Algorithms

FOURTH EDITION

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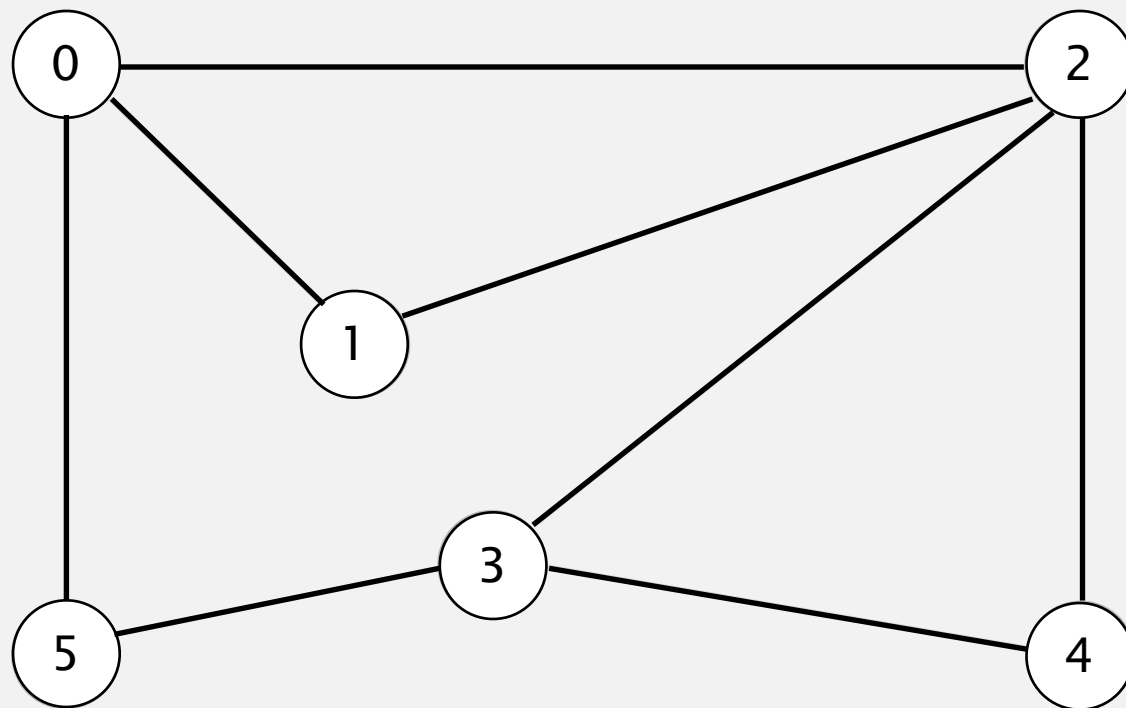
http://algs4.cs.princeton.edu

4.1 BREADTH-FIRST SEARCH

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
- Add to queue all unmarked vertices adjacent to v and mark them.

graph G

tinyCG.txt

V → 6
8   ← E
0 5
2 4
2 3
1 2
0 1
3 4
3 5
0 2

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
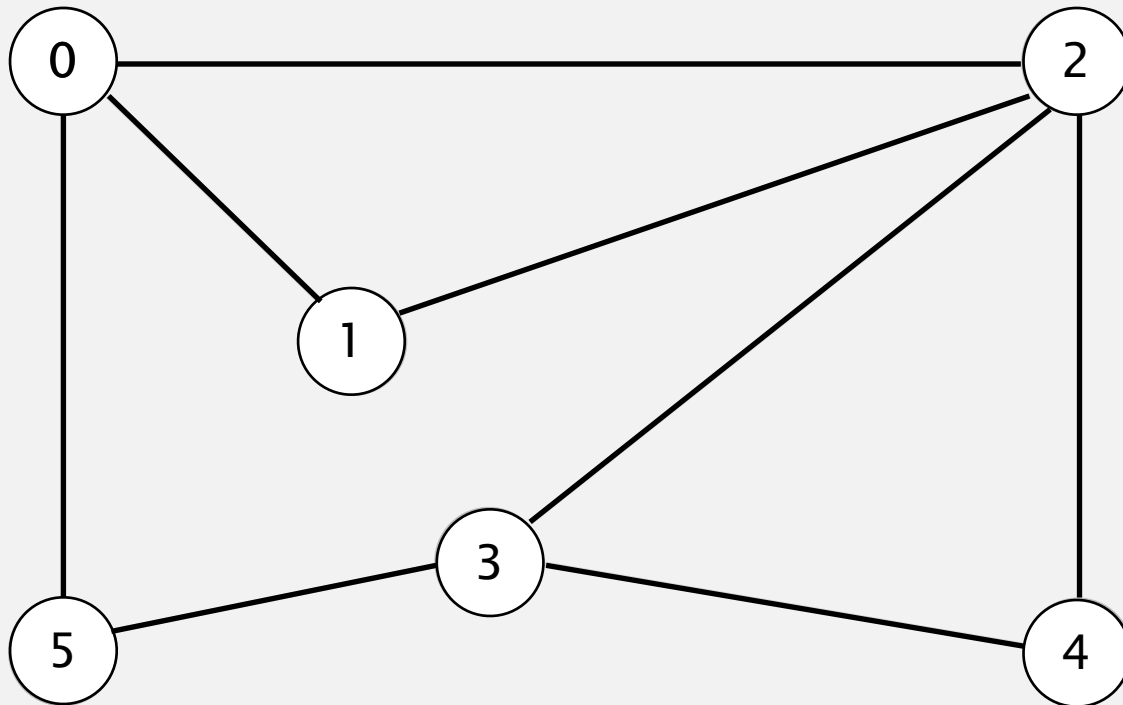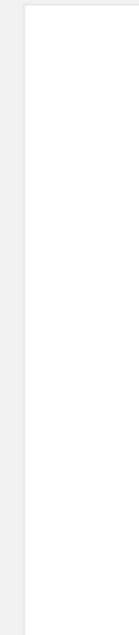- Add to queue all unmarked vertices adjacent to v and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	–	–
		2	–	–
		3	–	–
		4	–	–
		5	–	–

add 0 to queue

Breadth-first search demo

Repeat until queue is empty:
- Remove vertex v from queue.
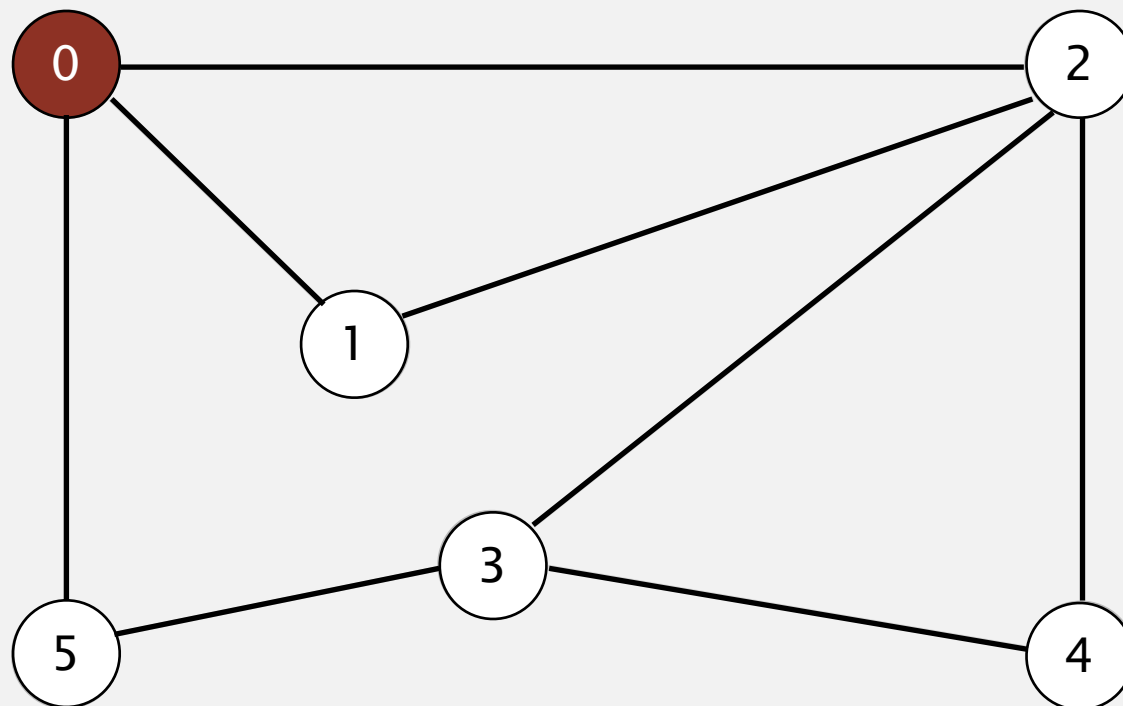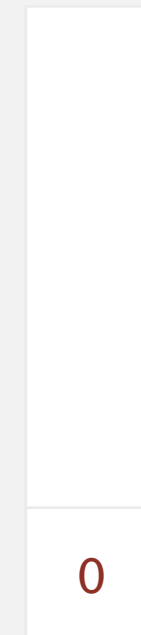- Add to queue all unmarked vertices adjacent to v and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	–	–
		2	–	–
		3	–	–
		4	–	–
0		5	–	–

dequeue 0

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex *v* from queue.
- Add to queue all unmarked vertices adjacent to *v* and mark them.
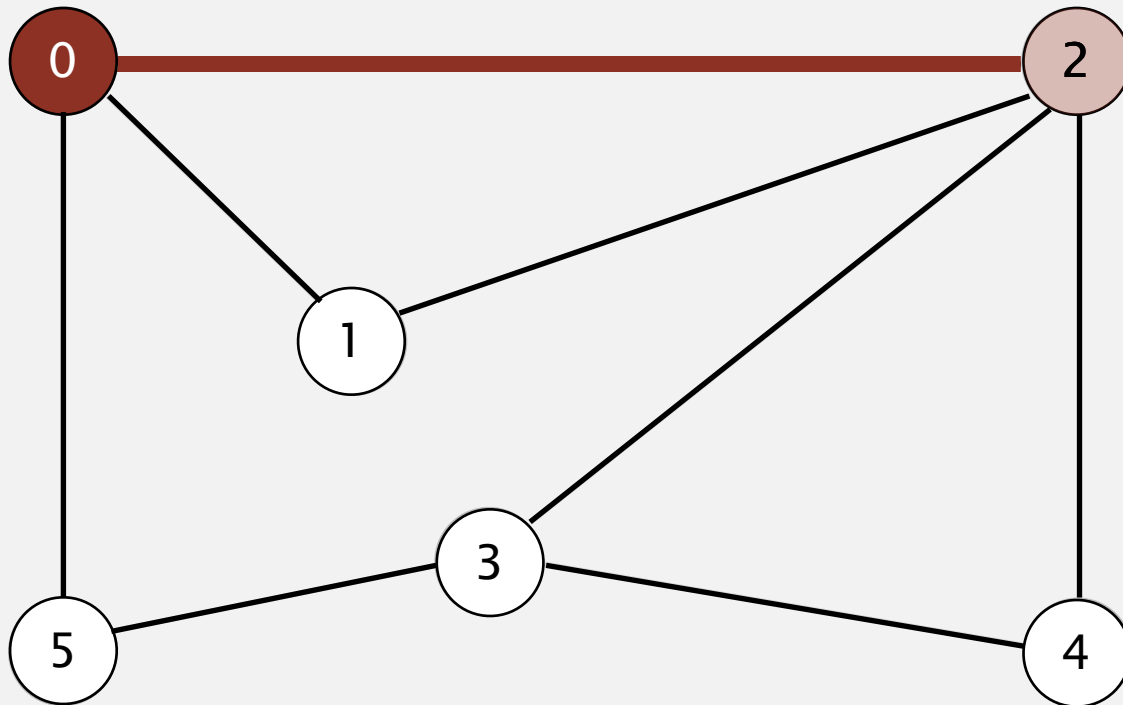

