WEEK 5

TODAY'S PLAN

- Homework

- Quiz

- Tutor Tasks
  - Order of Operations
  - Array Operations
  - Matrix and Vector Multiplication

HOMEWORK

HOMEWORK

- Please refrain from using Umlauts and ß in your Programs →Causes all kinds of issues

HOMEWORK

- Any Questions?

TUTOR TASKS

QUIZ

BONUS QUESTION

- Int I = 5;

- Int J = 2;

- System.out.println(I/J);

BONUS QUESTION – ANSWER

- Int I = 5;

- Int J = 2;

- System.out.println(I/J); → 2

ORDER OF OPERATIONS

Level	Operator	Description	Associativity
16	[ ] . ( )	access array element access object member parentheses	left to right
15	++ --	unary post-increment unary post-decrement	not associative
14	++ -- + - ! ~	unary pre-increment unary pre-decrement unary plus unary minus unary logical NOT unary bitwise NOT	right to left
13	( ) new	cast object creation	right to left
12	* / %	multiplicative	left to right
11	+ - +	additive string concatenation	left to right
10	<< >> >>>	shift	left to right
9	< <= > >= instanceof	relational	not associative
8	== !=	equality	left to right
7	&	bitwise AND	left to right
6	^	bitwise XOR	left to right
5	|	bitwise OR	left to right
4	&&	logical AND	left to right
3	||	logical OR	left to right
2	?:	ternary	right to left
1	= += -= *= /= %= &= ^= |= <<= >>= >>>=	assignment	right to left

ORDER OF OPERATIONS – RELEVANT

12	* / %	multiplicative	left to right
11	+ − +	additive string concatenation	left to right

ORDER OF OPERATIONS – TASKS

- 2 + 3 * 4 - 6

- 6 * 7 % 4

- (18 - 7) * (7.2 % 5.2)

- "34" + 2 * 4

ORDER OF OPERATIONS – TASKS

- (18 - 7) * (7.2 % 5.2)

- 18.0 - 7 * 9 % 10

- 4 / 2 * 9 / 4

- 813 % 100 / 3 + 2.4

- "34" + 2 + 4

- (double) 3 + 5 * 4 + 3 + Integer.parseInt("1") + 8

CUSTOM ARRAY METHODS

CUSTOM ARRAY METHODS

- public static void print(int[] array)
  - Prints Array in format: {1, 2, 3, 4, 5}
- public static int[] invert(int[] array)
  - {0, 1, 2, 3} becomes {3, 2, 1, 0}

CUSTOM ARRAY METHODS

- public static int[] cut(int[] array, int length)
  - cut(new int[] {1, 2, 3}, 2) becomes {1, 2}
  - cut(new int[] {1, 2, 3}, 5) becomes {1, 2, 3, 0, 0}
- public static int[] linearize(int[][] array)
  - linearize(new int[][] {{1, 3}, {25}, {7, 4, 6, 9}}) becomes {1, 3, 25, 7, 4, 6, 9}

MATRIX AND VECTOR OPERATIONS

MATRIX AND VECTOR OPERATIONS

- We shall <u>assume</u> that all Matrix Inputs are correct

MATRIX AND VECTOR OPERATIONS

■ public static int vecVecMul(int[] a, int[] b)

$$\begin{bmatrix} 1 & 2 & 3 \end{bmatrix} \cdot \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} = 1 \cdot 4 + 2 \cdot 5 + 3 \cdot 6 = 22$$

$$\underbrace{1 \times 3}_{} \quad \underbrace{3 \times 1}_{} \qquad = \qquad \underbrace{1 \times 1}_{}$$

MATRIX AND VECTOR OPERATIONS

■ public static int[] matVecMul(int[][] a, int[]b)

$$\begin{bmatrix} 1 & 0 & 2 & 0 \\ 0 & 3 & 0 & 4 \\ 0 & 0 & 5 & 0 \\ 6 & 0 & 0 & 7 \end{bmatrix} \cdot \begin{bmatrix} 2 \\ 5 \\ 1 \\ 8 \end{bmatrix} = \begin{bmatrix} 4 \\ 47 \\ 5 \\ 68 \end{bmatrix}$$

MATRIX AND VECTOR OPERATIONS

- public static int[][] transpose(int[][] a)

$$\text{If } \mathbf{A} = \begin{bmatrix} 1 & 5 & 9 \\ 2 & 3 & 8 \\ 6 & 8 & 7 \end{bmatrix}, \text{ then } \mathbf{A}^T = \begin{bmatrix} 1 & 2 & 6 \\ 5 & 3 & 8 \\ 9 & 8 & 7 \end{bmatrix}$$

- public static int[][] matMatMult(int[][] a, int[][]b)

$$A_{3x2} \cdot B_{2x4} = C_{3x4} = \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{pmatrix} =$$

$$= \begin{pmatrix} 1 \cdot 1 + 2 \cdot 5 & 1 \cdot 2 + 2 \cdot 6 & 1 \cdot 3 + 2 \cdot 7 & 1 \cdot 4 + 2 \cdot 8 \\ 3 \cdot 1 + 4 \cdot 5 & 3 \cdot 2 + 4 \cdot 6 & 3 \cdot 3 + 4 \cdot 7 & 3 \cdot 4 + 4 \cdot 8 \\ 5 \cdot 1 + 6 \cdot 5 & 5 \cdot 2 + 6 \cdot 6 & 5 \cdot 3 + 6 \cdot 7 & 5 \cdot 4 + 6 \cdot 8 \end{pmatrix} = \begin{pmatrix} 11 & 14 & 17 & 20 \\ 23 & 30 & 37 & 44 \\ 35 & 46 & 57 & 68 \end{pmatrix}$$