

Graphs



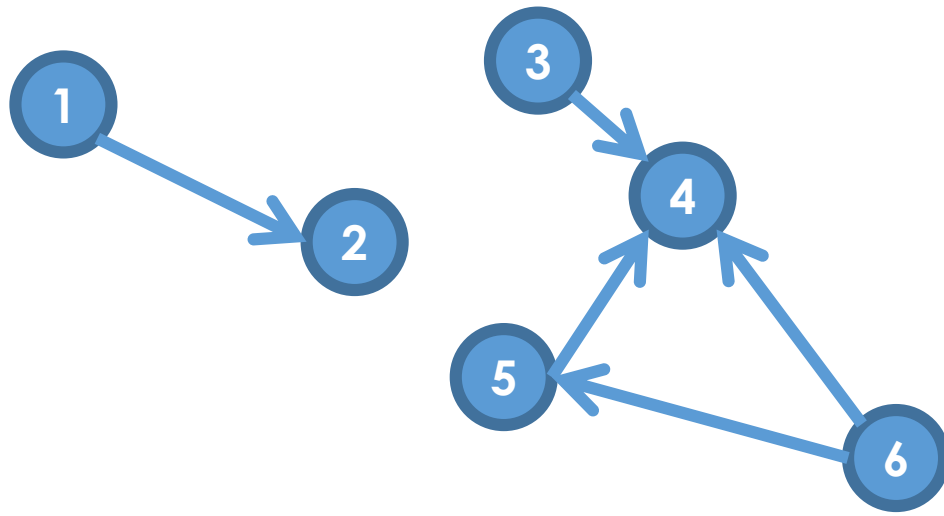
Representation: Adjacency Matrix



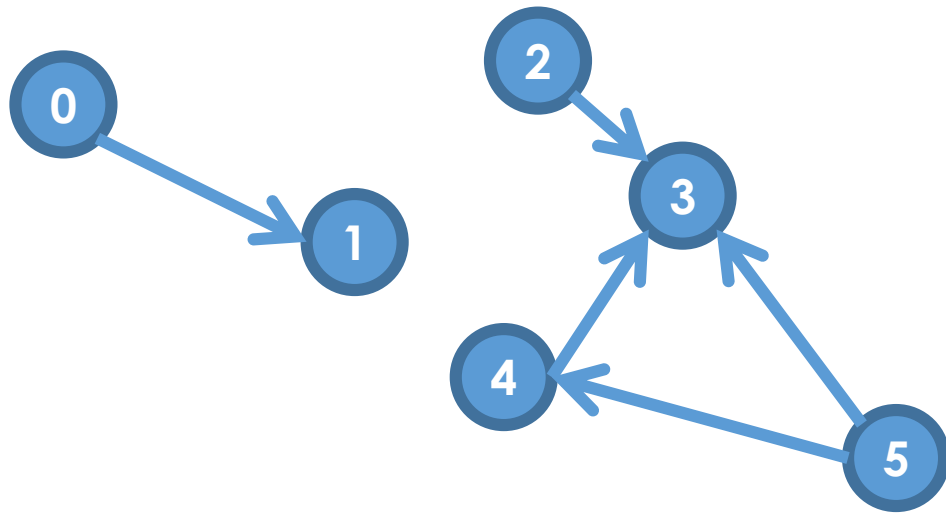
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by Christine Alvarado, Mia Minnes, and Leo Porter, 2015.

By the end of this video you will be able to...

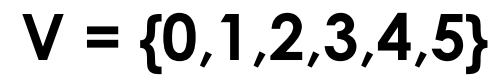
- Implement graphs in Java using adjacency matrix