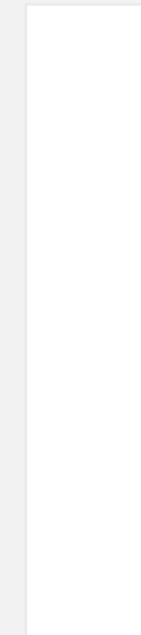| queue	v	edgeTo[]	distTo[]
	0	–	0
	1	–	–
	2	0	1
	3	–	–
	4	–	–
	5	–	–

dequeue 0

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
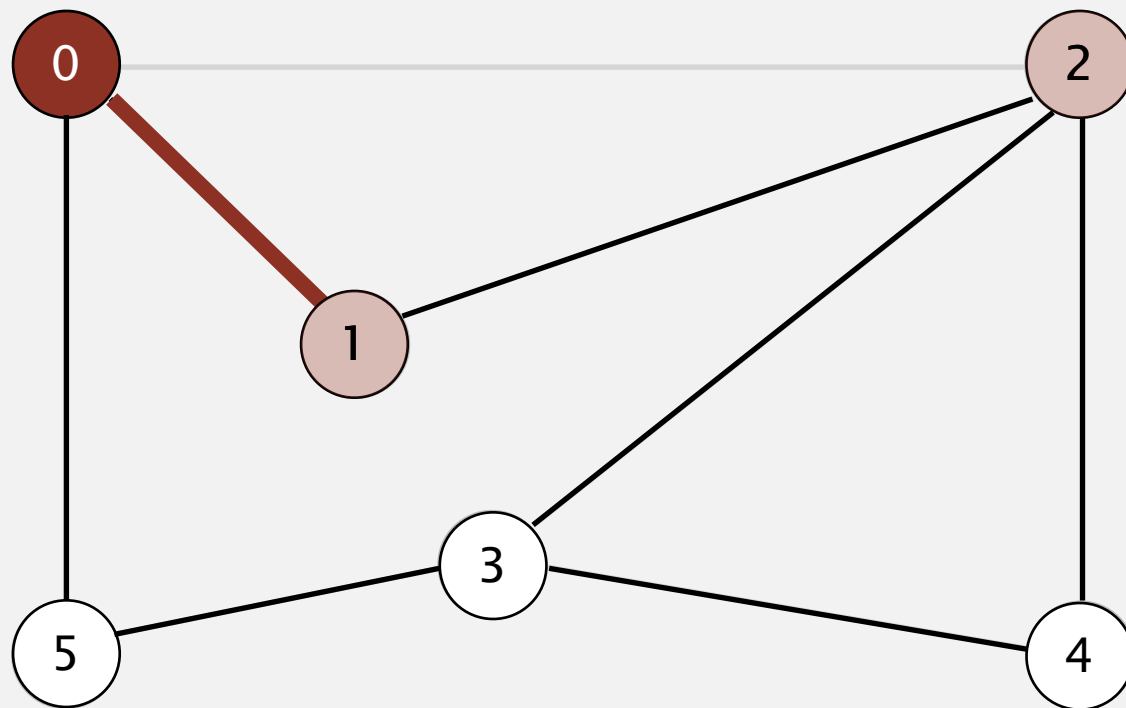- Add to queue all unmarked vertices adjacent to v and mark them.

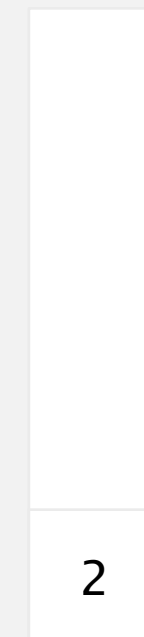| queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	–	–
		4	–	–
		5	–	–
2				

dequeue 0

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
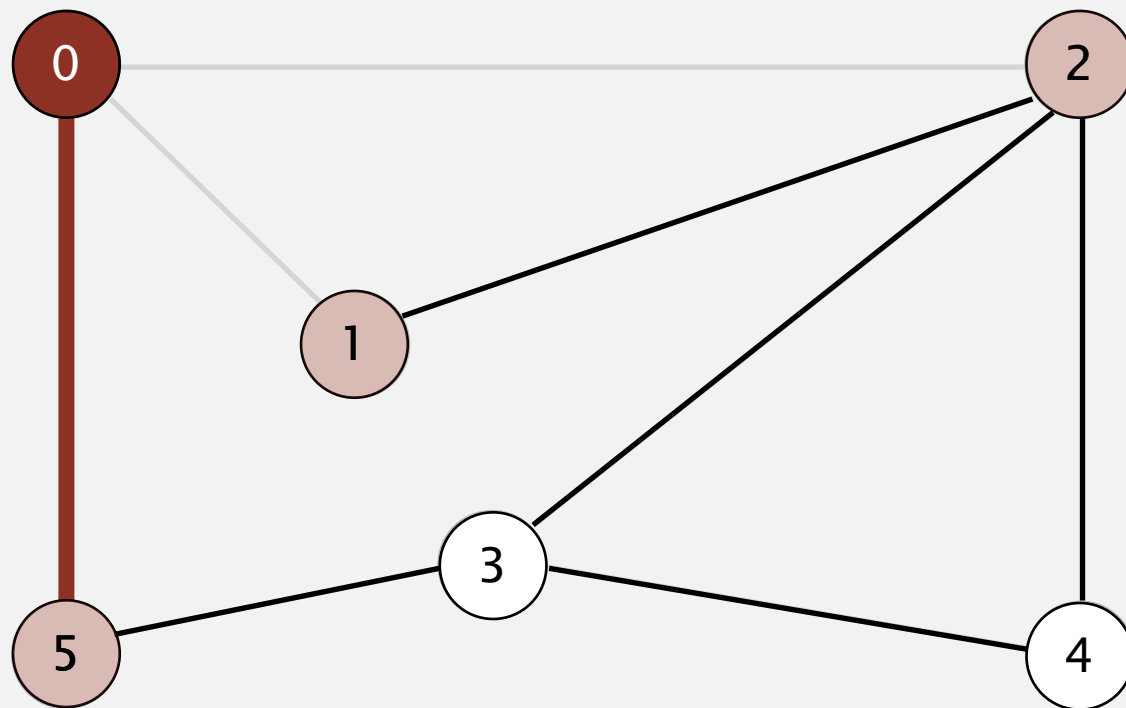- Add to queue all unmarked vertices adjacent to v and mark them.

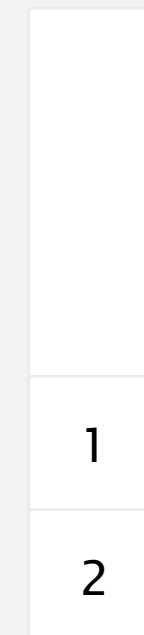| queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	–	–
1		4	0	1
		5	–	–
2				

dequeue 0

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
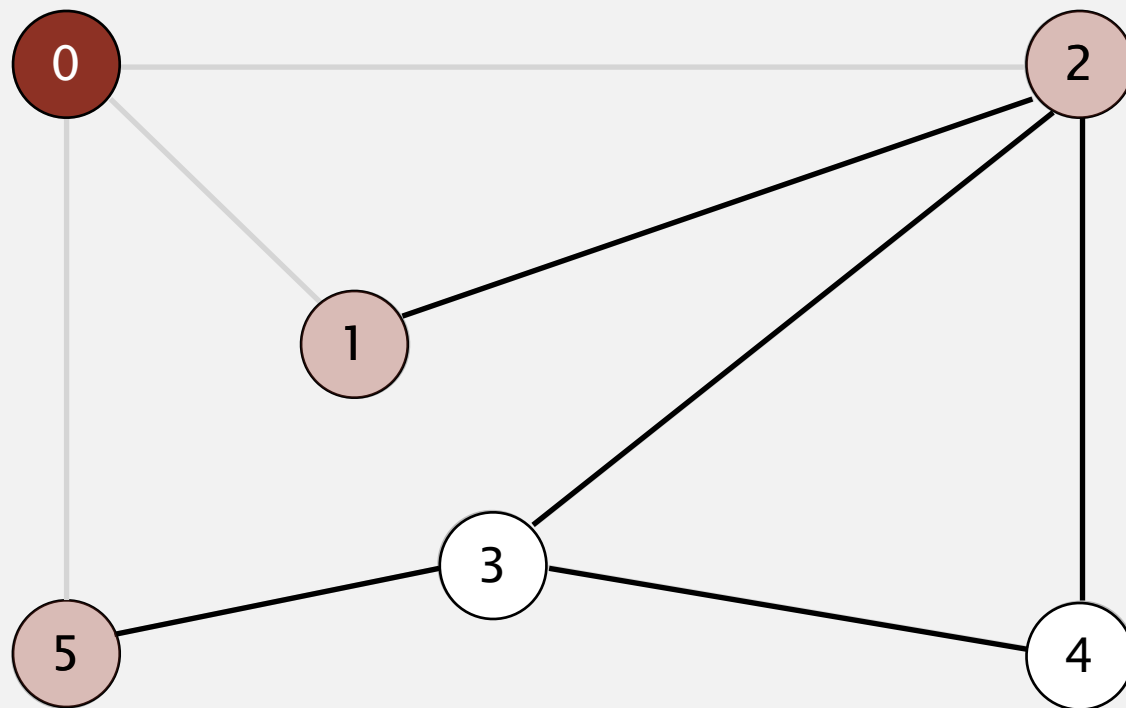- Add to queue all unmarked vertices adjacent to v and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
5		3	–	–
1		4	–	–
2		5	0	1

0 done

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex *v* from queue.
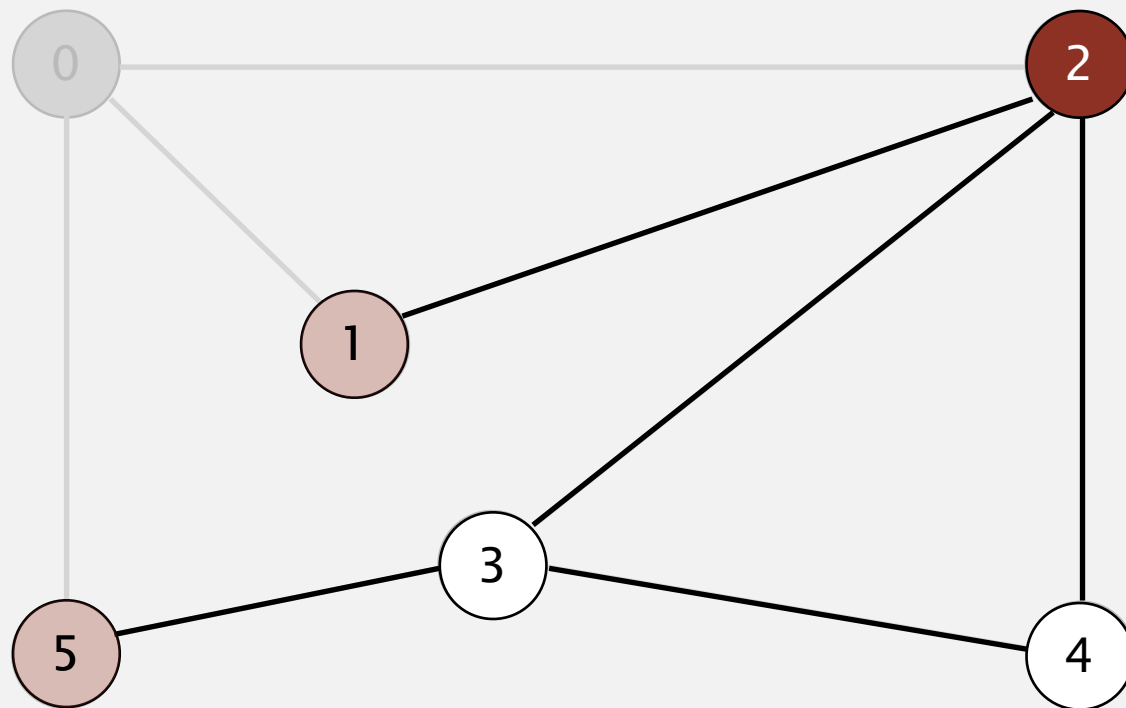- Add to queue all unmarked vertices adjacent to *v* and mark them.

