

1.6 Transverse 2D Array

In my video, I will show

- 2D Array
- Methods (or functions)
 - 3x3 Matrix Addition Method
 - 3x3 Subtraction Method
 - 3x3 multiplication Method
- Pass Inputs into a Method
- Return 2D Array
- Nested For-Loops
- Show $X = AB - BA$
- Show $Y = 2AB + 0.5A$
- Show $Z1 = (AB)C$, $Z2 = A(BC)$

- 3x3 Matrix Addition Method

$$A \begin{bmatrix} 0 & 2 & -1 \\ -2 & 0 & -4 \\ 1 & 4 & 0 \end{bmatrix} + B \begin{bmatrix} 0 & 2 & -1 \\ -2 & 0 & -1 \\ 1 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 4 & -2 \\ -4 & 0 & -5 \\ 2 & 5 & 0 \end{bmatrix}$$

- 3x3 Subtraction Method

$$\begin{pmatrix} 1 & 3 & 4 \\ 2 & 5 & 6 \\ 4 & 3 & 2 \end{pmatrix} - \begin{pmatrix} 2 & 7 & 1 \\ 0 & 4 & 6 \\ 9 & 8 & 1 \end{pmatrix} = \begin{pmatrix} 1-2 & 3-7 & 4-1 \\ 2-0 & 5-4 & 6-6 \\ 4-9 & 3-8 & 2-1 \end{pmatrix}$$

- 3x3 Scalar multiplication Method

$$2A = 2 \cdot \begin{bmatrix} -5 & 2 & 0 \\ 7 & -3 & 4 \\ -1 & 3 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 2(-5) & 2(2) & 2(0) \\ 2(7) & 2(-3) & 2(4) \\ 2(-1) & 2(3) & 2(2) \end{bmatrix}$$

$$2A = \begin{bmatrix} -10 & 4 & 0 \\ 14 & -6 & 8 \\ -2 & 6 & 4 \end{bmatrix}$$

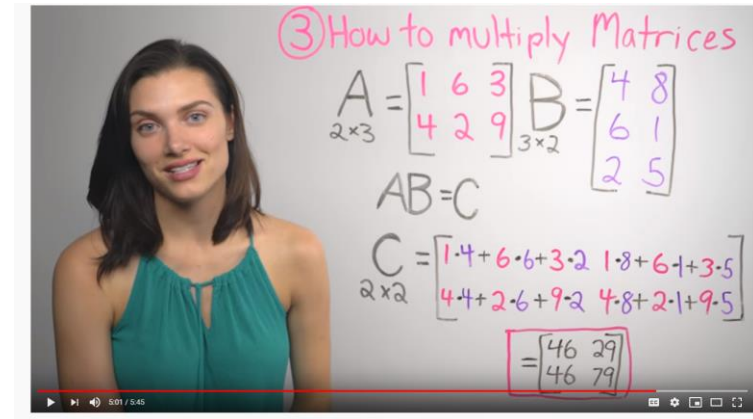
3x3 Matric Multiplication

- Hint: Use For-Loops 3 times

$$\begin{bmatrix} 3 & 12 & 4 \\ 5 & 6 & 8 \\ 1 & 0 & 2 \end{bmatrix} \begin{bmatrix} 7 & 3 & 8 \\ 11 & 9 & 5 \\ 6 & 8 & 4 \end{bmatrix}$$
$$= \begin{bmatrix} 3*7+12*11+4*6 & 3*3+12*9+4*8 & 3*8+12*5+4*4 \\ 5*7+6*11+8*6 & 5*3+6*9+8*8 & 5*8+6*5+8*4 \\ 1*7+0*11+2*6 & 1*3+0*9+2*8 & 1*8+0*5+2*4 \end{bmatrix}$$
$$= \begin{bmatrix} 177 & 149 & 100 \\ 149 & 133 & 102 \\ 19 & 19 & 16 \end{bmatrix}$$

1.5 Array, Method and For Loop

- Watch new video.
- <https://www.youtube.com/watch?v=T1h71v-u3SQ>
- Learn matrix algebra



