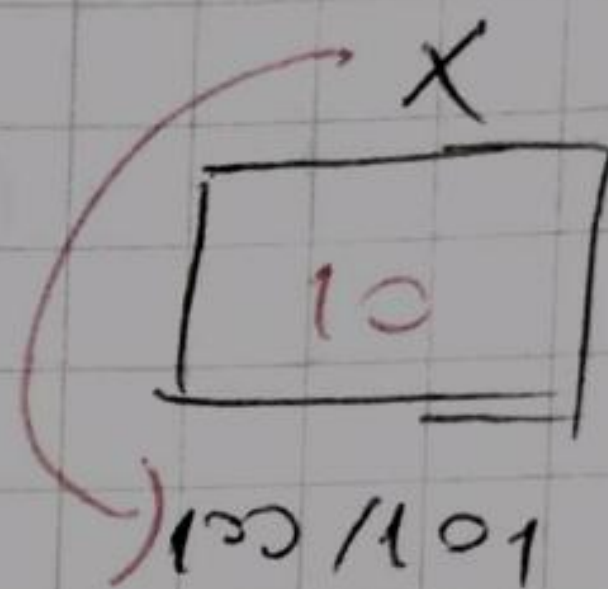


Arrays in Compilers

int A[5] = { 3, 5, 8, 4, 2 }

	0	1	2	3	4
A	3	5	8	4	2
	200/1	213	204/5	617	205/9

int x = 10;



~~Compiler x diye bit değıster~~

Compiler x isimli machine koduna çevirir +
in bellekte bulundugu adresi verir. Bu tür
compiler işi gerçekleştirir

örnek olarak 3. indexteki ifadesi değıstirmek
isteyelim ve b

A[3] = 10;

	0	1	2	3	4
A	3	5	8	4	2
	200/1	213	415	617	819

$$Add(A[3]) = 200 + 3 \times 2 = 206$$

$$Add(A[3]) = L_0 + 3 \times 2 = 206$$

$$Add(A[3]) = L_0 + i \times w$$

L_0 = dizinin başlangıç
adres

i = index numarası

w = data size (int, float, char)

eğer index 1 ile başlıyorsa (örneğin)

	1	2	3	4	5
A	3	5	8	4	2
	2001	213	415	617	819

10

$$A[3] = 10;$$

$$Add(A[3]) = 200 + (3-1) \times 2 = 204$$

$$Add(A[i]) = L_0 + (i-1) \times w$$

↓
Burada 1 faktörün ifade bu da program dille
yavuzluk katar.

Row Major Formula for 2D Arrays

PERA

int A[3][4];

M

N

A	0	1	2	3
0	a ₀₀	a ₀₁	a ₀₂	a ₀₃
1	a ₁₀	a ₁₁	a ₁₂	a ₁₃
2	a ₂₀	a ₂₁	a ₂₂	a ₂₃

A	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
a ₀₀	a ₀₁	a ₀₂	a ₀₃	a ₁₀	a ₁₁	a ₁₂	a ₁₃	a ₂₀	a ₂₁	a ₂₂	a ₂₃													

200 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Lo

row₀

row₁

row₂

So given, if the given block is single then

$$Add(A[i][j]) = 200 + [(i+2)*2] = 212$$

$$Add(A[2][3]) = 200 + [2*4+3]*2 = 222$$

$$Add(A[i][j]) = Lo + [i*n+j]*w \rightarrow 5$$

Index i den bar karon

$$Add(A[i][j]) = Lo + [(i-1)*n + (j-1)]*w \rightarrow 7$$

for the 2 line arithmetic if the x

but program is not calculating

re the elur.

PERA

Column Major Formula for 2D Arrays

int A[m][n]