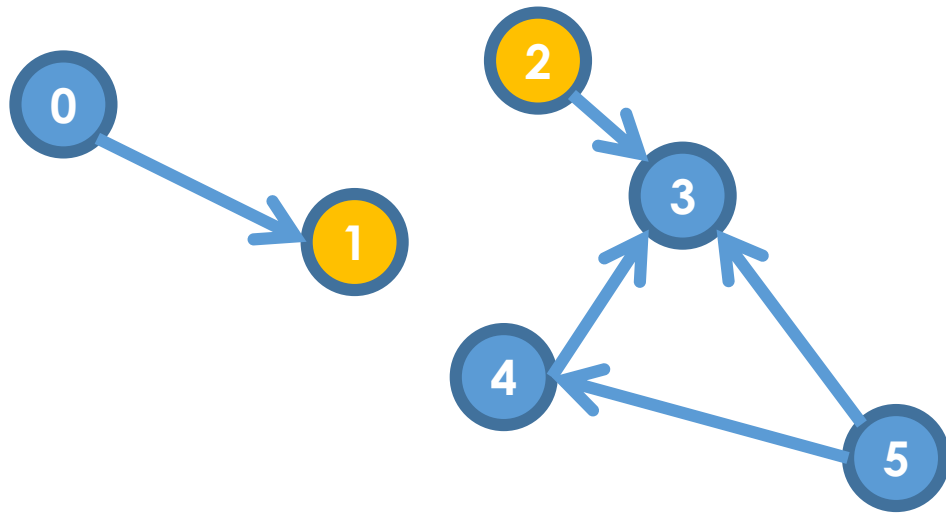


$V = \{1,2,3,4,5,6\}$



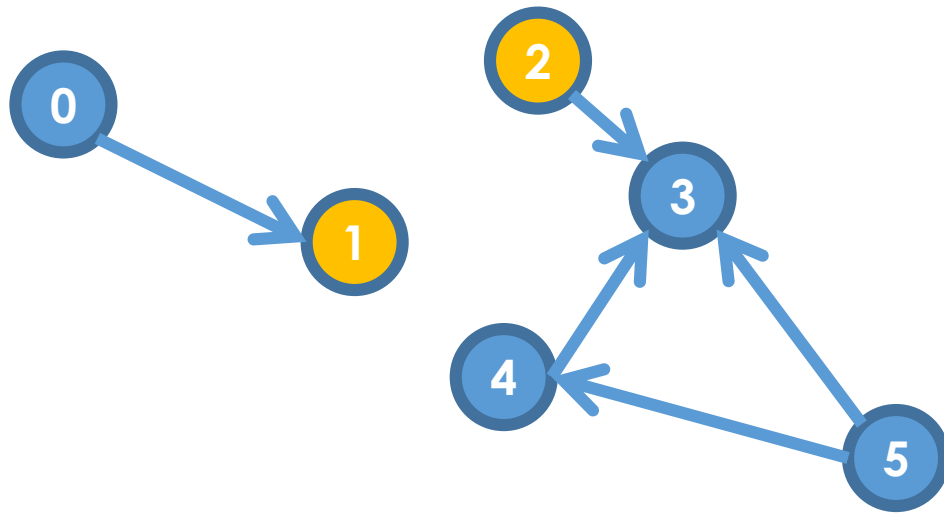
$V = \{0,1,2,3,4,5\}$

[illegible]



$V = \{0,1,2,3,4,5\}$

		2			
1					



$V = \{0,1,2,3,4,5\}$

		2			
1		0			



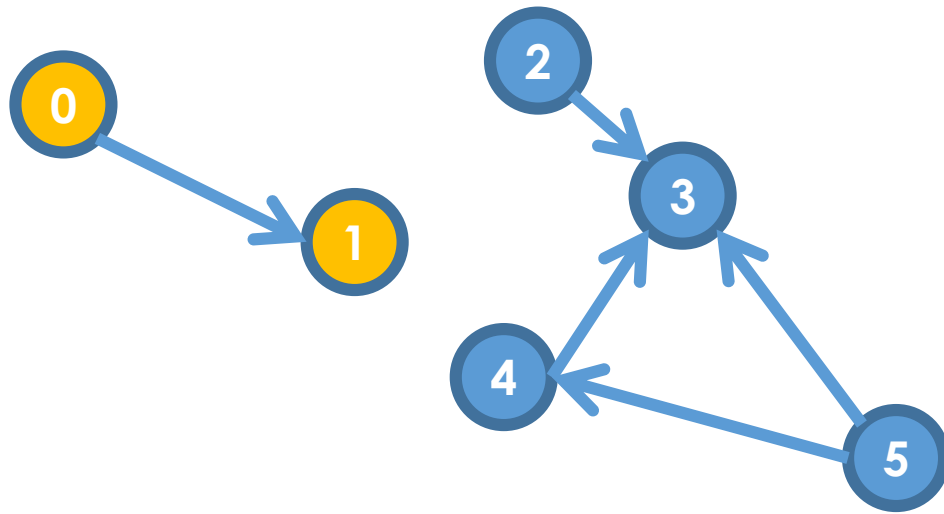
0

[illegible]



