Pemrograman Komputer

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Matriks

$$[A] = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$$

$$[B] = \begin{bmatrix} j & k & l \\ m & n & o \\ p & q & r \end{bmatrix}$$

$$[C] = \begin{bmatrix} \alpha & \beta & \chi \\ \delta & \varepsilon & \varphi \\ \gamma & \eta & \iota \end{bmatrix}$$

Jika [C] = [A][B], maka c_{ij} = ?

$$\beta = ak + bn + cq$$

$$\varepsilon = dk + en + fq$$

Matriks

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

$$[C] = \begin{bmatrix} c_{11} & c_{12} & c_{13} \\ c_{21} & c_{22} & c_{23} \\ c_{31} & c_{32} & c_{33} \end{bmatrix}$$

Jika [C] = [A][B], maka c_{ij} = ?

$$c_{12} = a_{11}b_{12} + a_{12}b_{22} + a_{13}b_{32}$$

$$c_{22} = a_{21}b_{12} + a_{22}b_{22} + a_{23}b_{32}$$

Matriks

- Jadi perkalian matriks dapat ditulis sebagai:

$$c_{12} = a_{11}b_{12} + a_{12}b_{22} + a_{13}b_{32}$$

atau secara umum dapat ditulis sebagai

$$c_{ij} = a_{i1}b_{1j} + a_{i2}b_{2j} + a_{i3}b_{3j}$$

$$c_{ij} = \sum_{k=1}^{3} a_{ik}b_{kj}$$

- Untuk matriks berukuran *n*:

$$c_{ij} = \sum_{k=1}^{n} a_{ik}b_{kj}$$

- Index *i* dan *j* dihitung dari 1 sampai dengan *n*.
- Jadi c_{ij} harus dihitung untuk $i = 1,2,\ldots,n$ dan $j = 1,2,\ldots,n$

Kode FORTRAN

```
C23456789112345678921234567893123456789412345678 95

      PROGRAM PerkalianMatriks
      REAL A(20, 20), B(20, 20), C(20, 20)
C     ... Inputkan dimensi matriks serta Matriks A, B
      DO J = 1, N
         DO I = 1, N
            Hasil = 0.0
            DO K = 1, N
               Hasil = Hasil + A(I,K)*B(K,J)
            ENDDO
            C(I,J) = Hasil
         ENDDO
      ENDDO
      END
```