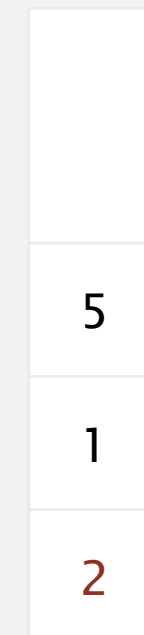| queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
5		3	–	–
1		4	–	–
		5	0	1
2				

dequeue 2

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
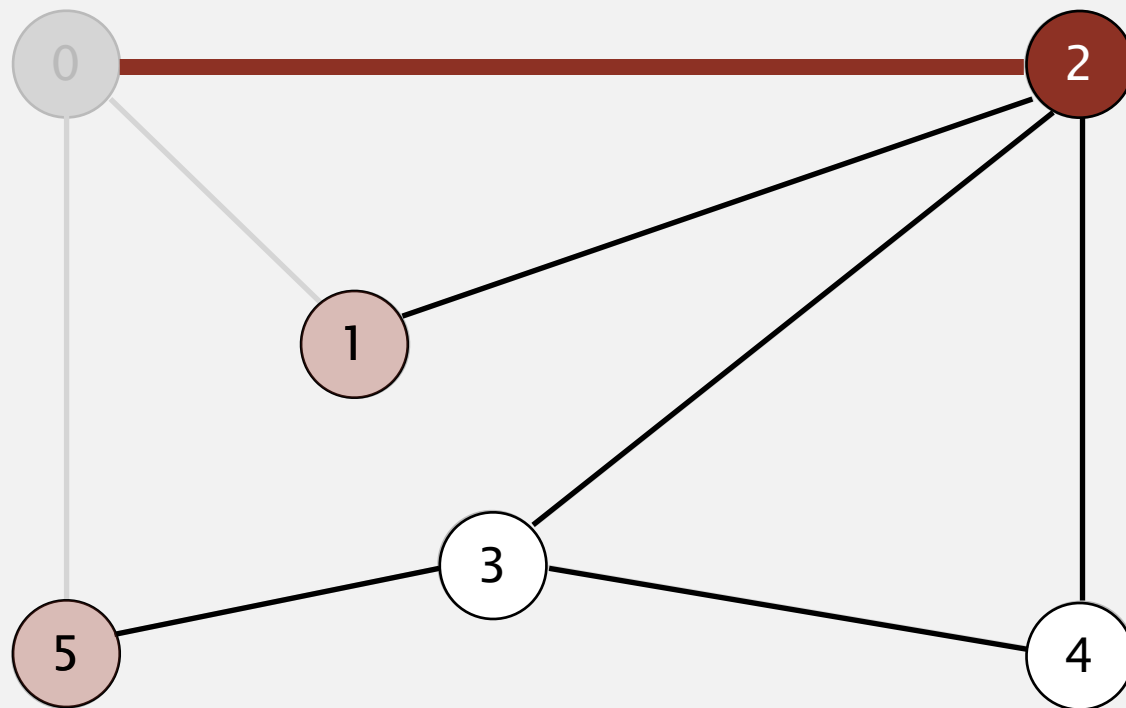- Add to queue all unmarked vertices adjacent to v and mark them.

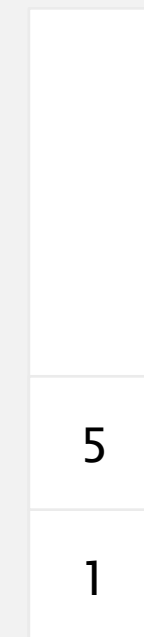| queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	–	–
5		4	–	–
		5	0	1
1				

dequeue 2

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
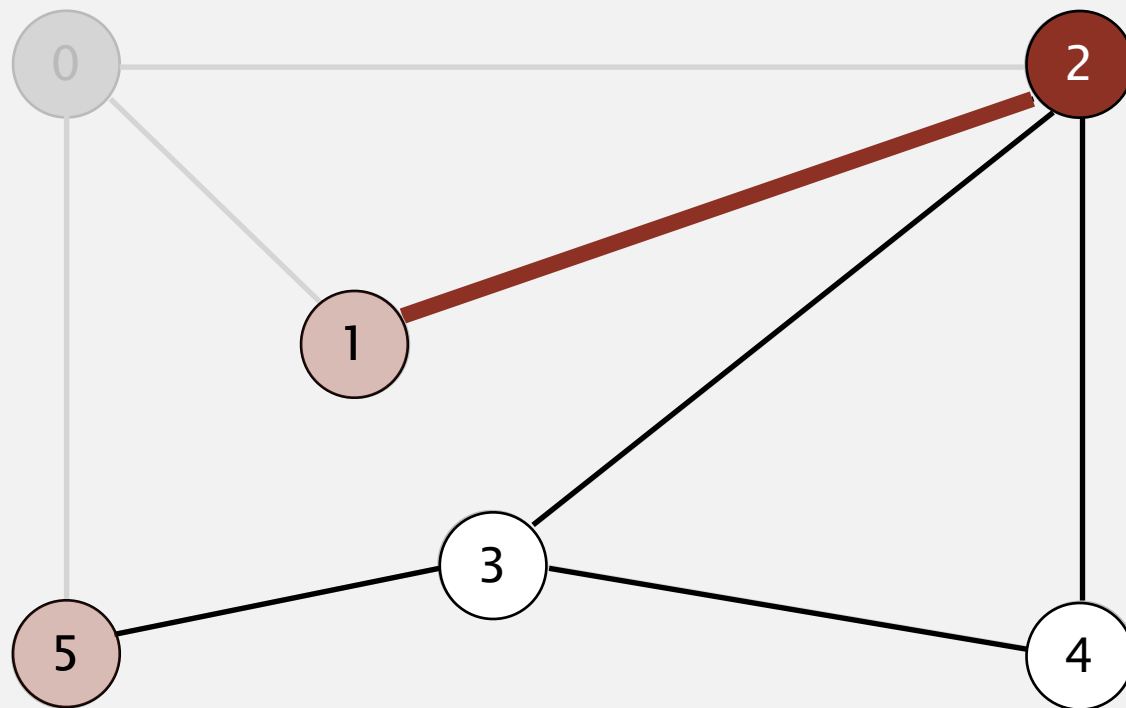- Add to queue all unmarked vertices adjacent to v and mark them.

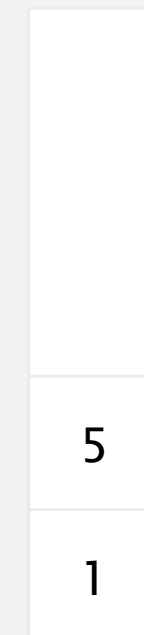| queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	–	–
5		4	–	–
		5	0	1
1				

dequeue 2

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
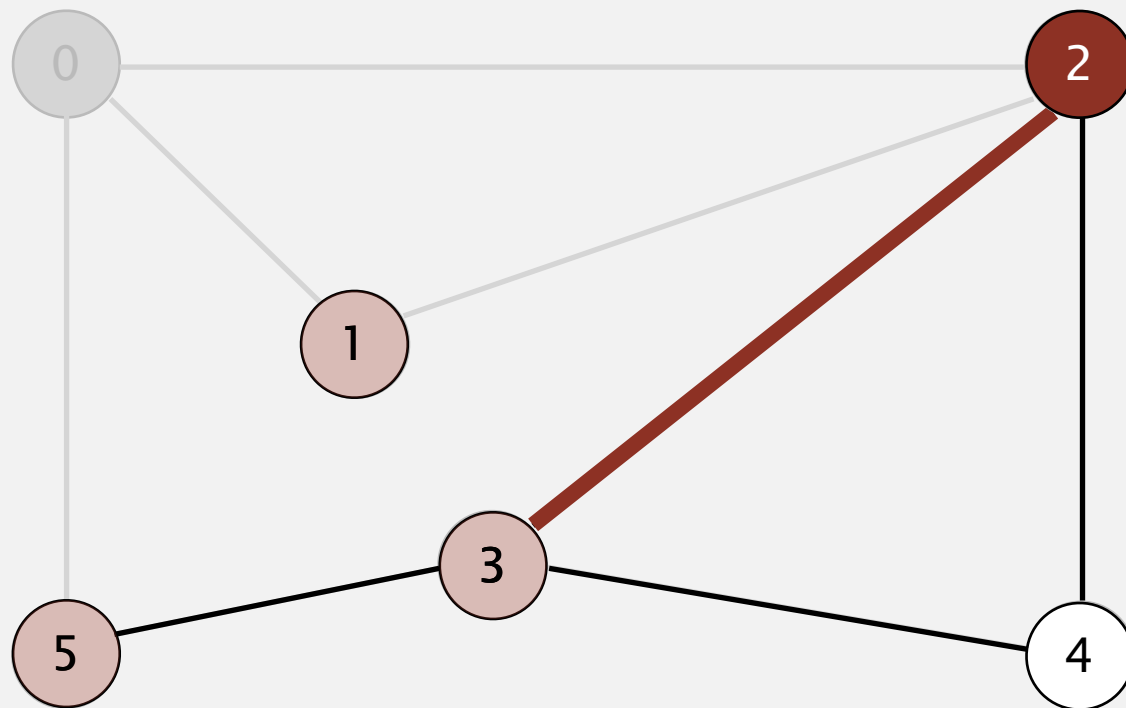- Add to queue all unmarked vertices adjacent to v and mark them.

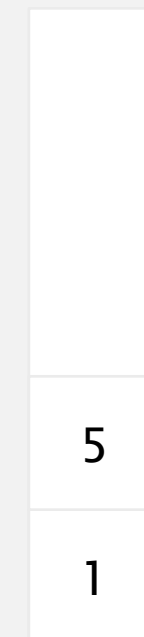| queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
5		4	–	–
		5	0	1
1				

dequeue 2

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
- Add to queue all unmarked vertices adjacent to v and mark them.

