac{a_{14}}{a_{11}} & \cdots & a_{3n}-a_{31}.\frac{a_{1n}}{a_{11}} \\ 0 & a_{42}-a_{41}.\frac{a_{12}}{a_{11}} & a_{43}-a_{41}.\frac{a_{13}}{a_{11}} & a_{44}-a_{41}.\frac{a_{14}}{a_{11}} & \cdots & a_{4n}-a_{41}.\frac{a_{1n}}{a_{11}} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n2}-a_{n1}.\frac{a_{12}}{a_{11}} & a_{n3}-a_{n1}.\frac{a_{13}}{a_{11}} & a_{n4}-a_{n1}.\frac{a_{14}}{a_{11}} & \cdots & a_{nn}-a_{n1}.\frac{a_{1n}}{a_{11}} \end{vmatrix}$$

$$= a_{11}.\frac{1}{a_{11}}\begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ 0 & a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ 0 & \frac{1}{a_{11}}(a_{32}a_{11}-a_{31}a_{12}) & \frac{1}{a_{11}}(a_{33}a_{11}-a_{31}a_{13}) & \frac{1}{a_{11}}(a_{34}a_{11}-a_{31}a_{14}) & \cdots & \frac{1}{a_{11}}(a_{3n}a_{11}-a_{31}a_{1n}) \\ 0 & a_{42}-a_{41}.\frac{a_{12}}{a_{11}} & a_{43}-a_{41}.\frac{a_{13}}{a_{11}} & a_{44}-a_{41}.\frac{a_{14}}{a_{11}} & \cdots & a_{4n}-a_{41}.\frac{a_{1n}}{a_{11}} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n2}-a_{n1}.\frac{a_{12}}{a_{11}} & a_{n3}-a_{n1}.\frac{a_{13}}{a_{11}} & a_{n4}-a_{n1}.\frac{a_{14}}{a_{11}} & \cdots & a_{nn}-a_{n1}.\frac{a_{1n}}{a_{11}} \end{vmatrix}$$

$$= a_{11}.\frac{1}{a_{11}}.\frac{1}{a_{11}}\begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ 0 & a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ 0 & a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ 0 & a_{42}-a_{41}.\frac{a_{12}}{a_{11}} & a_{43}-a_{41}.\frac{a_{13}}{a_{11}} & a_{44}-a_{41}.\frac{a_{14}}{a_{11}} & \cdots & a_{4n}-a_{41}.\frac{a_{1n}}{a_{11}} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n2}-a_{n1}.\frac{a_{12}}{a_{11}} & a_{n3}-a_{n1}.\frac{a_{13}}{a_{11}} & a_{n4}-a_{n1}.\frac{a_{14}}{a_{11}} & \cdots & a_{nn}-a_{n1}.\frac{a_{1n}}{a_{11}} \end{vmatrix}$$

$$= a_{11}.\frac{1}{a_{11}}.\frac{1}{a_{11}}\begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ 0 & a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ 0 & a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ 0 & \frac{1}{a_{11}}(a_{42}a_{11}-a_{41}a_{12}) & \frac{1}{a_{11}}(a_{43}a_{11}-a_{41}a_{13}) & \frac{1}{a_{11}}(a_{44}a_{11}-a_{41}a_{14}) & \cdots & \frac{1}{a_{11}}(a_{4n}a_{11}-a_{41}a_{1n}) \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n2}-a_{n1}.\frac{a_{12}}{a_{11}} & a_{n3}-a_{n1}.\frac{a_{13}}{a_{11}} & a_{n4}-a_{n1}.\frac{a_{14}}{a_{11}} & \cdots & a_{nn}-a_{n1}.\frac{a_{1n}}{a_{11}} \end{vmatrix}$$

$$= a_{11}.\frac{1}{a_{11}}.\frac{1}{a_{11}}.\frac{1}{a_{11}}\begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ 0 & a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ 0 & a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ 0 & a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n2}-a_{n1}.\frac{a_{12}}{a_{11}} & a_{n3}-a_{n1}.\frac{a_{13}}{a_{11}} & a_{n4}-a_{n1}.\frac{a_{14}}{a_{11}} & \cdots & a_{nn}-a_{n1}.\frac{a_{1n}}{a_{11}} \end{vmatrix}$$

