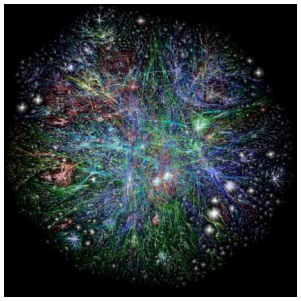
CS 225

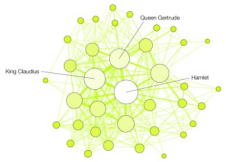
Data Structures

March 26 – Graph Implementations

G Carl Evans

Graphs





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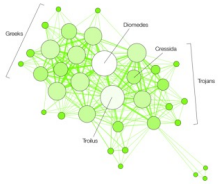

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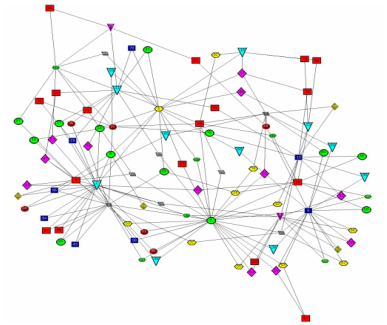
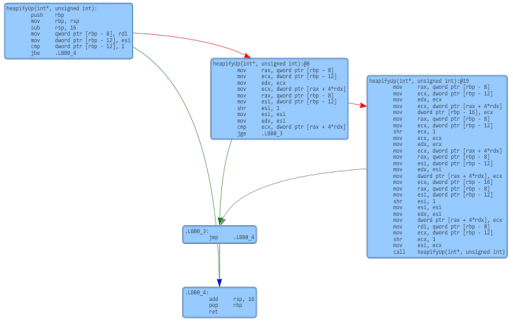
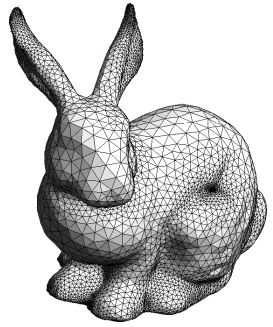
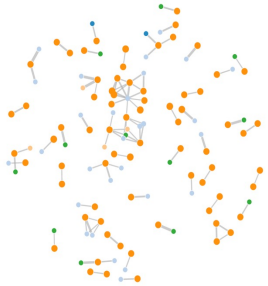


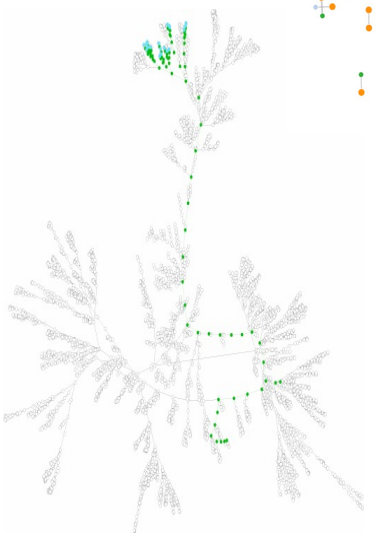
To study all of these structures:

1. A common vocabulary
2. Graph implementations
3. Graph traversals
4. Graph algorithms





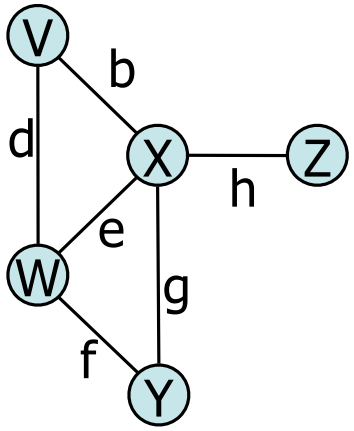




Graph ADT

Data:

- **Vertices**
- **Edges**
- **Some data structure maintaining the structure between vertices and edges.**



Functions:

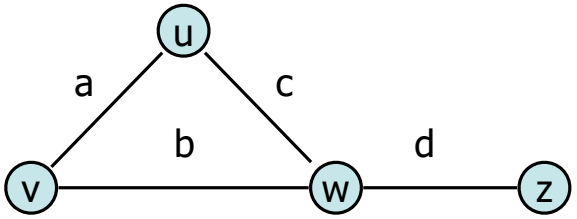
- **insertVertex(K key);**
- **insertEdge(Vertex v1, Vertex v2, K key);**

