MYONGJI UNIVERSITY

Graph

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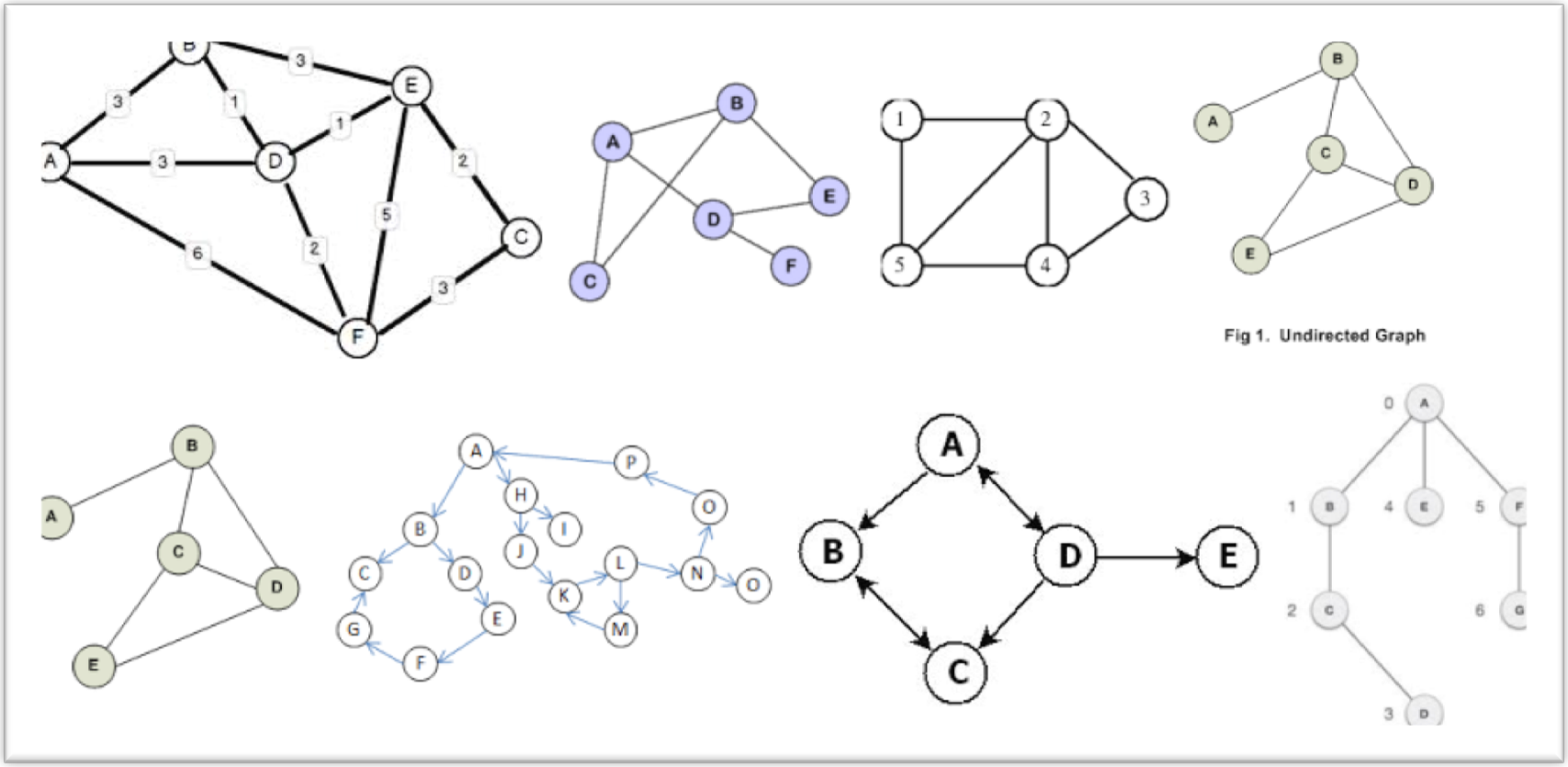
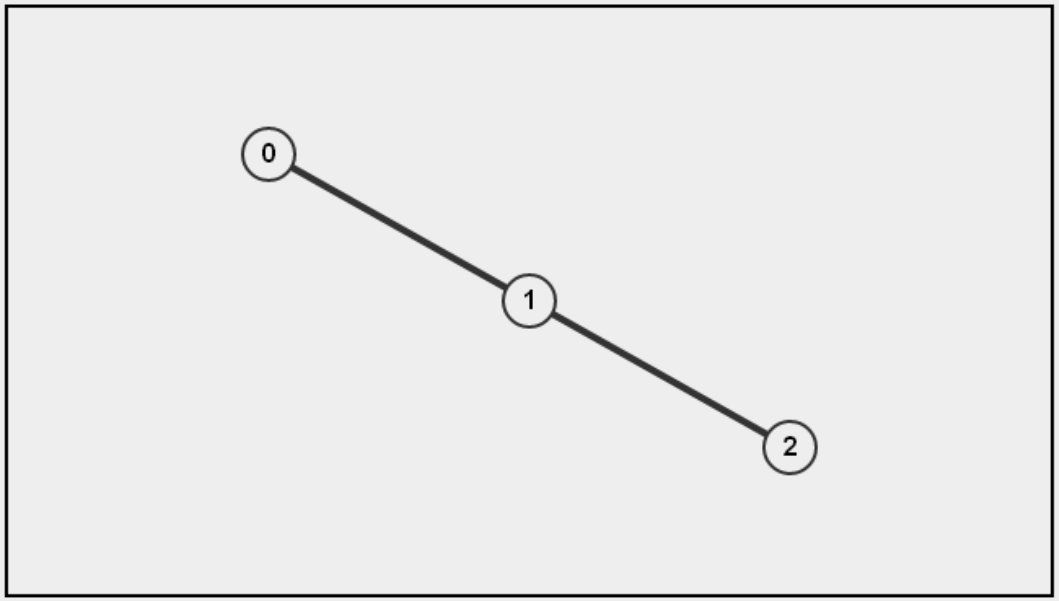
Graph