queue	v	edgeTo[]	distTo[]
	0	–	0
	1	0	1
	2	0	1
3	3	2	2
5	4	–	–
1	5	0	1

dequeue 2

Breadth-first search demo

Repeat until queue is empty:
- Remove vertex v from queue.
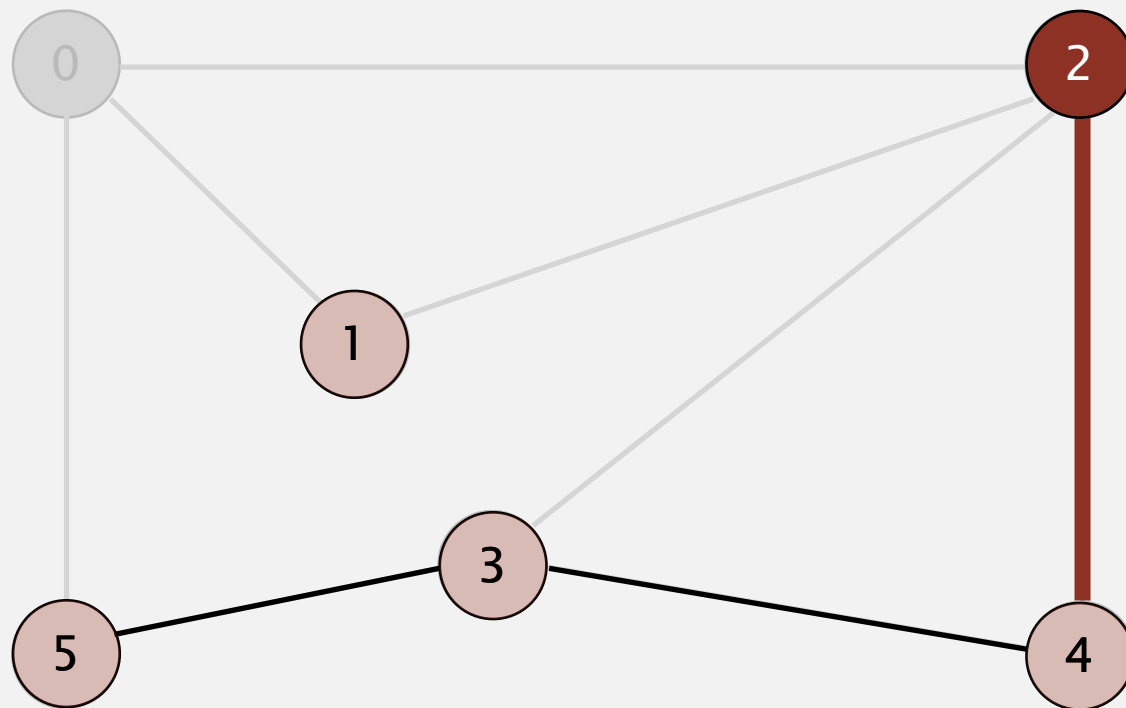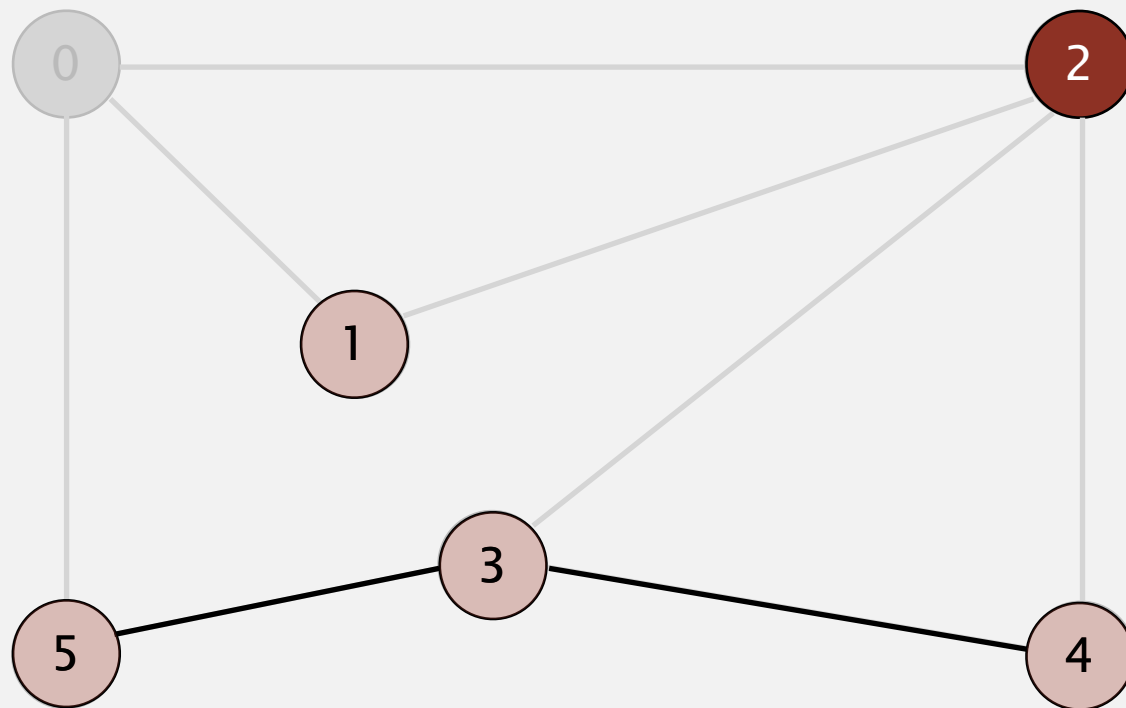- Add to queue all unmarked vertices adjacent to v and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
4		2	0	1
3		3	2	2
5		4	2	2
		5	0	1
1				

2 done

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
- Add to queue all unmarked vertices adjacent to v and mark them.

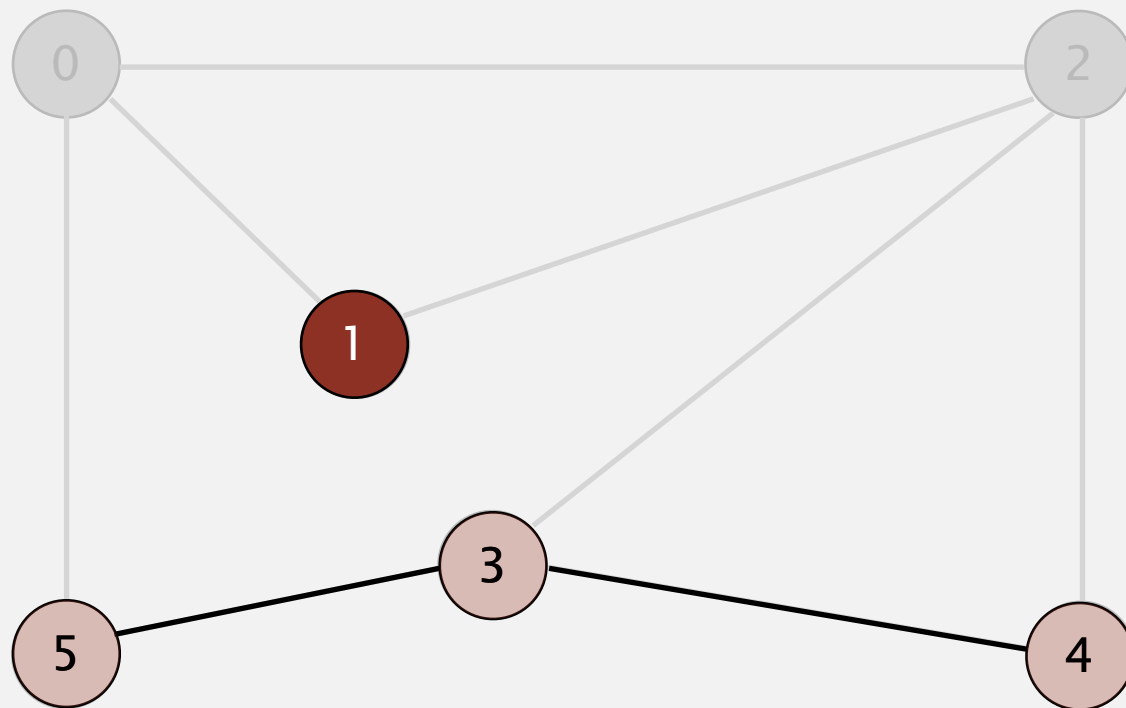| queue		v	edgeTo[]	distTo[]
		0	–	0
4		1	0	1
		2	0	1
3		3	2	2
5		4	2	2
		5	0	1
1				

dequeue 1

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.

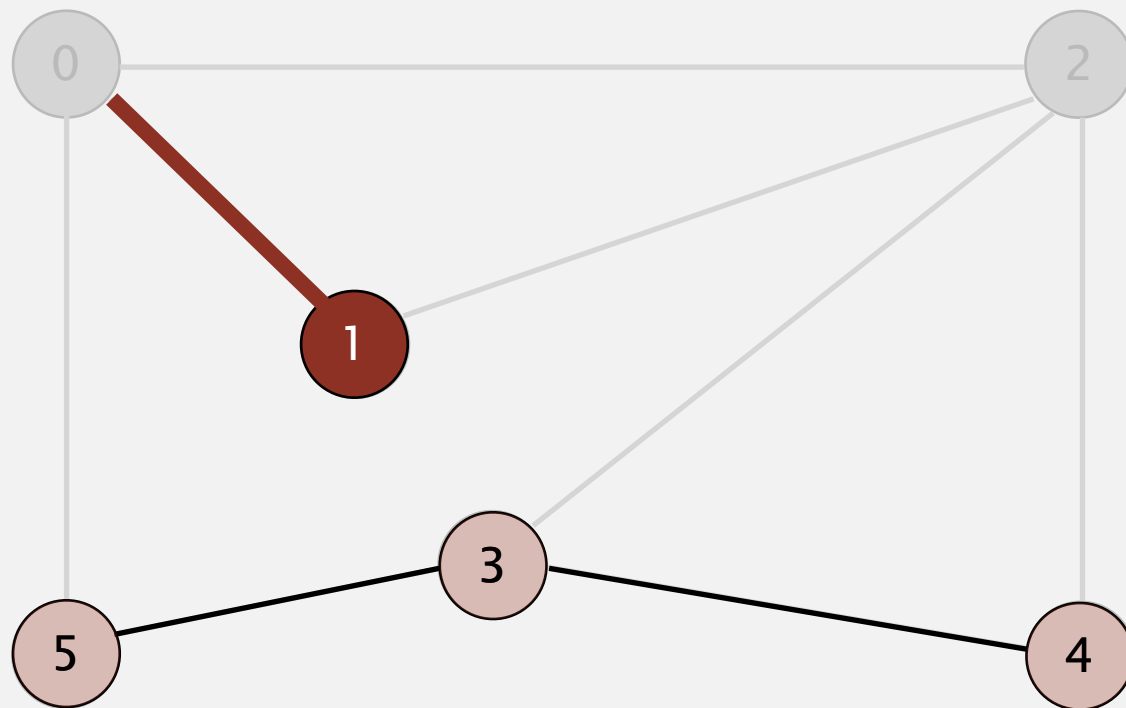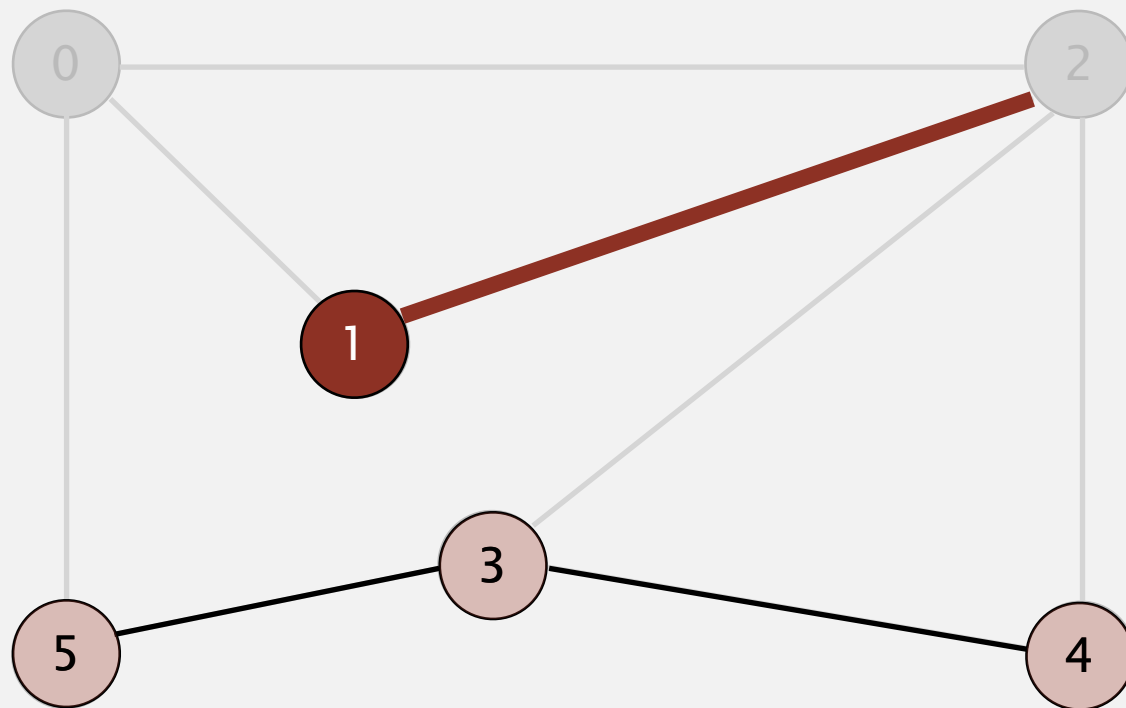- Add to queue all unmarked vertices adjacent to v and mark them.

queue	v	edgeTo[]	distTo[]
	0	–	0
	1	0	1
	2	0	1
4	3	2	2
3	4	2	2
5	5	0	1

dequeue 1

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex *v* from queue.