Kode VBA-Excel – Fixed Array

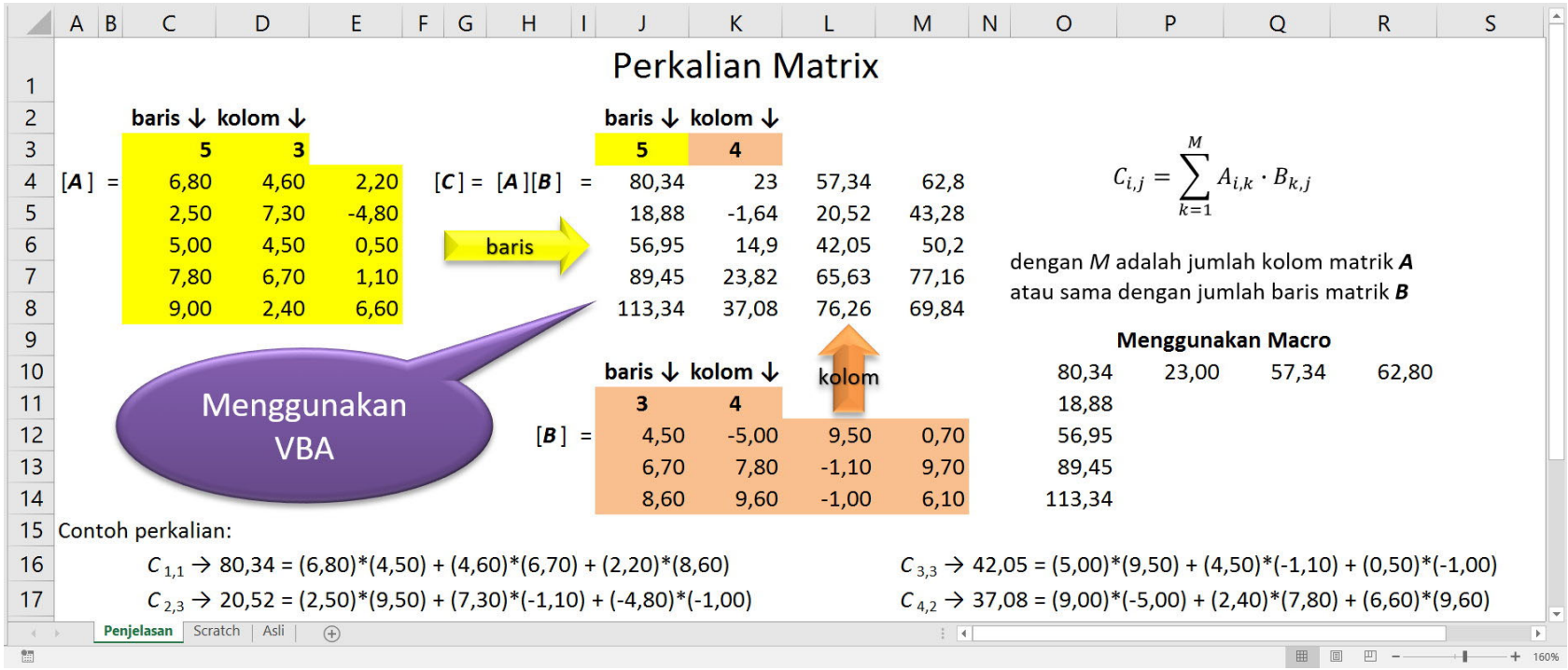
```
Sub PerkalianMatrik()

Dim I, J, K, BarisA, KolomA, BarisB, KolomB As
Integer
Const Max As Integer = 20
Dim MatrixA(1 To Max, 1 To Max), MatrixB(1 To
Max, 1 To Max) As Single
Dim Hasil As Single
   'Membaca data Matrix A
    BarisA = Range("C3")
    KolomA = Range("D3")
    For I = 1 To BarisA
       For J = 1 To KolomA
          MatrixA(I, J) = Range("C4").Cells(I, J)
       Next J
    Next I
   'Membaca data Matrix B
   BarisB = Range("J11")
   KolomB = Range("K11")
   For I = 1 To BarisB
      For J = 1 To KolomB
         MatrixB(I, J) = Range("J12").Cells(I, J)
      Next J
   Next I

   'Mengalikan Matrix [A][B]
      Range("J3") = BarisA
      Range("K3") = KolomB
      For I = 1 To BarisA
         For J = 1 To KolomB
            Hasil = 0#
            For K = 1 To KolomA
               Hasil = Hasil + MatrixA(I, K) * MatrixB(K, J)
            Next K
            Range("J4").Cells(I, J) = Hasil
         Next J
      Next I

End Sub
```

Contoh Hasil VBA dalam Worksheet



Perkalian Matrix

	baris ↓	kolom →		
[A] =	6,80	4,60	2,20	
	2,50	7,30	-4,80	
	5,00	4,50	0,50	
	7,80	6,70	1,10	
	9,00	2,40	6,60	

baris

	baris ↓	kolom →		
[C] = [A][B] =	80,34	23	57,34	62,8
	18,88	-1,64	20,52	43,28
	56,95	14,9	42,05	50,2
	89,45	23,82	65,63	77,16
	113,34	37,08	76,26	69,84

kolom

	baris ↓	kolom →		
[B] =	4,50	-5,00	9,50	0,70
	6,70	7,80	-1,10	9,70
	8,60	9,60	-1,00	6,10

Menggunakan VBA

$$C_{i,j} = \sum_{k=1}^{M} A_{i,k} \cdot B_{k,j}$$

dengan *M* adalah jumlah kolom matrik ***A***
atau sama dengan jumlah baris matrik ***B***

Menggunakan Macro

80,34	23,00	57,34	62,80
18,88			
56,95			
89,45			
113,34			

Contoh perkalian:

$C_{1,1}$ → 80,34 = (6,80)*(4,50) + (4,60)*(6,70) + (2,20)*(8,60)

$C_{2,3}$ → 20,52 = (2,50)*(9,50) + (7,30)*(-1,10) + (-4,80)*(-1,00)

$C_{3,3}$ → 42,05 = (5,00)*(9,50) + (4,50)*(-1,10) + (0,50)*(-1,00)