$$= a_{11}.\frac{1}{a_{11}}.\frac{1}{a_{11}}.\frac{1}{a_{11}}\begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ 0 & a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ 0 & a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ 0 & a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & \frac{1}{a_{11}}(a_{n2}a_{11}-a_{n1}a_{12}) & \frac{1}{a_{11}}(a_{n3}a_{11}-a_{n1}a_{13}) & \frac{1}{a_{11}}(a_{n4}a_{11}-a_{n1}a_{14}) & \cdots & \frac{1}{a_{11}}(a_{nn}a_{11}-a_{n1}a_{1n}) \end{vmatrix}$$

$$= a_{11}.\frac{1}{a_{11}{}^{n-1}}\begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ 0 & a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ 0 & a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ 0 & a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n2}a_{11}-a_{n1}a_{12} & a_{n3}a_{11}-a_{n1}a_{13} & a_{n4}a_{11}-a_{n1}a_{14} & \cdots & a_{nn}a_{11}-a_{n1}a_{1n} \end{vmatrix}$$

$$= \frac{1}{a_{11}{}^{n-1-1}}\begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ 0 & a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ 0 & a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ 0 & a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n2}a_{11}-a_{n1}a_{12} & a_{n3}a_{11}-a_{n1}a_{13} & a_{n4}a_{11}-a_{n1}a_{14} & \cdots & a_{nn}a_{11}-a_{n1}a_{1n} \end{vmatrix}$$

$$= \frac{1}{a_{11}{}^{n-2}}\begin{vmatrix} 1 & \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ 0 & a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ 0 & a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ 0 & a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n2}a_{11}-a_{n1}a_{12} & a_{n3}a_{11}-a_{n1}a_{13} & a_{n4}a_{11}-a_{n1}a_{14} & \cdots & a_{nn}a_{11}-a_{n1}a_{1n} \end{vmatrix}$$

$$= \frac{1}{a_{11}{}^{n-2}}\left| 1\begin{vmatrix} a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n2}a_{11}-a_{n1}a_{12} & a_{n3}a_{11}-a_{n1}a_{13} & a_{n4}a_{11}-a_{n1}a_{14} & \cdots & a_{nn}a_{11}-a_{n1}a_{1n} \end{vmatrix}\right.$$

$$-0\begin{vmatrix} \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n2}a_{11}-a_{n1}a_{12} & a_{n3}a_{11}-a_{n1}a_{13} & a_{n4}a_{11}-a_{n1}a_{14} & \cdots & a_{nn}a_{11}-a_{n1}a_{1n} \end{vmatrix}$$

$$+0\begin{vmatrix} \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n2}a_{11}-a_{n1}a_{12} & a_{n3}a_{11}-a_{n1}a_{13} & a_{n4}a_{11}-a_{n1}a_{14} & \cdots & a_{nn}a_{11}-a_{n1}a_{1n} \end{vmatrix}$$

$$-0\begin{vmatrix} \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n2}a_{11}-a_{n1}a_{12} & a_{n3}a_{11}-a_{n1}a_{13} & a_{n4}a_{11}-a_{n1}a_{14} & \ddots & a_{nn}a_{11}-a_{n1}a_{1n} \end{vmatrix}$$

$$\left.+0\begin{vmatrix} \frac{a_{12}}{a_{11}} & \frac{a_{13}}{a_{11}} & \frac{a_{14}}{a_{11}} & \cdots & \frac{a_{1n}}{a_{11}} \\ a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \end{vmatrix}\right|$$

$$= \frac{1}{a_{11}{}^{n-2}}\left| 1\begin{vmatrix} a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n2}a_{11}-a_{n1}a_{12} & a_{n3}a_{11}-a_{n1}a_{13} & a_{n4}a_{11}-a_{n1}a_{14} & \cdots & a_{nn}a_{11}-a_{n1}a_{1n} \end{vmatrix} -0+0-0+0 \right|$$

$$= \frac{1}{a_{11}{}^{n-2}}\begin{vmatrix} a_{22}a_{11}-a_{21}a_{12} & a_{23}a_{11}-a_{21}a_{13} & a_{24}a_{11}-a_{21}a_{14} & \cdots & a_{2n}a_{11}-a_{21}a_{1n} \\ a_{32}a_{11}-a_{31}a_{12} & a_{33}a_{11}-a_{31}a_{13} & a_{34}a_{11}-a_{31}a_{14} & \cdots & a_{3n}a_{11}-a_{31}a_{1n} \\ a_{42}a_{11}-a_{41}a_{12} & a_{43}a_{11}-a_{41}a_{13} & a_{44}a_{11}-a_{41}a_{14} & \cdots & a_{4n}a_{11}-a_{41}a_{1n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n2}a_{11}-a_{n1}a_{12} & a_{n3}a_{11}-a_{n1}a_{13} & a_{n4}a_{11}-a_{n1}a_{14} & \cdots & a_{nn}a_{11}-a_{n1}a_{1n} \end{vmatrix}$$