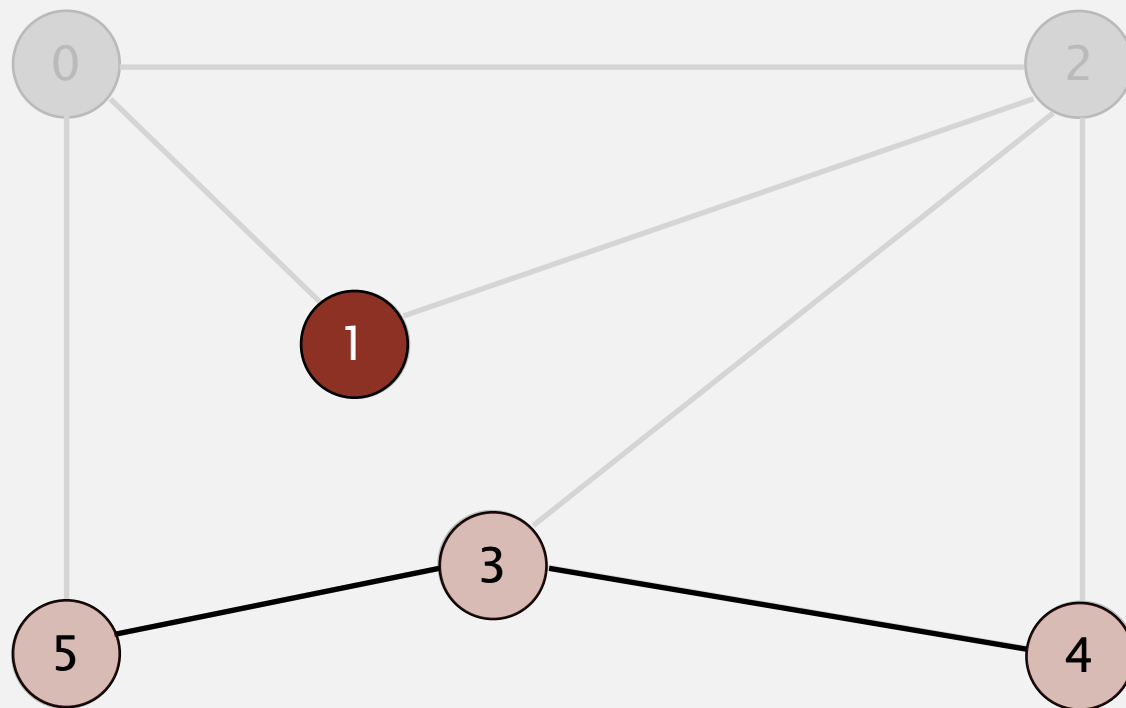- Add to queue all unmarked vertices adjacent to *v* and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
4		3	2	2
		4	2	2
3		5	0	1
5				

dequeue 1

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.

- Add to queue all unmarked vertices adjacent to v and mark them.
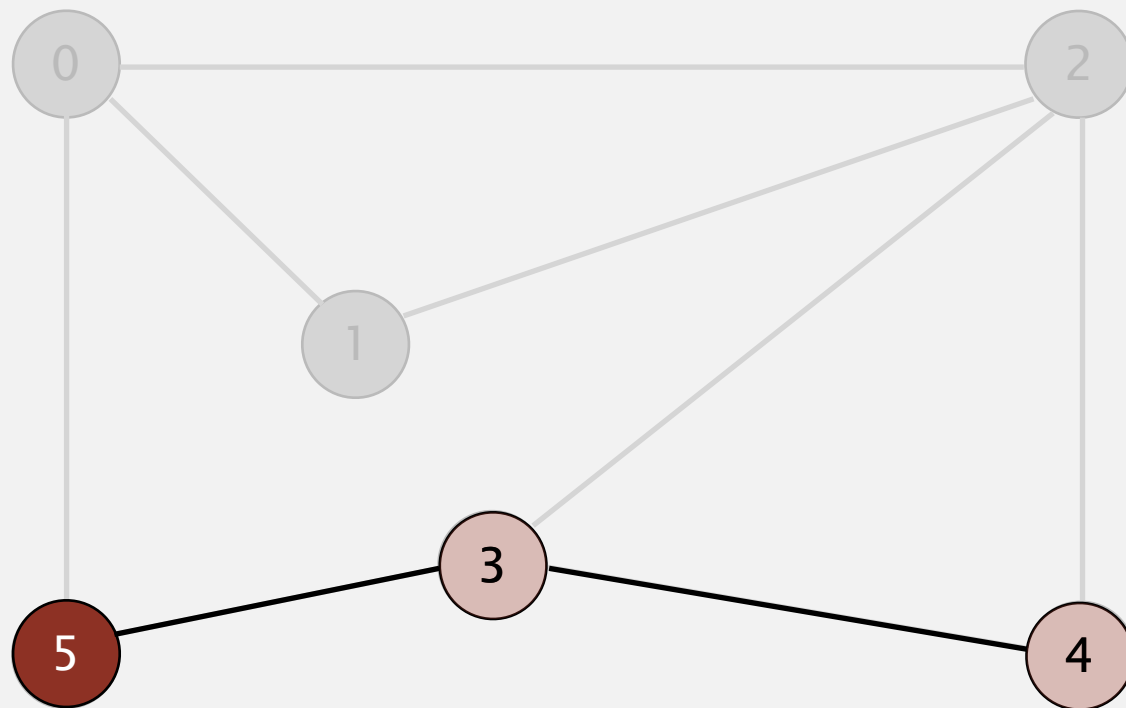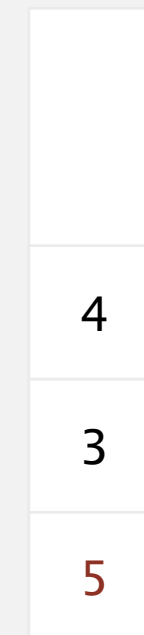

queue	v	edgeTo[]	distTo[]
	0	–	0
	1	0	1
	2	0	1
4	3	2	2
3	4	2	2
5	5	0	1

1 done

Breadth-first search demo

Repeat until queue is empty:
- Remove vertex v from queue.
- Add to queue all unmarked vertices adjacent to v and mark them.
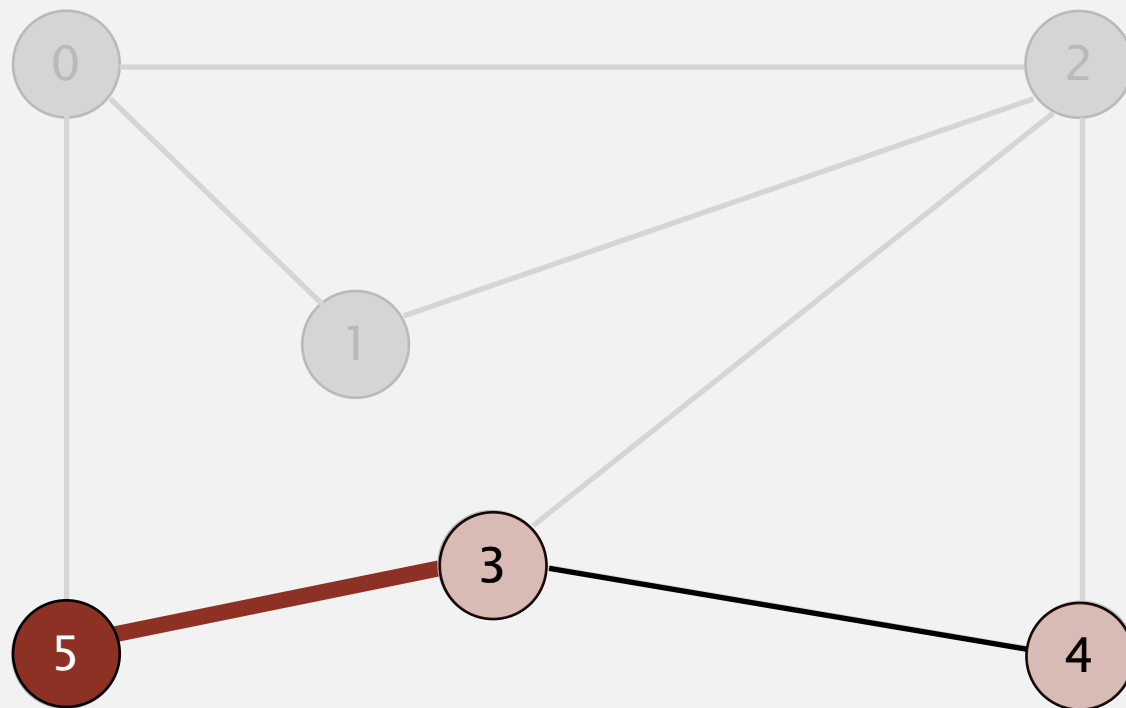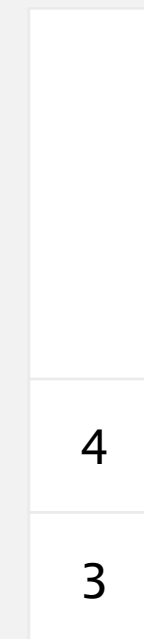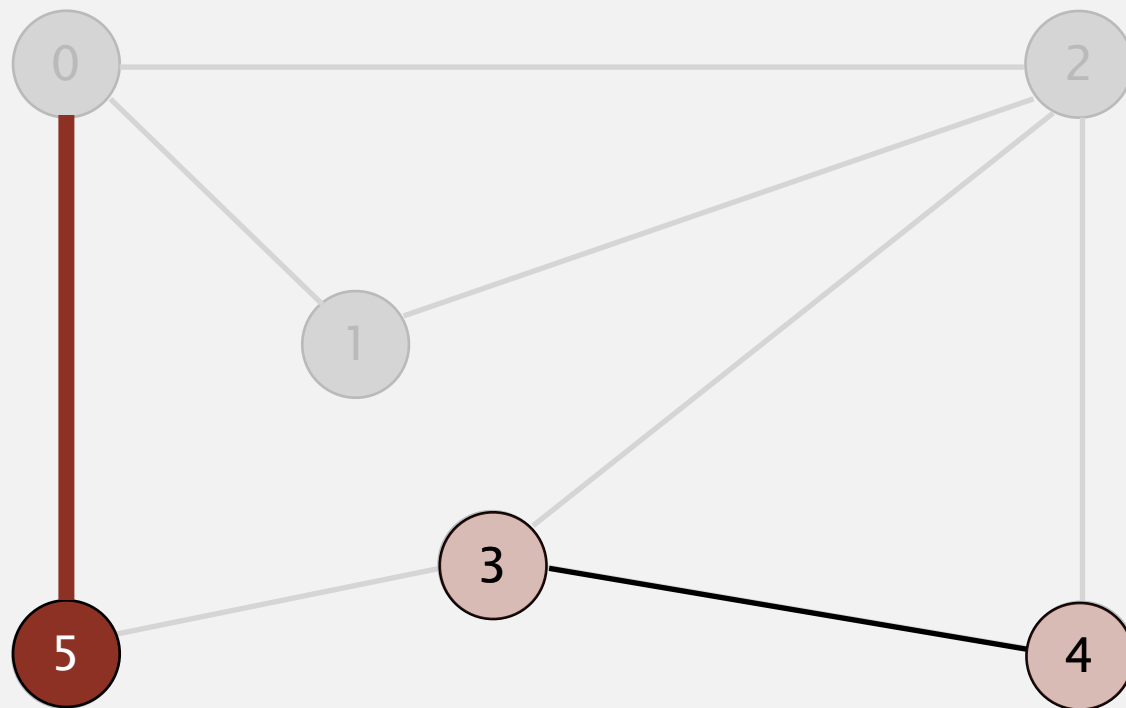

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
4		3	2	2
		4	2	2
3				
		5	0	1
5				

dequeue 5

Repeat until queue is empty:

- Remove vertex v from queue.
- Add to queue all unmarked vertices adjacent to v and mark them.