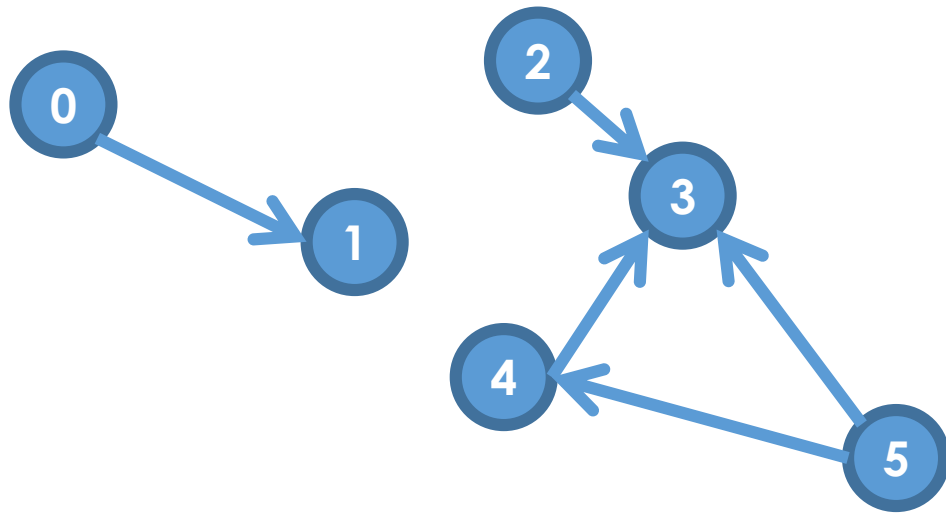
	1				
0	1				

	1				
0	1				



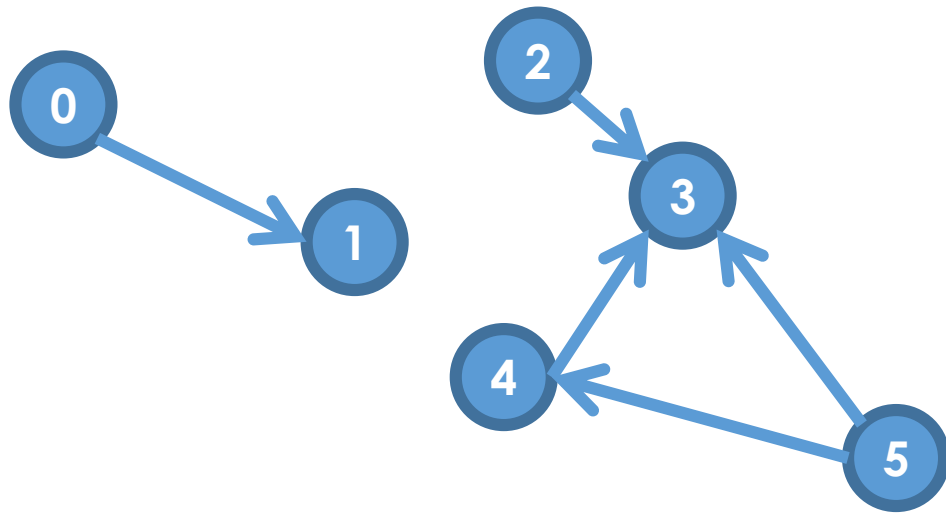
$V = \{0,1,2,3,4,5\}$

	0	1				
0		1				
1	0					



$V = \{0,1,2,3,4,5\}$

	1				
			1		
			1		
			1	1	



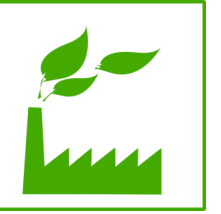
$V = \{0,1,2,3,4,5\}$

0	1	0	0	0	0
0	0	0	0	0	0
0	0	0	1	0	0
0	0	0	0	0	0
0	0	0	1	0	0
0	0	0	1	1	0

```
public class GraphAdjMatrix extends Graph {
```

```
    private int[][] adjMatrix;
```

```
    ...
```

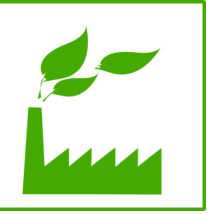


```
public class GraphAdjMatrix extends Graph {
```

```
    private int[][] adjMatrix;
```

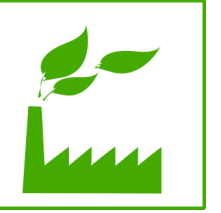
```
    ...
```

```
    public void implementAddEdge(int v, int w) {  
        adjMatrix[v][w] = 1;  
    }
```

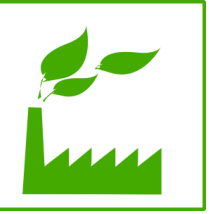


```
public class GraphAdjMatrix extends Graph {  
    private int[][] adjMatrix;  
  
    ...  
  
    public void addEdge(int v, int w) {  
        adjMatrix[v][w] = 1;  
    }  
}
```

What about adding vertices to the graph?



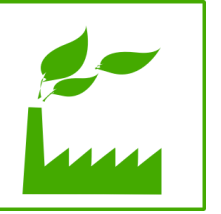
```
public class GraphAdjMatrix extends Graph {
    private int[][] adjMatrix;
    ...
    public void implementAddVertex() {
        int v = getNumVertices();
        if (v >= adjMatrix.length) {
            int[][] newAdjMatrix = new int[v*2][v*2];
            for (int i=0; i<adjMatrix.length; i++) {
                for (int j=0; j<adjMatrix.length; j++) {
                    newAdjMatrix[i][j] = adjMatrix[i][j];
                }
            }
            adjMatrix = newAdjMatrix;
        }
        for (int i=0; i<adjMatrix[v].length; i++) {
            adjMatrix[v][i]=0;
        }
    }
}
```




```
public class GraphAdjMatrix extends Graph {
```

```
    private int[][] adjMatrix;
```

```
//constructor, methods update values of adjMatrix
```



IVQ: How long does it take to test whether there is an edge between vertex v and vertex w in the graph?

Recap: Adjacency matrices

- Algebraic representation of graph structure.
- Fast to test for edges.
- Fast to add/remove edges.
- Slow to add/remove vertices.
- Requires a lot of memory.