$$= \frac{1}{a_{11}{}^{n-2}}\begin{vmatrix} \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{21} & a_{23} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{14} \\ a_{21} & a_{24} \end{vmatrix} & \cdots & \begin{vmatrix} a_{11} & a_{1n} \\ a_{21} & a_{2n} \end{vmatrix} \\ \begin{vmatrix} a_{11} & a_{12} \\ a_{31} & a_{32} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{31} & a_{33} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{14} \\ a_{31} & a_{34} \end{vmatrix} & \cdots & \begin{vmatrix} a_{11} & a_{1n} \\ a_{31} & a_{3n} \end{vmatrix} \\ \begin{vmatrix} a_{11} & a_{12} \\ a_{41} & a_{42} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{41} & a_{43} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{14} \\ a_{41} & a_{44} \end{vmatrix} & \cdots & \begin{vmatrix} a_{11} & a_{1n} \\ a_{41} & a_{4n} \end{vmatrix} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \begin{vmatrix} a_{11} & a_{12} \\ a_{n1} & a_{n2} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{n1} & a_{n3} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{14} \\ a_{n1} & a_{n4} \end{vmatrix} & \cdots & \begin{vmatrix} a_{11} & a_{1n} \\ a_{n1} & a_{nn} \end{vmatrix} \end{vmatrix}.$$

Jadi, jika

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{bmatrix},$$

maka

$$\det(A) = \frac{1}{a_{11}{}^{n-2}}\begin{vmatrix} \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{21} & a_{23} \end{vmatrix} & \cdots & \begin{vmatrix} a_{11} & a_{1n} \\ a_{21} & a_{2n} \end{vmatrix} \\ \begin{vmatrix} a_{11} & a_{12} \\ a_{31} & a_{32} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{31} & a_{33} \end{vmatrix} & \cdots & \begin{vmatrix} a_{11} & a_{1n} \\ a_{31} & a_{3n} \end{vmatrix} \\ \vdots & \vdots & \ddots & \vdots \\ \begin{vmatrix} a_{11} & a_{12} \\ a_{n1} & a_{n2} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{n1} & a_{n3} \end{vmatrix} & \cdots & \begin{vmatrix} a_{11} & a_{1n} \\ a_{n1} & a_{nn} \end{vmatrix} \end{vmatrix}$$

3.2 Penyelesaian Determinan Matriks Persegi Menggunakan Metode Chio Secara Manual

Berikut ini akan diberikan contoh penyelesaian determinan matriks persegi menggunakan metode kondensasi Chio secara manual.

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Matriks Persegi berordo 6×6

Diberikan matriks 6×6

$$A = \begin{bmatrix} 3 & 1 & 4 & 0 & 3 & 1 \\ 2 & 2 & 3 & 5 & 1 & 1 \\ 1 & 5 & 4 & 3 & 2 & 2 \\ 0 & 3 & 2 & 3 & 5 & 0 \\ 5 & 3 & 1 & 2 & 2 & 2 \\ 1 & 2 & 3 & 0 & 1 & 3 \end{bmatrix}.$$

Penyelesaian:

Langkah-langkah penyelesaian sebagai berikut

a. Matriks yang diberikakan adalah $n = 6$.

b. Diperoleh $a_{11} = 3$.
Karena $n = 6$ dan $a_{11} = 3$, maka $\frac{1}{(a_{11})^{n-2}} = \frac{1}{(3)^{6-2}}$.