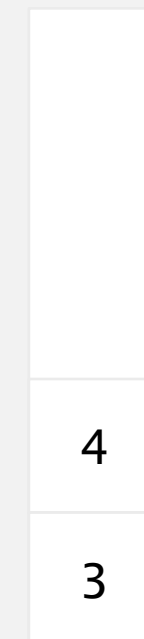| queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
4		4	2	2
3		5	0	1

dequeue 5

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
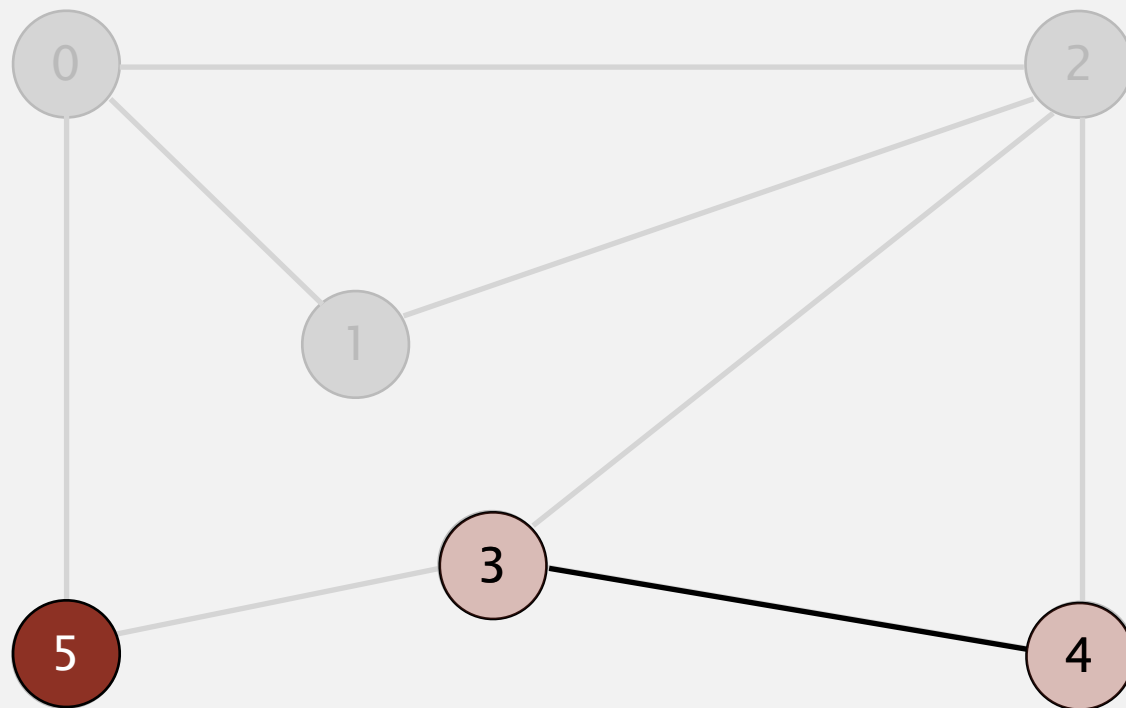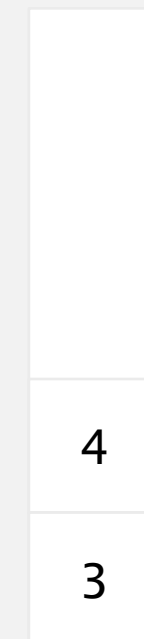- Add to queue all unmarked vertices adjacent to v and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
4		4	2	2
		5	0	1
3				

dequeue 5

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex *v* from queue.

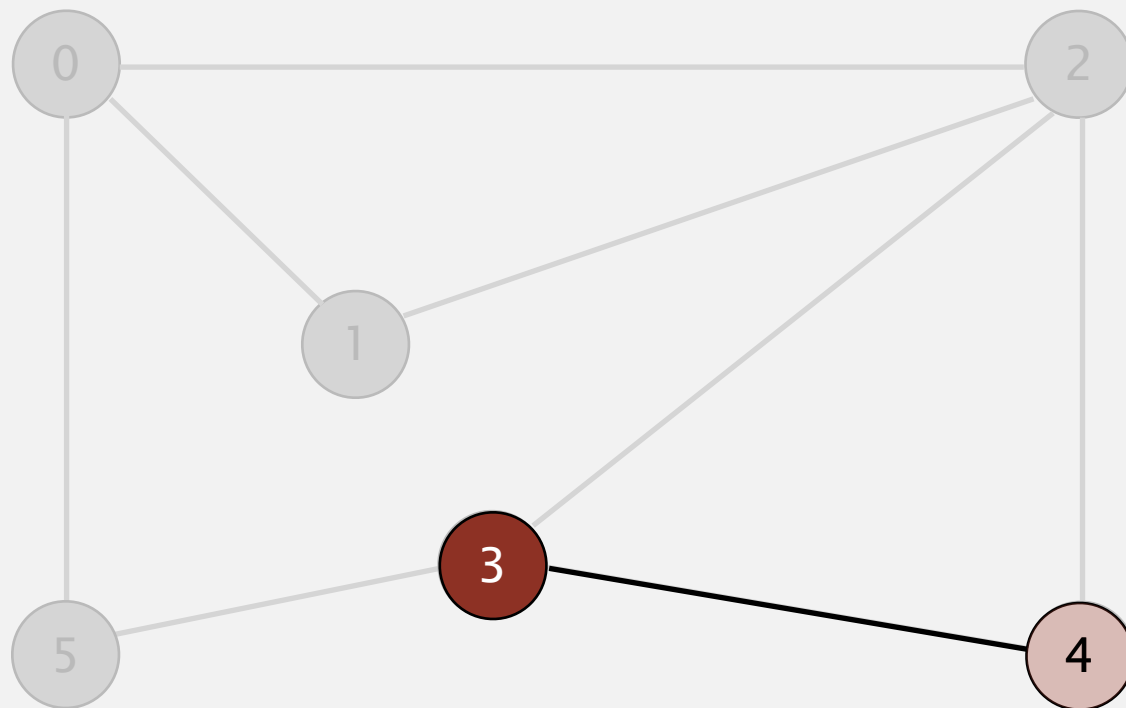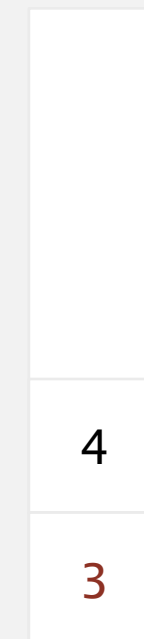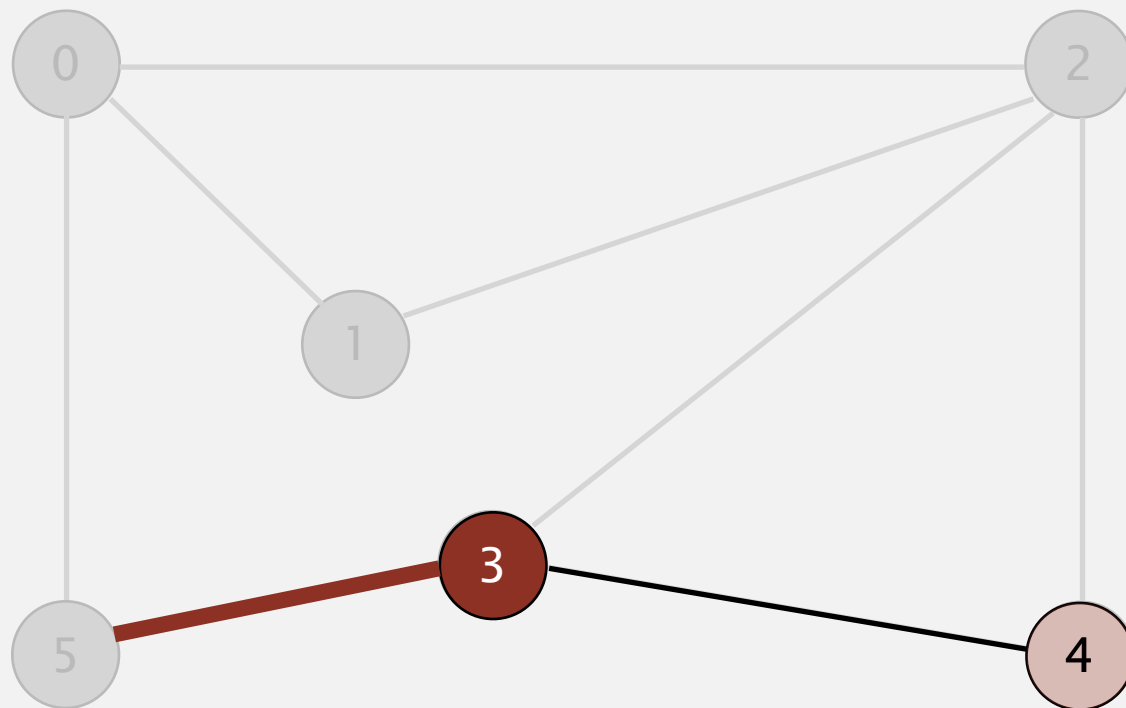- Add to queue all unmarked vertices adjacent to *v* and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
4		4	2	2
		5	0	1
3				

5 done

Repeat until queue is empty:

- Remove vertex v from queue.
- Add to queue all unmarked vertices adjacent to v and mark them.

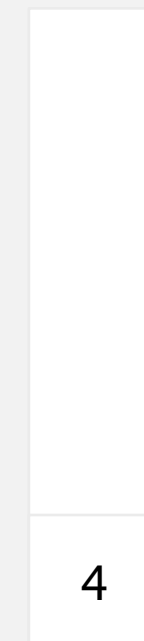| queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
4		4	2	2
3		5	0	1

dequeue 3

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
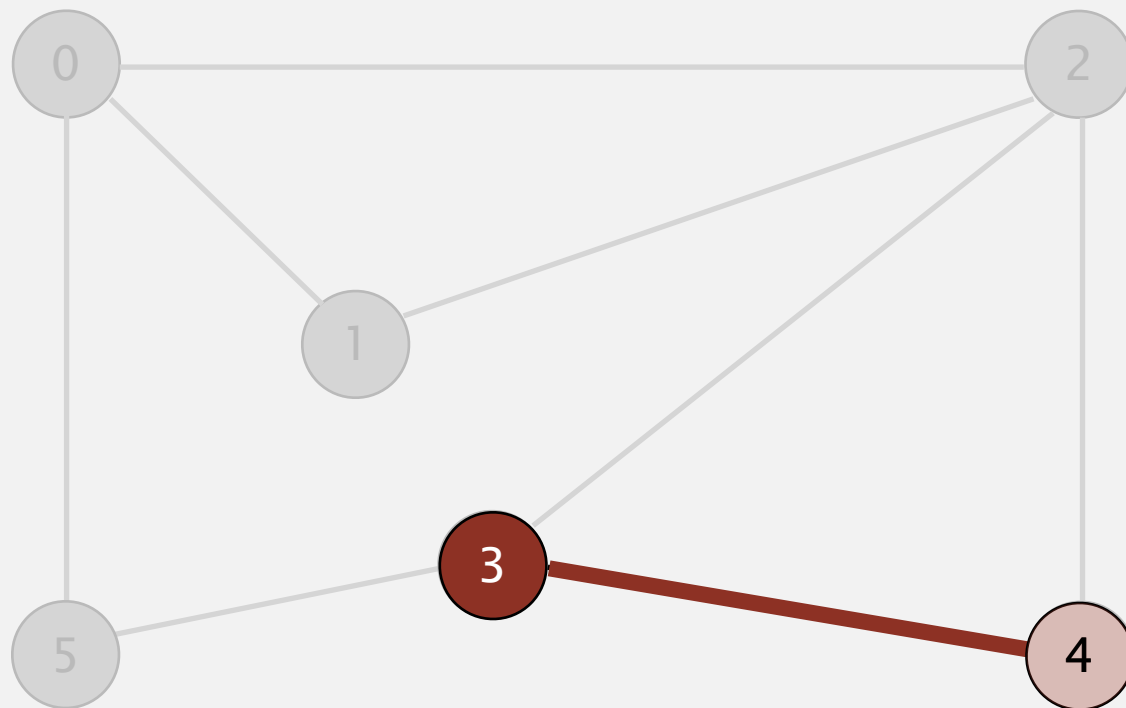- Add to queue all unmarked vertices adjacent to v and mark them.

