

# Topic 7:

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## Matrices

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## Why Are We Studying Matrices?

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Matrices have plenty of uses in Computer Science. E.g.:

- Representation ...
  - ... of the graph data structure (see CSc 345)
  - ... of functions and relations (see Topics 8 and 9)
- Affine transformations in Computer Graphics

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# Matrix Fundamentals (1 / 3)

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## Definition: Matrix

Notation:

# Matrix Fundamentals (2 / 3)

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## Definition: Square Matrices

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## Definition: Matrix Equality

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# Matrix Fundamentals (3 / 3)

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## Definition: Transposition

## Definition: Matrix Symmetry

## Example(s):

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# Matrix Operations (1 / 5)

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## 1. Matrix Addition

### Definition: Matrix Addition (a.k.a. Matrix Sum)

### Example(s):

# Matrix Operations (2 / 5)

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## 2. Scalar Multiplication

### Definition: Scalar

### Definition: Scalar Multiplication

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### Example(s):

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# Matrix Operations (3 / 5)

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## 3. Matrix Multiplication

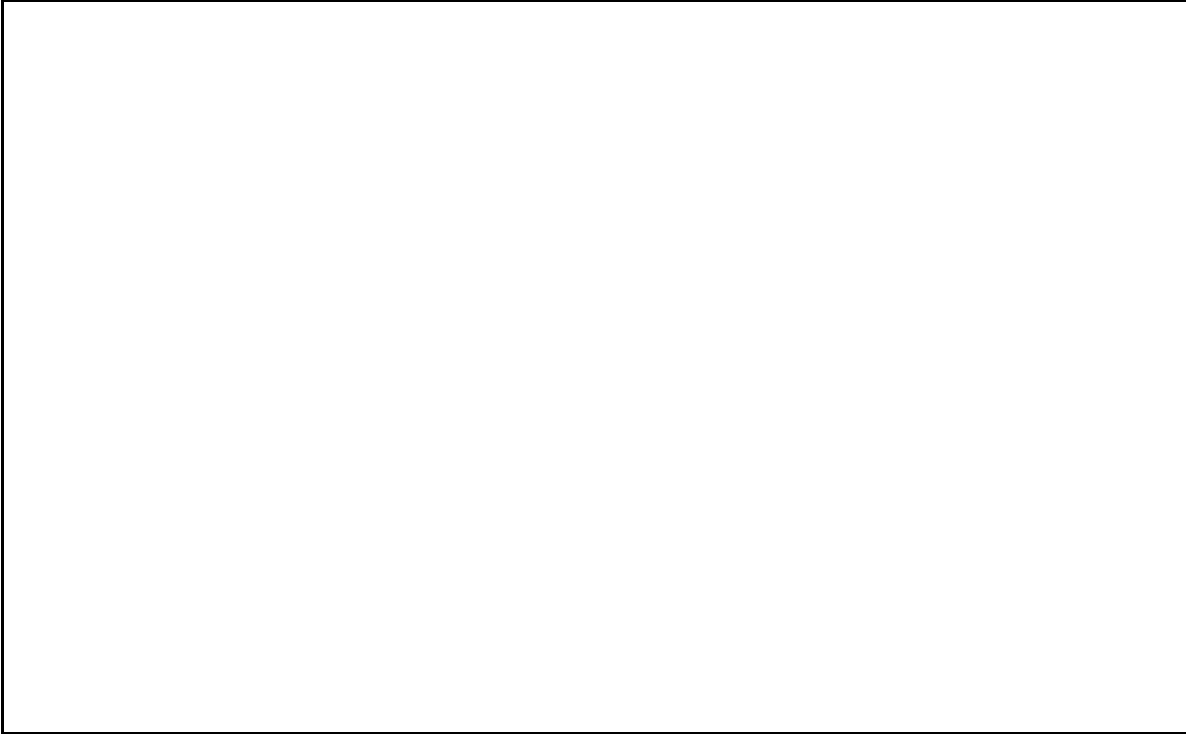
### Definition: Matrix Multiplication (a.k.a. Matrix Product)

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## Matrix Operations (4 / 5)

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Example(s):



## Matrix Operations (5 / 5)

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Example(s):



# Identity Matrices

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Remember the concept of Multiplicative Identity?

## Definition: Identity Matrices

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# Matrix Powers

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## Definition: $n^{th}$ Matrix Power

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## Example(s):

## Example: Affine Transformations (1 / 3)

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Used to 'move' objects in computer graphics.