c. Proses kondensasi pertama

$$\det(A) = \begin{vmatrix} 3 & 1 & 4 & 0 & 3 & 1 \\ 2 & 2 & 3 & 5 & 1 & 1 \\ 1 & 5 & 4 & 3 & 2 & 2 \\ 0 & 3 & 2 & 3 & 5 & 0 \\ 5 & 3 & 1 & 2 & 2 & 2 \\ 1 & 2 & 3 & 0 & 1 & 3 \end{vmatrix}$$

$$= \frac{1}{(3)^{6-2}} \begin{vmatrix} \begin{vmatrix} 3 & 1 \\ 2 & 2 \end{vmatrix} & \begin{vmatrix} 3 & 4 \\ 2 & 3 \end{vmatrix} & \begin{vmatrix} 3 & 0 \\ 2 & 5 \end{vmatrix} & \begin{vmatrix} 3 & 3 \\ 2 & 1 \end{vmatrix} & \begin{vmatrix} 3 & 1 \\ 2 & 1 \end{vmatrix} \\ \begin{vmatrix} 3 & 1 \\ 1 & 5 \end{vmatrix} & \begin{vmatrix} 3 & 4 \\ 1 & 4 \end{vmatrix} & \begin{vmatrix} 3 & 0 \\ 1 & 3 \end{vmatrix} & \begin{vmatrix} 3 & 3 \\ 1 & 2 \end{vmatrix} & \begin{vmatrix} 3 & 1 \\ 1 & 2 \end{vmatrix} \\ \begin{vmatrix} 3 & 1 \\ 0 & 3 \end{vmatrix} & \begin{vmatrix} 3 & 4 \\ 0 & 2 \end{vmatrix} & \begin{vmatrix} 3 & 0 \\ 0 & 3 \end{vmatrix} & \begin{vmatrix} 3 & 3 \\ 0 & 5 \end{vmatrix} & \begin{vmatrix} 3 & 1 \\ 0 & 0 \end{vmatrix} \\ \begin{vmatrix} 3 & 1 \\ 5 & 3 \end{vmatrix} & \begin{vmatrix} 3 & 4 \\ 5 & 1 \end{vmatrix} & \begin{vmatrix} 3 & 0 \\ 5 & 2 \end{vmatrix} & \begin{vmatrix} 3 & 3 \\ 5 & 2 \end{vmatrix} & \begin{vmatrix} 3 & 1 \\ 5 & 2 \end{vmatrix} \\ \begin{vmatrix} 3 & 1 \\ 1 & 2 \end{vmatrix} & \begin{vmatrix} 3 & 4 \\ 1 & 3 \end{vmatrix} & \begin{vmatrix} 3 & 0 \\ 1 & 0 \end{vmatrix} & \begin{vmatrix} 3 & 3 \\ 1 & 1 \end{vmatrix} & \begin{vmatrix} 3 & 1 \\ 1 & 3 \end{vmatrix} \end{vmatrix}.$$

d. Karena hasil kondensasi determinannya masih berordo 5×5, maka akan terus disederhanakan menjadi determinan berordo 2×2. Lakukan proses kondensasi ke-2, yaitu

$$\det(A) = \frac{1}{81} \begin{vmatrix} 4 & 1 & 15 & -3 & 1 \\ 14 & 8 & 9 & 3 & 5 \\ 9 & 6 & 9 & 15 & 0 \\ 4 & -17 & 6 & -9 & 1 \\ 5 & 5 & 0 & 0 & 8 \end{vmatrix}.$$

e. Proses kondensasi ke-2, perhatikan elemen a_{11} pada hasil kondensasi ke-2, $a_{11} = 4$. Karena $n = 5$ dan $a_{11} = 4$, maka $\frac{1}{(a_{11})^{n-2}} = \frac{1}{(4)^{5-2}}$.
Diperoleh,

$$\det(A) = \left(\frac{1}{81}\right)\left(\frac{1}{(4)^{5-2}}\right) \begin{vmatrix} \begin{vmatrix} 4 & 1 \\ 14 & 8 \end{vmatrix} & \begin{vmatrix} 4 & 15 \\ 14 & 9 \end{vmatrix} & \begin{vmatrix} 4 & -3 \\ 14 & 3 \end{vmatrix} & \begin{vmatrix} 4 & 1 \\ 14 & 5 \end{vmatrix} \\ \begin{vmatrix} 4 & 1 \\ 9 & 6 \end{vmatrix} & \begin{vmatrix} 4 & 15 \\ 9 & 9 \end{vmatrix} & \begin{vmatrix} 4 & -3 \\ 9 & 15 \end{vmatrix} & \begin{vmatrix} 4 & 1 \\ 9 & 0 \end{vmatrix} \\ \begin{vmatrix} 4 & 1 \\ 4 & -17 \end{vmatrix} & \begin{vmatrix} 4 & 15 \\ 4 & 6 \end{vmatrix} & \begin{vmatrix} 4 & -3 \\ 4 & -9 \end{vmatrix} & \begin{vmatrix} 4 & 1 \\ 4 & 1 \end{vmatrix} \\ \begin{vmatrix} 4 & 1 \\ 5 & 5 \end{vmatrix} & \begin{vmatrix} 4 & 15 \\ 5 & 0 \end{vmatrix} & \begin{vmatrix} 4 & -3 \\ 5 & 0 \end{vmatrix} & \begin{vmatrix} 4 & 1 \\ 5 & 8 \end{vmatrix} \end{vmatrix}.$$