- **removeVertex(Vertex v);**
- **removeEdge(Vertex v1, Vertex v2);**

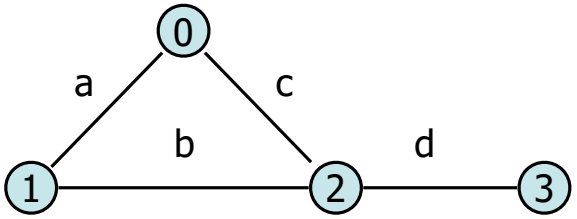
- **incidentEdges(Vertex v);**
- **areAdjacent(Vertex v1, Vertex v2);**

- **origin(Edge e);**
- **destination(Edge e);**

Graph Implementation Idea



Graph Implementation: Edge List



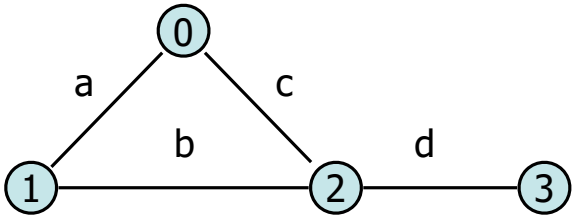
Vertex Collection:

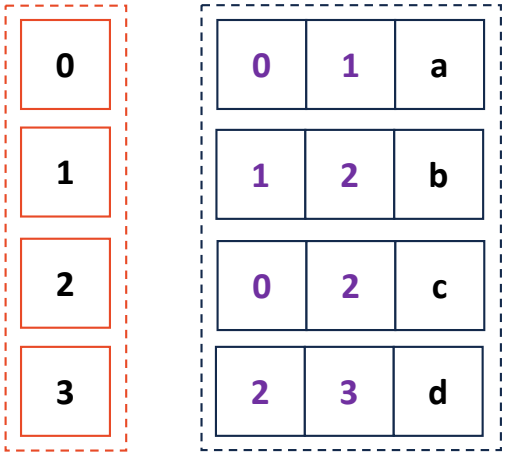
0
1
2
3

Edge Collection:

0	1	a
1	2	b
0	2	c
2	3	d

Graph Implementation: Edge List

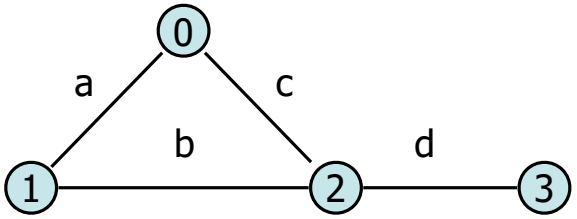


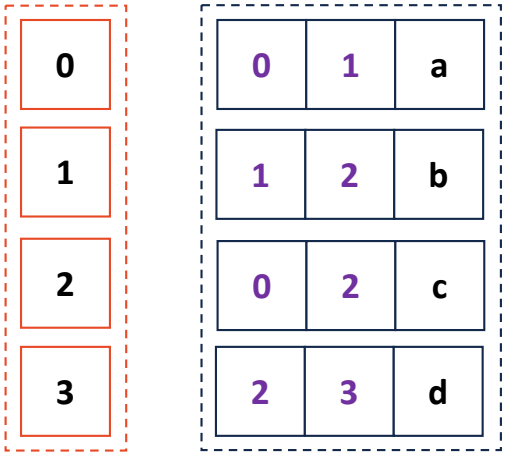


insertVertex(K key):

removeVertex(Vertex v):

Graph Implementation: Edge List



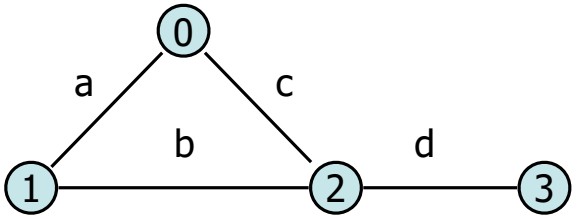


incidentEdges(Vertex v):

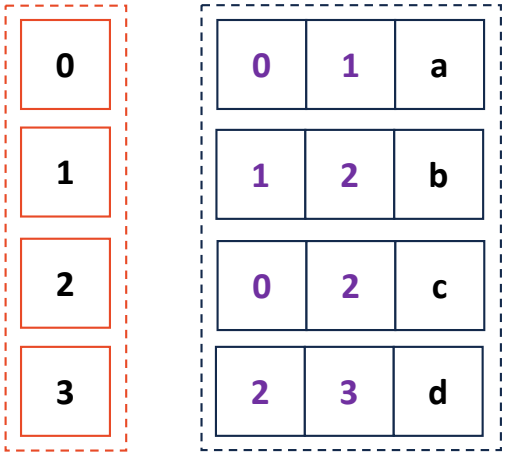
areAdjacent(Vertex v1, Vertex v2):

```
G.incidentEdges(v1).contains(v2)
```