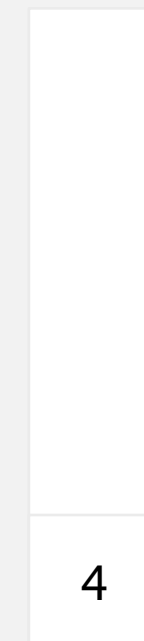| queue	v	edgeTo[]	distTo[]
	0	–	0
	1	0	1
	2	0	1
	3	2	2
	4	2	2
	5	0	1
4			

dequeue 3

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
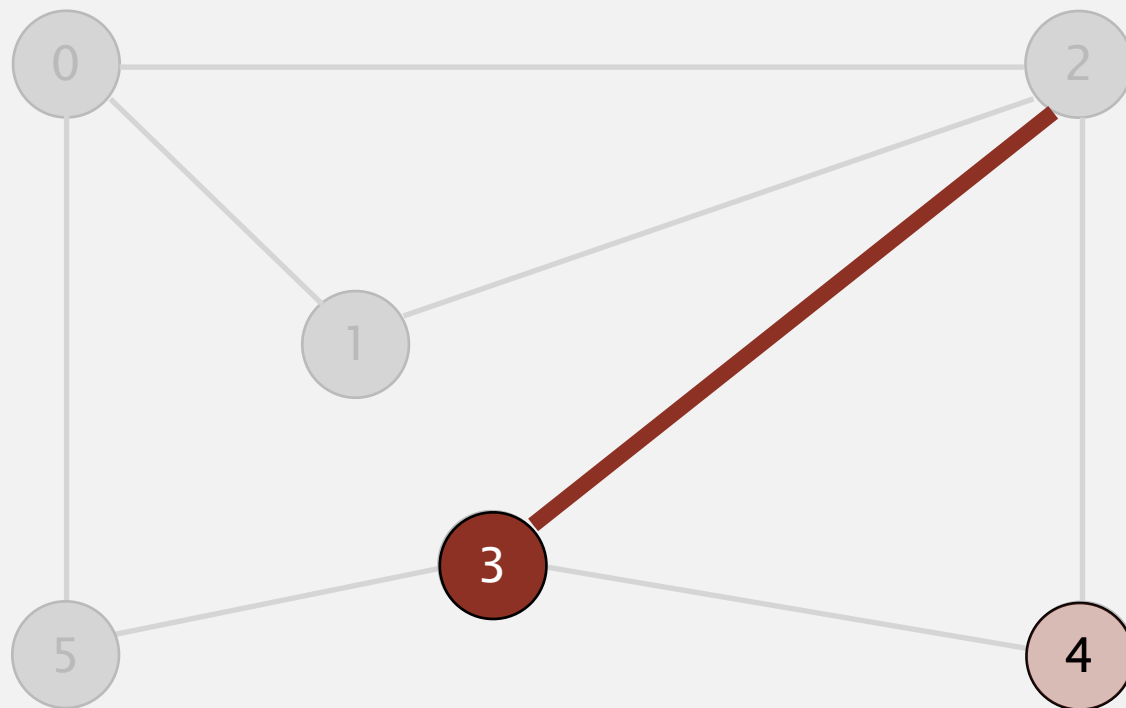- Add to queue all unmarked vertices adjacent to v and mark them.

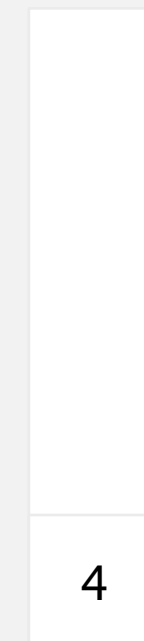| queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
		4	2	2
		5	0	1
4				

dequeue 3

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
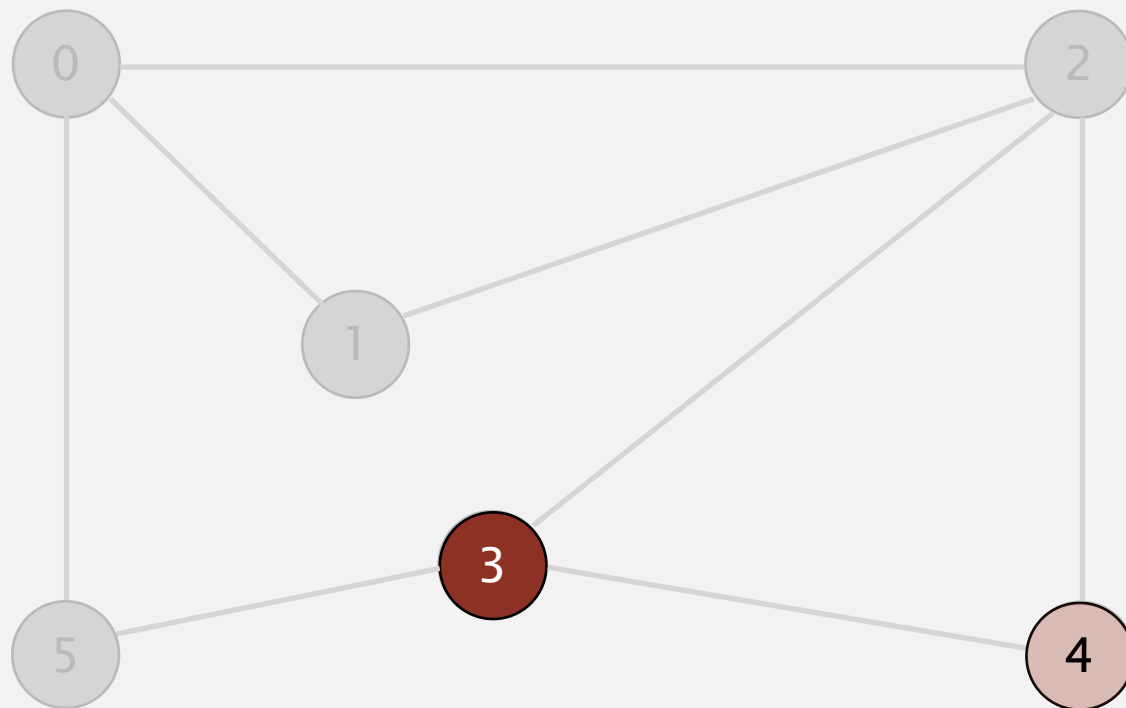- Add to queue all unmarked vertices adjacent to v and mark them.

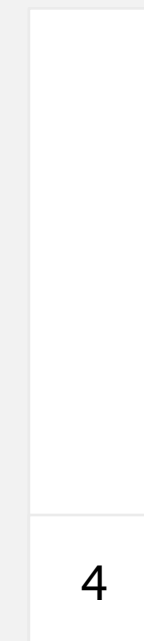| queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
		4	2	2
4		5	0	1

dequeue 3

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.

- Add to queue all unmarked vertices adjacent to v and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
		4	2	2
		5	0	1
4				

3 done

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.

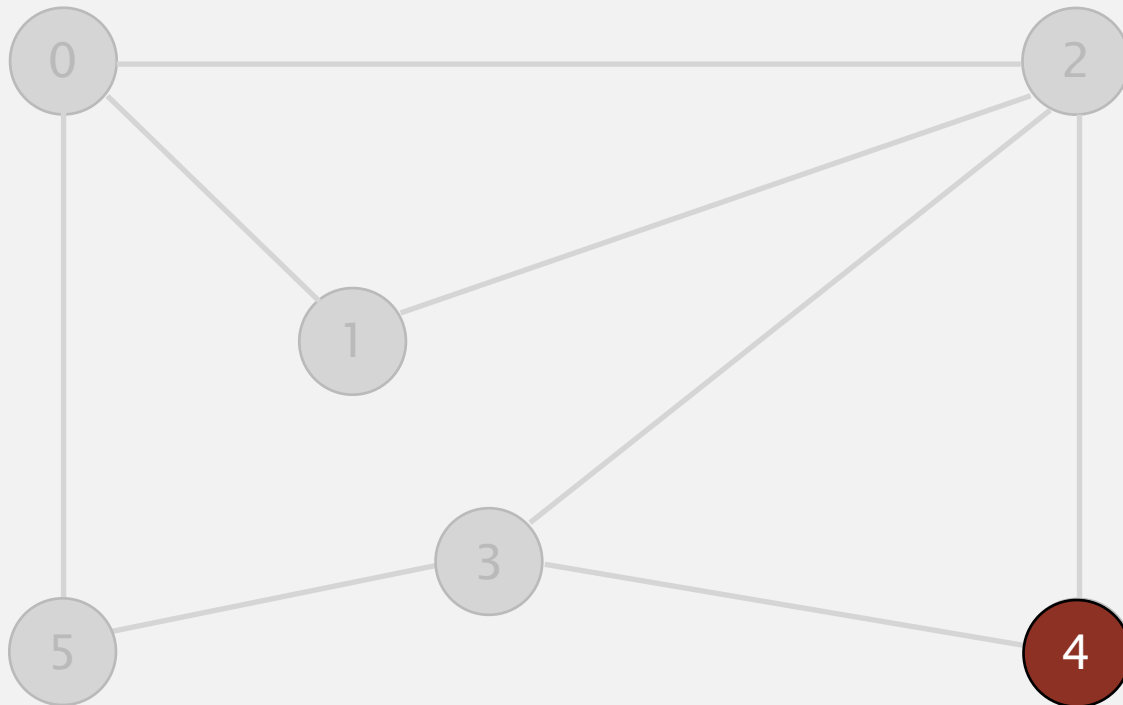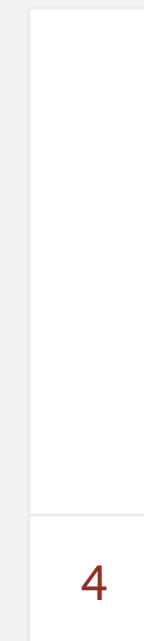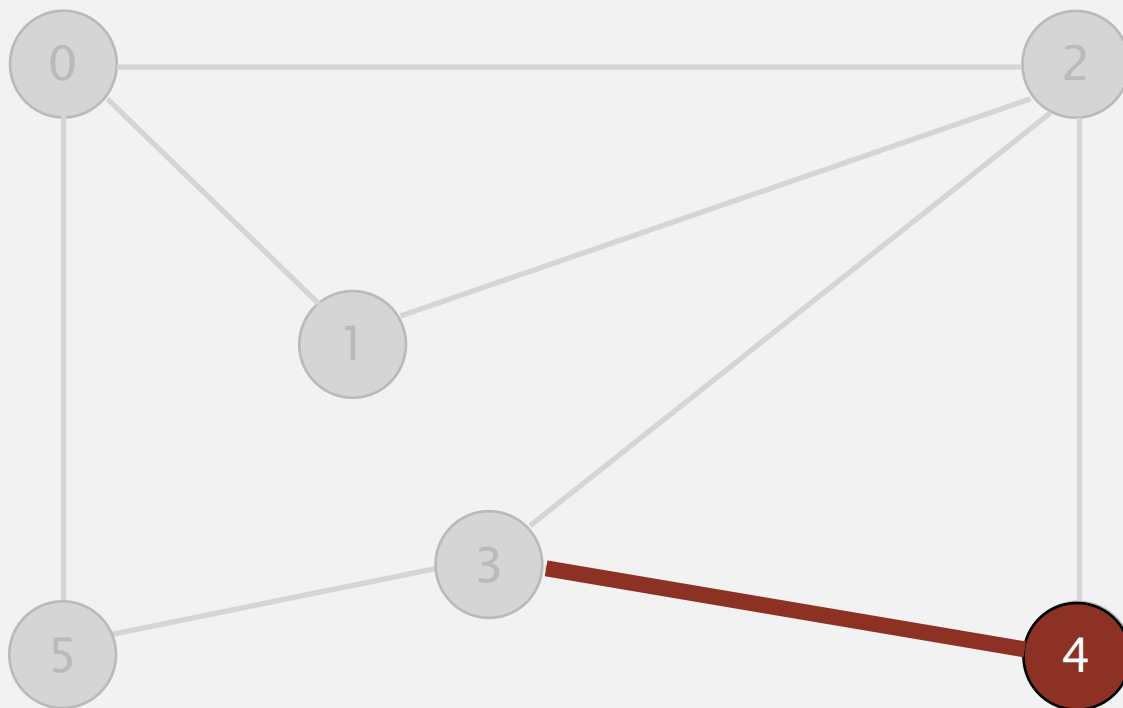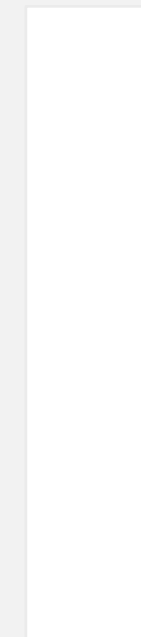- Add to queue all unmarked vertices adjacent to v and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
		4	2	2
		5	0	1
4				