f. Hasil kondensasi determinannya masih berordo 4×4, maka akan terus disederhanakan menjadi determinan berordo 2×2. Lakukan proses kondensasi ke-3. Lakukan hal yang sama seperti contoh sebelumnya, yaitu

$$\det(A) = \left(\frac{1}{81}\right)\left(\frac{1}{64}\right) \begin{bmatrix} 18 & -174 & 54 & 6 \\ 15 & -99 & 87 & -9 \\ -72 & -36 & -24 & 0 \\ 15 & -75 & 15 & 27 \end{bmatrix}.$$

g. Proses kondensasi ke-3, perhatikan elemen a_{11} pada hasil kondensasi ke-2, $a_{11} = 18$. Karena $n = 5$ dan $a_{11} = 4$, maka $\frac{1}{(a_{11})^{n-2}} = \frac{1}{(18)^{4-2}}$.
Diperoleh,

$$\det(A) = \left(\frac{1}{81}\right)\left(\frac{1}{64}\right)\left(\frac{1}{(18)^{4-2}}\right) \begin{vmatrix} \begin{vmatrix} 18 & = 174 \\ 15 & -99 \end{vmatrix} & \begin{vmatrix} 18 & 54 \\ 15 & 87 \end{vmatrix} & \begin{vmatrix} 18 & 6 \\ 15 & -9 \end{vmatrix} \\ \begin{vmatrix} 18 & -174 \\ -72 & -36 \end{vmatrix} & \begin{vmatrix} 18 & 54 \\ -72 & -24 \end{vmatrix} & \begin{vmatrix} 18 & 6 \\ -72 & 0 \end{vmatrix} \\ \begin{vmatrix} 18 & -174 \\ 15 & -75 \end{vmatrix} & \begin{vmatrix} 18 & 54 \\ 15 & 15 \end{vmatrix} & \begin{vmatrix} 18 & 6 \\ 15 & 27 \end{vmatrix} \end{vmatrix}.$$

h. Hasil kondensasi determinannya masih berordo 3×3, maka akan terus disederhanakan menjadi determinan berordo 2×2, yaitu

$$\det(A) = \left(\frac{1}{81}\right)\left(\frac{1}{64}\right)\left(\frac{1}{324}\right) \begin{vmatrix} 828 & 756 & -252 \\ -13176 & 3456 & 432 \\ 1260 & -540 & 396 \end{vmatrix}.$$

i. Proses kondensasi ke-4, perhatikan elemen a_{11} pada hasil kondensasi ke-4, $a_{11} = 828$. Karena $n = 3$ dan $a_{11} = 828$, maka $\frac{1}{(a_{11})^{n-2}} = \frac{1}{(828)^{3-2}}$.
Diperoleh,

$$\det(A) = \left(\frac{1}{81}\right)\left(\frac{1}{64}\right)\left(\frac{1}{324}\right)\left(\frac{1}{(828)^{3-2}}\right) \begin{vmatrix} \begin{vmatrix} 828 & 756 \\ -13176 & 3456 \end{vmatrix} & \begin{vmatrix} 828 & -252 \\ -13176 & 432 \end{vmatrix} \\ \begin{vmatrix} 828 & 756 \\ 1260 & -540 \end{vmatrix} & \begin{vmatrix} 828 & -252 \\ 1260 & 396 \end{vmatrix} \end{vmatrix}$$

$$= \left(\frac{1}{81}\right)\left(\frac{1}{64}\right)\left(\frac{1}{324}\right)\left(\frac{1}{828}\right) \begin{vmatrix} 12822624 & -2962656 \\ -1399680 & 645408 \end{vmatrix}.$$

j. Karena matriks sudah berordo 2×2, lakukan perhitungan dengan mengalikan dan mengurangkan diagonal-diagonalnya yaitu

$$\det(A) = \frac{1}{1390722048}(8{,}27582E + 12 - 4{,}14677E + 12)$$

$$= \frac{1}{1390722048}(4{,}12905E + 12)$$

$$= \frac{4{,}12905E + 12}{1390722048}$$

$$= 2969.$$

k. Hasil determinan matriks A adalah 2969.