A	0	1	2	3
0	a ₀₀	a ₀₁	a ₀₂	a ₀₃
1	a ₁₀	a ₁₁	a ₁₂	a ₁₃
2	a ₂₀	a ₂₁	a ₂₂	a ₂₃

0	1	2	3	4	5	6	7	8	9	10	11
a ₀₀	a ₁₀	a ₂₀	a ₀₁	a ₁₁	a ₂₁	a ₀₂	a ₁₂	a ₂₂	a ₀₃	a ₁₃	a ₂₃
200/1	2	4	6	8	10	12	14	16	18	20	22/23
col 0			col 1			col 2			col 3		

$$Add(A[1][2]) = 200 + [2 \times 3 + 1] \times 2 = 214$$

$$Add(A[1][3]) = 200 + [3 \times 3 + 1] \times 2 = 220$$

$$Add(A[i][j]) = 200 + [j \times m + i] \times w \rightarrow \text{column}$$

Sol den sag den sag

$$Add(A[i][j]) = 200 + [i \times n + j] \times w \rightarrow \text{row}$$

Sol den sag den

her ikide ayni kütler kalixer

bu gütler her ikide Secretilixer

formulas for nD Arrays

Type $A [d_1] [d_2] [d_3] [d_4]$:

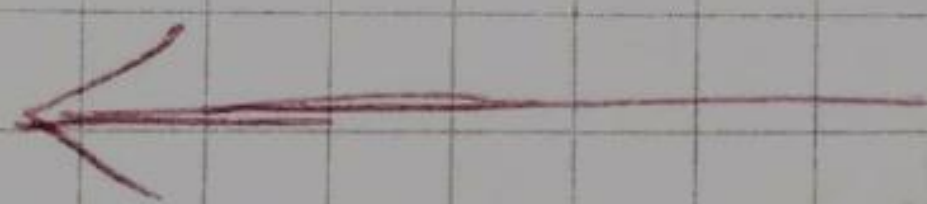
row-majority

$$\text{Addr} (A [i_1] [i_2] [i_3] [i_4]) = L_0 + [i_1 \times d_2 \times d_3 \times d_4 + i_2 \times d_3 \times d_4 + i_3 \times d_4 + i_4]$$

column-majority

genel formülü = $L_0 + \sum_{p=1}^n \left[i_p \times \prod_{q=p+1}^n d_q \right] \times w$

$$\text{Addr} (A [i_1] [i_2] [i_3] [i_4]) = L_0 + [i_4 \times d_3 \times d_2 \times d_1 + i_3 \times d_2 \times d_1 + i_2 \times d_1 + i_1]$$



buru detaylı inceleyelim

$$L_0 + \left[\underbrace{i_4 \times d_3 \times d_2 \times d_1}_3 + \underbrace{i_3 \times d_2 \times d_1}_2 + \underbrace{i_2 \times d_1}_1 + i_1 \right] \times w$$

$$4D \rightarrow 3+2+1$$

$$5D \rightarrow 4+3+2+1$$

$$nD \rightarrow n-1+n-2+\dots+3+2+1 = \frac{n \cdot (n-1)}{2}$$

$$\frac{n(n-1)}{2} = O(n^2)$$

bu da çok zaman alır

nerden sayarken devam

row-major

Type $A[d_1][d_2][d_3][d_4]$

$$\text{Addr}(A[i_1][i_2][i_3][i_4]) = L_0 + \left[\underline{i_1 \cdot d_2 \cdot d_3 \cdot d_4} + \underline{i_2 \cdot d_3 \cdot d_4} + \underline{i_3 \cdot d_4} + \underline{i_4} \right] \cdot w$$

$$i_1 \cdot d_2 \cdot d_3 \cdot d_4 + i_2 \cdot d_3 \cdot d_4 + i_3 \cdot d_4 + i_4$$

↓ factorize

$$i_4 + i_3 \cdot d_4 + i_2 \cdot d_3 \cdot d_4 + i_1 \cdot d_2 \cdot d_3 \cdot d_4$$

$$\downarrow i_4 + d_4 \cdot [i_3 + i_2 \cdot d_3 + i_1 \cdot d_2 \cdot d_3]$$

$$\downarrow i_4 + d_4 \cdot [i_3 + d_3 \cdot [i_2 + i_1 \cdot d_2]]$$

1 2 3

Horn's
Rule

$$LD \rightarrow 3$$

$$SD \rightarrow 4$$

$$nD \rightarrow n-1$$

$$O(n)$$

By factorizing row-major

data ref 6+4

formula for 3D Arrays

int A[l][m][n];

row-major

$$\text{Addr}(A[i][j][k]) = L_0 + [i \cdot m \cdot n + j \cdot n + k] \cdot w$$

column-major

$$\text{Addr}(A[i][j][k]) = L_0 + [k \cdot l \cdot m + j \cdot l + i] \cdot w$$