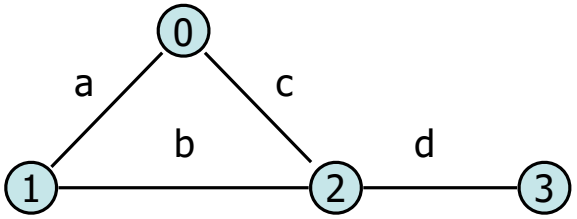
Graph Implementation: Edge List



insertEdge(Vertex v1, Vertex v2, K key):



Graph Implementation: Adjacency Matrix

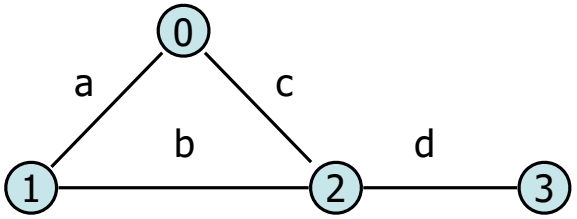


0
1
2
3

0	1	a
1	2	b
0	2	c
2	3	d

	0	1	2	3
0				
1				
2				
3				

Graph Implementation: Adjacency Matrix

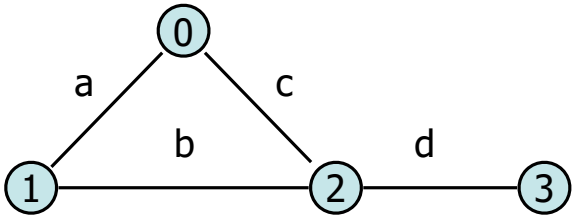


0
1
2
3

0	1	a
1	2	b
0	2	c
2	3	d

	0	1	2	3
0				
1				
2				
3				

Graph Implementation: Adjacency Matrix

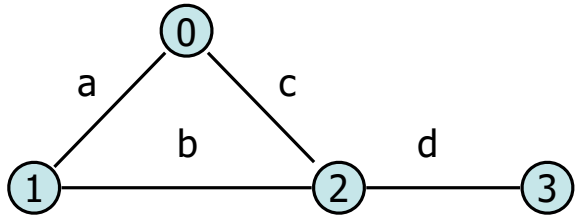


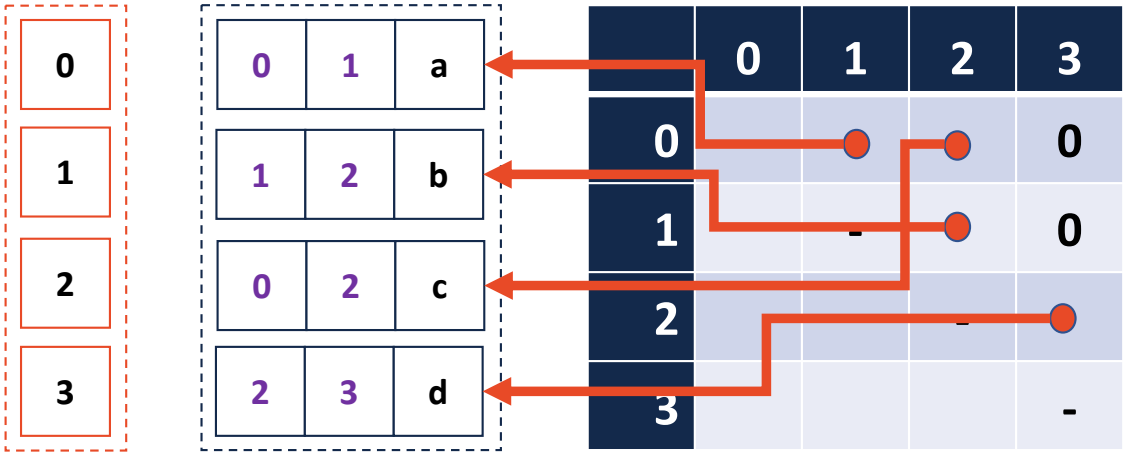