3.3 Penyelesaian Determinan Matriks Persegi Ordo $n \times n, n \geq 3$ Menggunakan Metode Kondensasi Chio dengan Excel dan Matlab

Berikut ini adalah tampilan koding program metode Chio $n \times n, n \geq 3$, dengan menggunakan Excel dan Matlab. Sintaks Program Metode Chio dengan Excel dan Matlab sebagai berikut:

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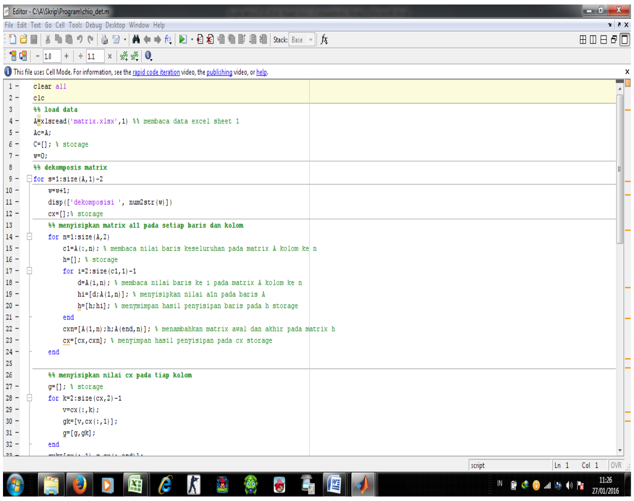
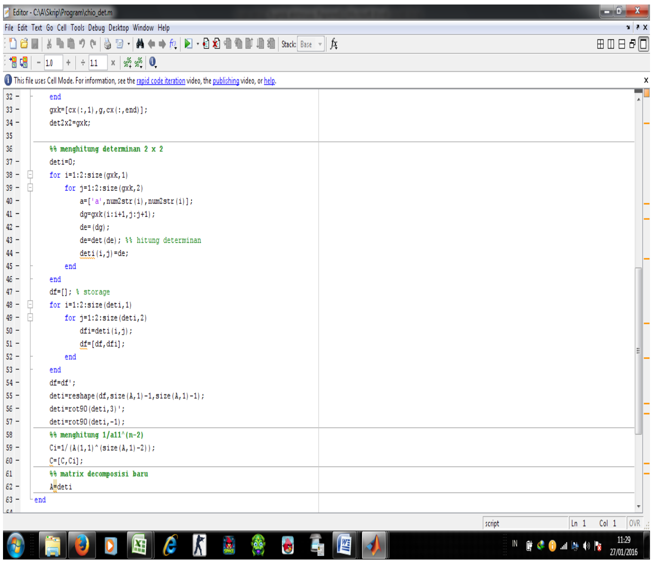
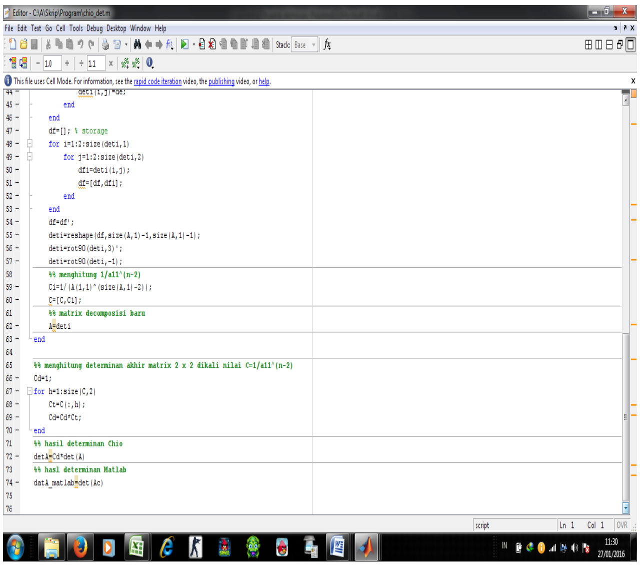