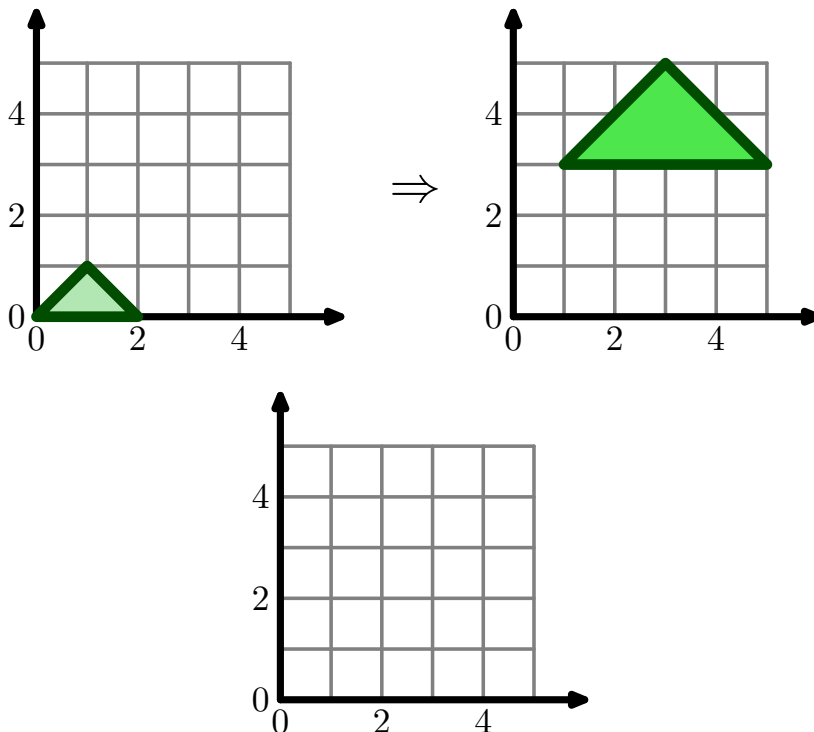
Background:

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## Example: Affine Transformations (2 / 3)

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Task:



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## Example: Affine Transformations (3 / 3)

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## Zero-One Matrices (1 / 3)

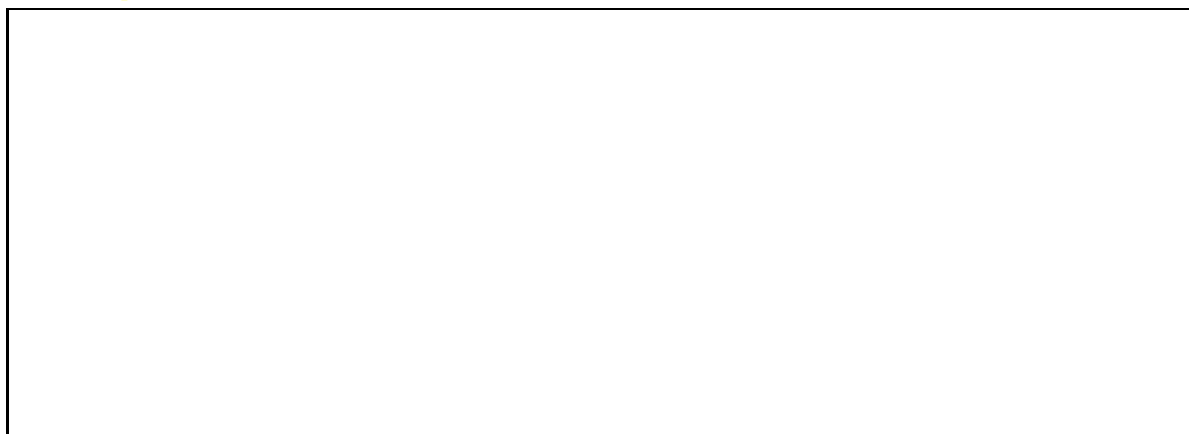
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Three Operations:

1. 'Join':

2. 'Meet':

**Example(s):**



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## Zero-One Matrices (2 / 3)

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### 3. Logical Matrix Product (a.k.a. Boolean Product):

**Example(s):**



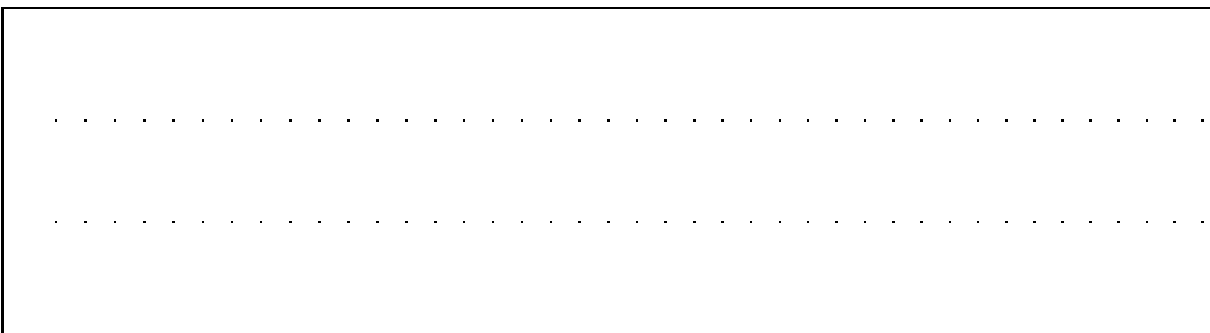
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## Zero-One Matrices (3 / 3)

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**Definition:**  $r^{th}$  **Logical Matrix Power (a.k.a. Boolean Power)**



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