$C_{4,2}$ → 37,08 = (9,00)*(-5,00) + (2,40)*(7,80) + (6,60)*(9,60)

Penjelasan | Scratch | Asli

Kode VBA-Excel – Dynamic Array

```
Sub PerkalianMatrik()

Dim I, J, K, BarisA, KolomA, BarisB, KolomB As
Integer
Const Max As Integer = 20
Dim MatrixA(), MatrixB() As Single
Dim Hasil As Single
   'Membaca data Matrix A
    BarisA = Range("C3")
    KolomA = Range("D3")
    ReDim MatrixA(BarisA, KolomA)
    For I = 1 To BarisA
       For J = 1 To KolomA
          MatrixA(I, J) = Range("C4").Cells(I, J)
       Next J
    Next I
   'Membaca data Matrix B
   BarisB = Range("J11")
   KolomB = Range("K11")
   ReDim MatrixB(BarisB, KolomB)
   For I = 1 To BarisB
      For J = 1 To KolomB
         MatrixB(I, J) = Range("J12").Cells(I, J)
      Next J
   Next I

'Mengalikan Matrix [A][B]
   Range("J3") = BarisA
   Range("K3") = KolomB
   For I = 1 To BarisA
      For J = 1 To KolomB
         Hasil = 0#
         For K = 1 To KolomA
            Hasil = Hasil + MatrixA(I, K) * MatrixB(K, J)
         Next K
         Range("J4").Cells(I, J) = Hasil
      Next J
   Next I

End Sub
```

Contoh Hasil VBA dalam Worksheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Perkalian Dua Matrix dengan VBA [C]=[A][B]**																
2	**Matrix [A]: 5x3 (A3)**				**Matrix [B]: 3x4 (E3)**					**Matrix [C]=[A][B]: 5x4 (J3)**					Perkalian dengan VBA		
3	6,80	4,60	2,20		4,50	-5,00	9,50	0,70		80,34	23,00	57,34	62,80				
4	2,50	7,30	-4,80		6,70	7,80	-1,10	9,70		18,88	-1,64	20,52	43,28				
5	5,00	4,50	0,50		8,60	9,60	-1,00	6,10		56,95	14,90	42,05	50,20		Perkalian dengan MMULT		
6	7,80	6,70	1,10							89,45	23,82	65,63	77,16				
7	9,00	2,40	6,60							113,34	37,08	76,26	69,84				
8																	
9	**Perkalian Dua Matrix dengan Fungsi [C]=MMULT([A],B[])**																
10			**Matrix [A]: 8x3 (C11)**				**Matrix [B]: 3x5 (G11)**						**Matrix [C]=[A][B]: 8x5 (M11)**				
11			6,80	4,60	2,20		4,50	-5,00	9,50	0,70	-5,00		80,34	23,00	57,34	62,80	23,00
12			2,50	7,30	-4,80		6,70	7,80	-1,10	9,70	7,80		18,88	-1,64	20,52	43,28	-1,64
13			5,00	4,50	0,50		8,60	9,60	-1,00	6,10	9,60		56,95	14,90	42,05	50,20	14,90
14			7,80	6,70	1,10								89,45	23,82	65,63	77,16	23,82
15			9,00	2,40	6,60								113,34	37,08	76,26	69,84	37,08
16			2,50	7,30	-4,80								18,88	-1,64	20,52	43,28	-1,64
17			5,00	4,50	0,50								56,95	14,90	42,05	50,20	14,90
18			7,80	6,70	1,10								89,45	23,82	65,63	77,16	23,82
19																	
20	**Perkalian Dua Matrix dengan VBA [C]=[A][B]**																
21	**Matrix [A]: 5x3 (A22)**				**Matrix [B]: 3x5 (E22)**						**Matrix [C]=[A][B]: 5x5 (K22)**						
22	6,80	4,60	2,20		4,50	-5,00	9,50	0,70	4,00		80,34	23,00	57,34	62,80	34,00		
23	2,50	7,30	-4,80		6,70	7,80	-1,10	9,70			18,88	-1,64	20,52	43,28	12,50		
24	5,00	4,50	0,50		8,60	9,60	-1,00	6,10			56,95	14,90	42,05	50,20	25,00		
25	7,80	6,70	1,10								89,45	23,82	65,63	77,16	39,00		
26	9,00	2,40	6,60								113,34	37,08	76,26	69,84	45,00		