Gambar 2 Sintak Determinan Metode Kondensasi Chio dengan Matlab



Gambar 3 Sintak Determinan Metode Kondensasi Chio dengan Matlab



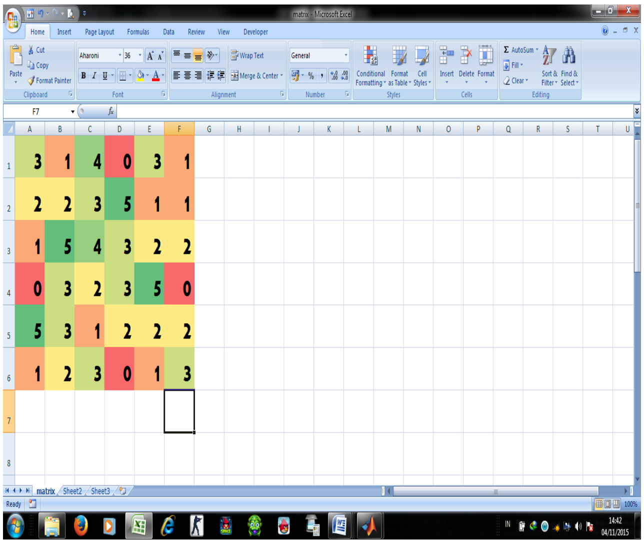
Gambar 4 Sintak Determinan Metode Kondensasi Chio dengan Matlab

Matriks Persegi Berordo 6 × 6

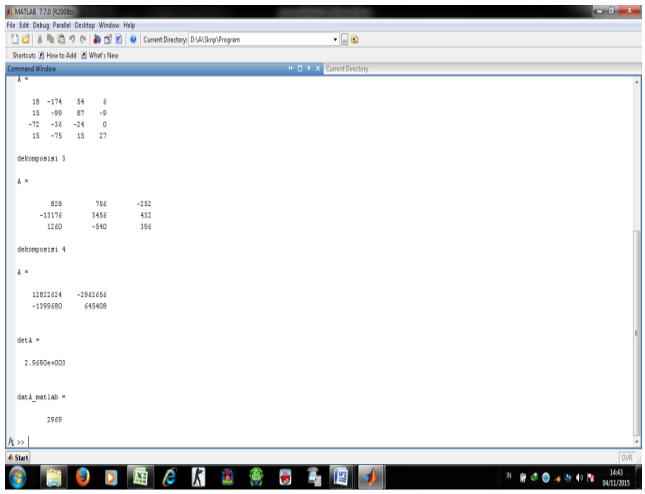
Diberikan matriks 6 × 6

$$A = \begin{bmatrix} 3 & 1 & 4 & 0 & 3 & 1 \\ 2 & 2 & 3 & 5 & 1 & 1 \\ 1 & 5 & 4 & 3 & 2 & 2 \\ 0 & 3 & 2 & 3 & 5 & 0 \\ 5 & 3 & 1 & 2 & 2 & 2 \\ 1 & 2 & 3 & 0 & 1 & 3 \end{bmatrix}.$$

Dengan menggunakan Excel dan Matlab, maka hasil determinan dapat dilihat pada gambar 3.2 dan gambar 3.3 sebagai berikut



Gambar 5 Tampilan Matriks dengan Excel



Gambar 6 Tampilan Hasil Determinan Metode Kondensasi Chio dengan Matlab

4. KESIMPULAN

Berdasarkan hasil penelitian dan pembahasan, dapat disimpulkan bahwa untuk menentukan nilai determinan matriks persegi $n \times n$, $n \geq 3, \forall\, n \in \mathbb{N}$ dengan menggunakan metode kondensasi Chio yaitu melakukan proses perhitungan determinan matriks yang mengekspansikan matriks awal ordo $n \times n$ menjadi matriks $(n-1) \times (n-1)$ dengan elemen a_{11} sebagai kofaktornya, proses ekspansi ini melibatkan matriks ordo 2×2, setiap proses kondensasi Chio menghasilkan determinan matriks $(n-1) \times (n-1)$ dan kofaktor dari matriks sebelumnya, proses kondensasi berhenti jika matriks $n \times n$ berubah menjadi matriks 2×2. Selanjutnya aplikasikan perhitungan determinan suatu matriks dengan metode kondensasi Chio menggunakan Excel dan Matlab.

5. SARAN

Disarankan bagi pembaca yang tertarik agar dapat mengembangkan penelitian ini untuk mengaplikasikan perhitungan determinan suatu matriks dengan metode kondensasi Chio dengan menggunakan menggunakan Delphi, C++, Visual Basic atau program penunjang lainnya.

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