0
1
2
3

0	1	a
1	2	b
0	2	c
2	3	d

	0	1	2	3
0	-	1	1	0
1		-	1	0
2			-	1
3				-

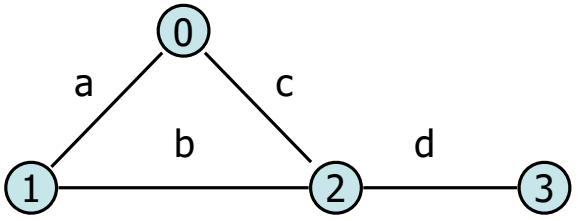
Graph Implementation: Adjacency Matrix

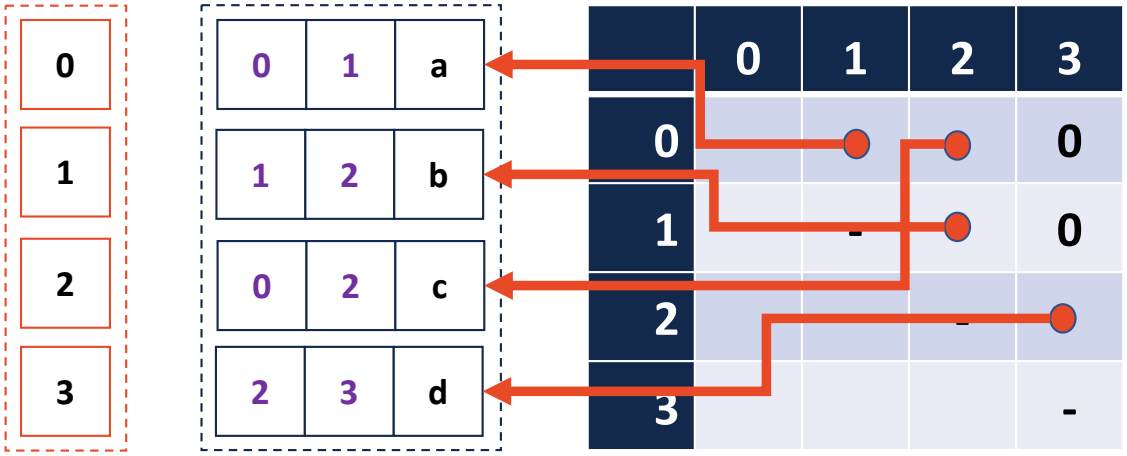




Graph Implementation: Adjacency Matrix

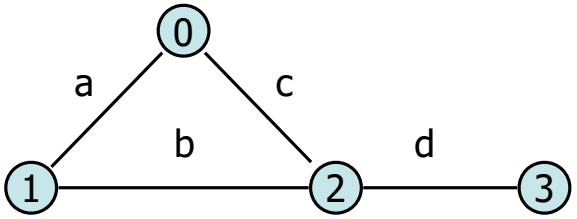
incidentEdges(Vertex v):

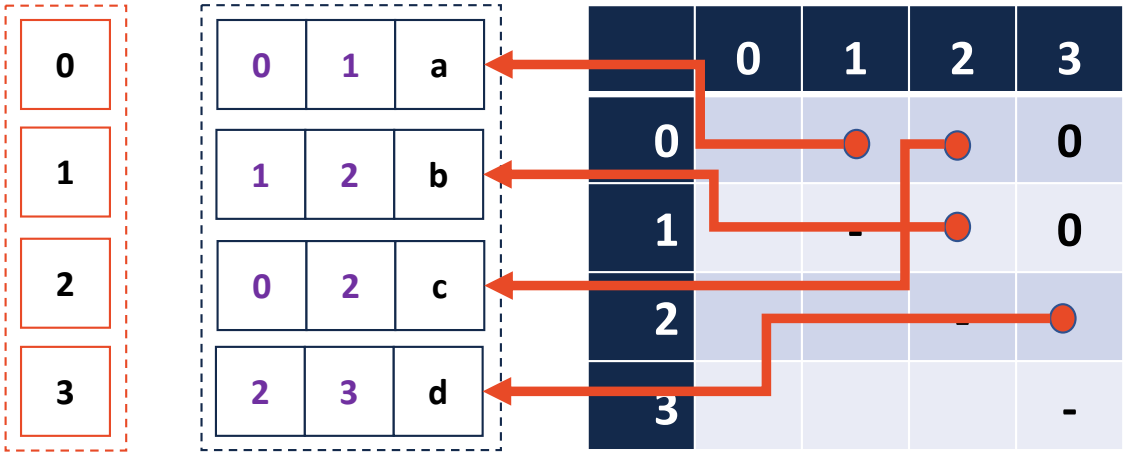




Graph Implementation: Adjacency Matrix

areAdjacent(Vertex v1, Vertex v2):





Graph Implementation: Adjacency Matrix

insertEdge(Vertex v1, Vertex v2, K key):