Example

- Post HW15
in your Youtube playlist

```
3 public class HW15 {
4
5     public static void main(String[] args) {
6         double[][] matA = {{1,2,3},{4,5,7},{7,8,11}};
7         double[][] matB = {{10,20,30},{40,50,70},{70,80,110}};
8         double[][] matC = {{0,0,0},{0,0,0},{0,0,0}};
9
10
11
12         System.out.println("Return 2D Array");
13         System.out.println("C = 2A + B + A");
14         matC= addMat(addMat(scalarMultiplyMat(2,matA), matB),matA);
15
16
17         for(int i=0; i < matC.length; i++) {
18             for(int j=0; j < matC[i].length; j++) {
19                 System.out.print(matC[i][j] + " ");
20             }
21             System.out.println("");
22         }
23     }
24
25
26     public static double[][] addMat(double[][] matA, double[][] matB ) {
27         double[][] matC = {{0,0,0},{0,0,0},{0,0,0}};
28
29         for(int i=0; i < matA.length; i++) {
30             for(int j=0; j < matA[i].length; j++) {
31                 matC[i][j]=matA[i][j]+matB[i][j];
32             }
33         }
34         return matC;
35     }
36
37     public static double[][] scalarMultiplyMat(double scalar, double[][] matA ) {
38         double[][] matC = {{0,0,0},{0,0,0},{0,0,0}};
39
40         for(int i=0; i < matA.length; i++) {
41             for(int j=0; j < matA[i].length; j++) {
42                 matC[i][j]=scalar*matA[i][j];
43             }
44         }
45         return matC;
46     }
47 }
```

Console

<terminated> HW15 [Java Application] C:\Program Files\AdoptOpenJDK\jdk-11.0.4.11-hotspot\bin\javaw.exe (Sep 5, .

Return 2D Array
C = 2A + B + A
13.0 26.0 39.0
52.0 65.0 91.0
91.0 104.0 143.0

Example

- Post HW16
in your Youtube playlist


```
1 package homework;
2 public class HW16 {
3     public static void main(String[] args) {
4         double[][] matA = {{1,2,3},{4,5,7},{7,8,11}};
5         double[][] matB = {{10,20,30},{40,50,70},{70,80,110}};
6         double[][] matC = {{0,0,0},{0,0,0},{0,0,0}};
7
8         System.out.println("C = AB+BA");
9         matC= addMat(multiplyMat(matA, matB),multiplyMat(matB,matA));
10
11         for(int i=0; i < matC.length; i++) {
12             for(int j=0; j < matC[i].length; j++) {
13                 System.out.print(matC[i][j] + " ");
14             }
15             System.out.println("");
16         }
17     }
18
19     public static double[][] addMat(double[][] matA,double[][] matB ) {
20         double[][] matC ={{0,0,0},{0,0,0},{0,0,0}};
21
22         for(int i=0; i < matA.length; i++) {
23             for(int j=0; j < matA[i].length; j++) {
24                 matC[i][j]=matA[i][j]+matB[i][j];
25             }
26         }
27         return matC;
28     }
29
30     public static double[][] multiplyMat(double[][] matA,double[][] matB ) {
31         double[][] matC ={{0,0,0},{0,0,0},{0,0,0}};
32
33         for(int i=0; i < matA.length; i++) {
34             for(int j=0; j < matA[i].length; j++) {
35                 for(int k=0; k < matB[0].length; k++) {
36                     matC[i][j]+=matA[i][k]*matB[k][j];
37                 }
38             }
39         }
40         return matC;
41     }
42 }
43
44
45
```

Console

<terminated> HW16 [Java Application] C:\Program Files\AdoptOpenJDK\jdk-11.0.4.11-hotspot\bin\javaw.exe (C:\Program Files\AdoptOpenJDK\jdk-11.0.4.11-hotspot\bin\javaw.exe)

C = AB+BA
600.0 720.0 1000.0
1460.0 1780.0 2480.0
2320.0 2840.0 3960.0

(Optional) MxN Matrix

- MxN Addition
- MxN matrix Multiplication
- MxM Inverse Matrix : Extra Credit 
- MxN Scalar Multiplication
- Error exception routines : `Mat(3x4) + Mat(3x5)`