dequeue 4

Repeat until queue is empty:

- Remove vertex *v* from queue.

- Add to queue all unmarked vertices adjacent to *v* and mark them.

queue	v	edgeTo[]	distTo[]
	0	–	0
	1	0	1
	2	0	1
	3	2	2
	4	2	2
	5	0	1

dequeue 4

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.

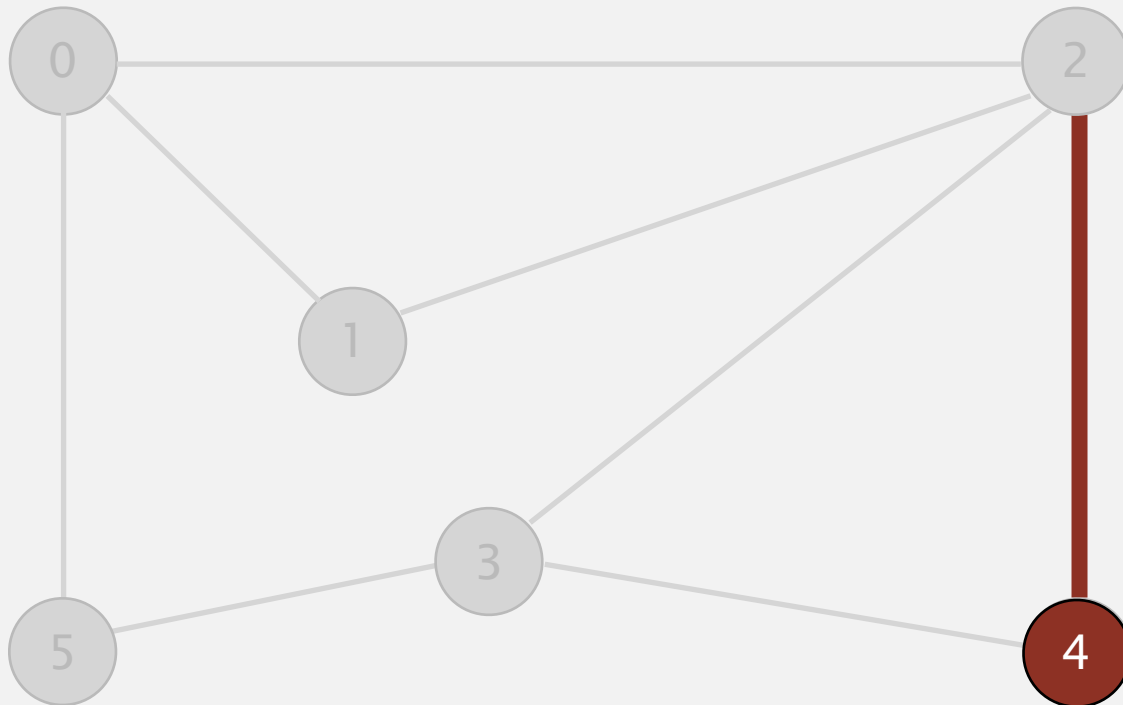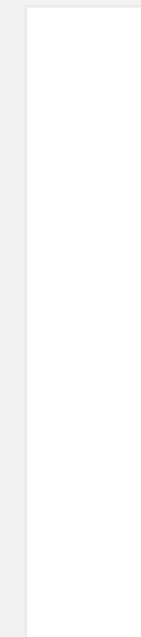- Add to queue all unmarked vertices adjacent to v and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
		4	2	2
		5	0	1

dequeue 4

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
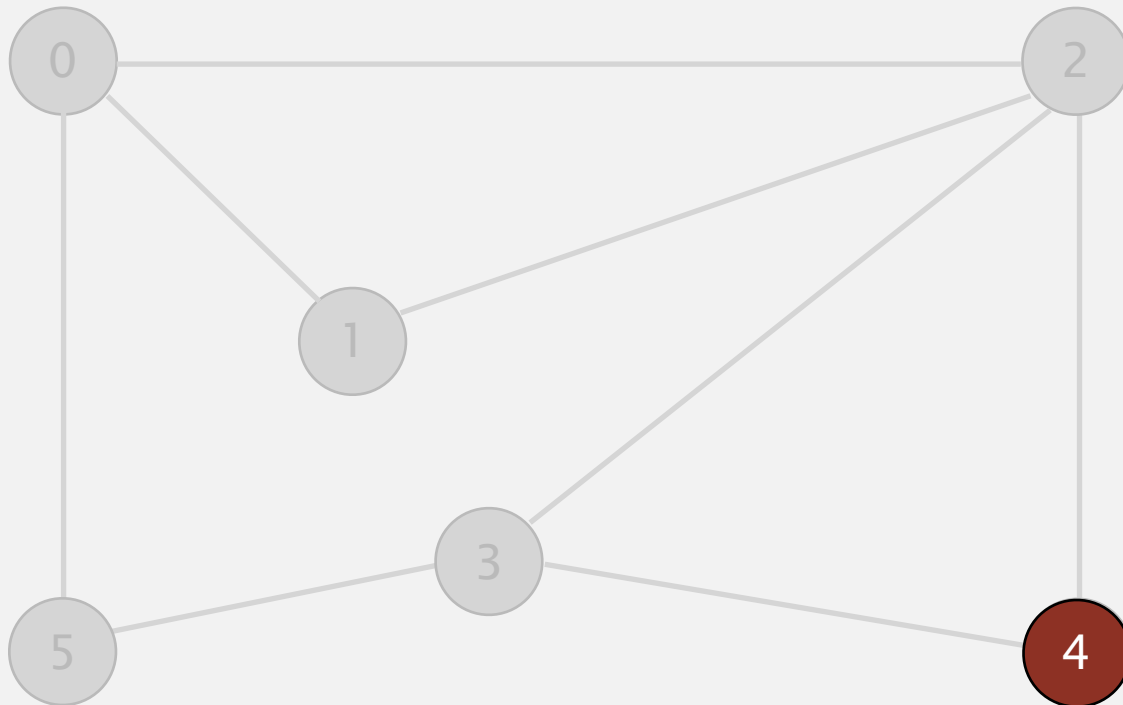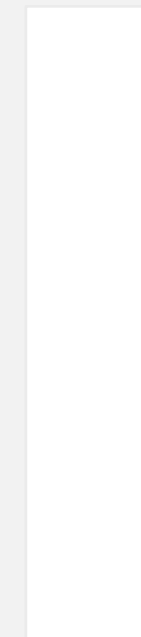- Add to queue all unmarked vertices adjacent to v and mark them.

queue		v	edgeTo[]	distTo[]
		0	–	0
		1	0	1
		2	0	1
		3	2	2
		4	2	2
		5	0	1

4 done

Breadth-first search demo

Repeat until queue is empty:

- Remove vertex v from queue.
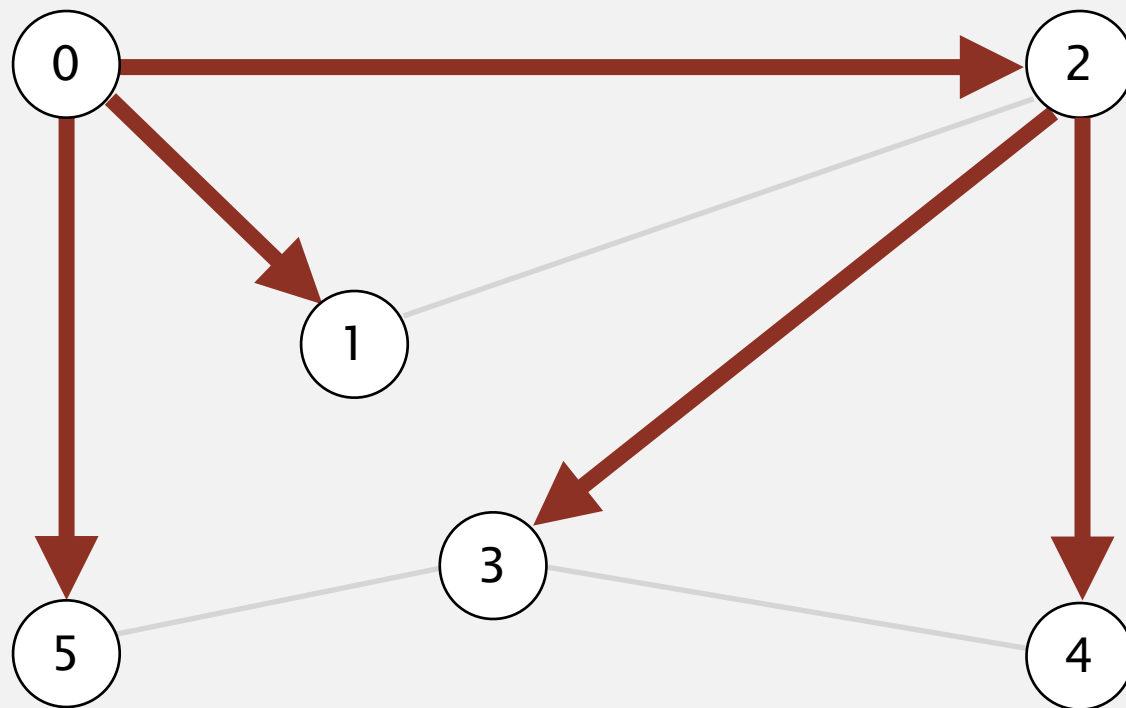- Add to queue all unmarked vertices adjacent to v and mark them.

v	edgeTo[]	distTo[]
0	–	0
1	0	1
2	0	1
3	2	2
4	2	2
5	0	1

done