- G={V,E} V: set of vertex, E: set of edges
- Directed/undirected



Graph representation 1: Array



• Tree? **Yes** • Complete? **No** • Bipartite? **Yes** • DAG? **No**

Adjacency Matrix

	0	1	2
0	0	1	0
1	1	0	1
2	0	1	0

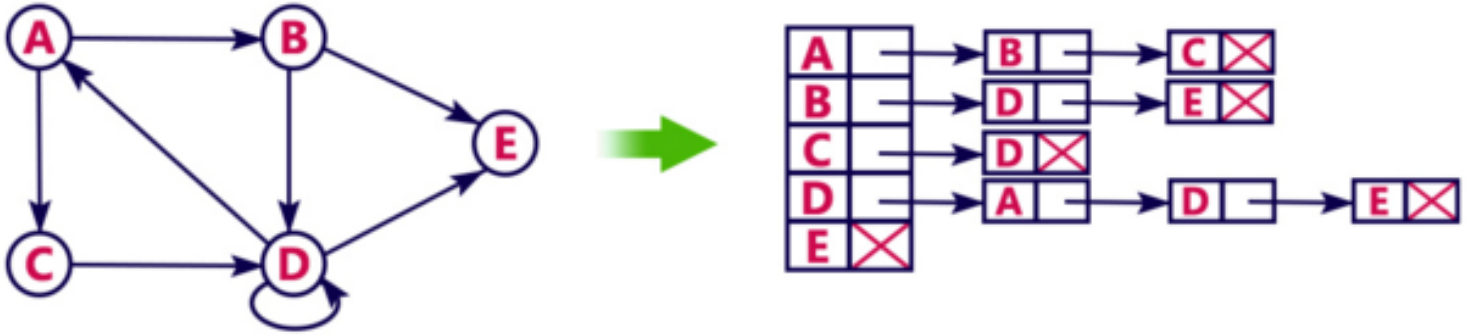
Adjacency List

0:	1	
1:	0	2
2:	1	

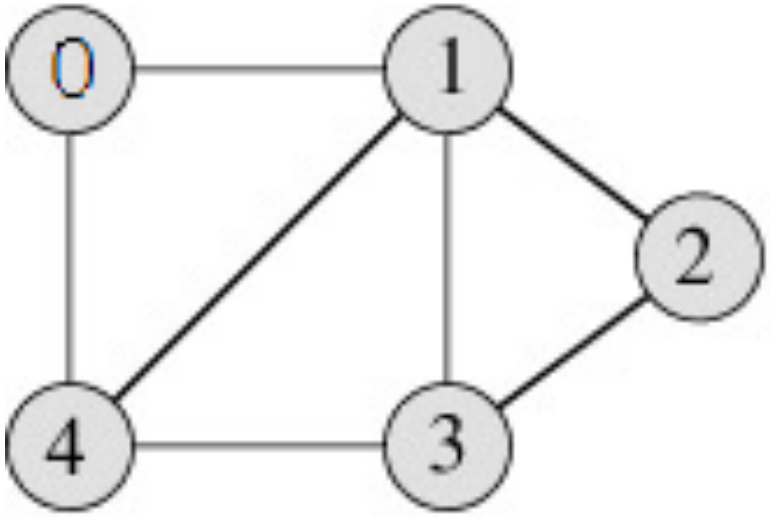
Edge List

0:	0	1
1:	1	2

Graph representation 2: Linked List



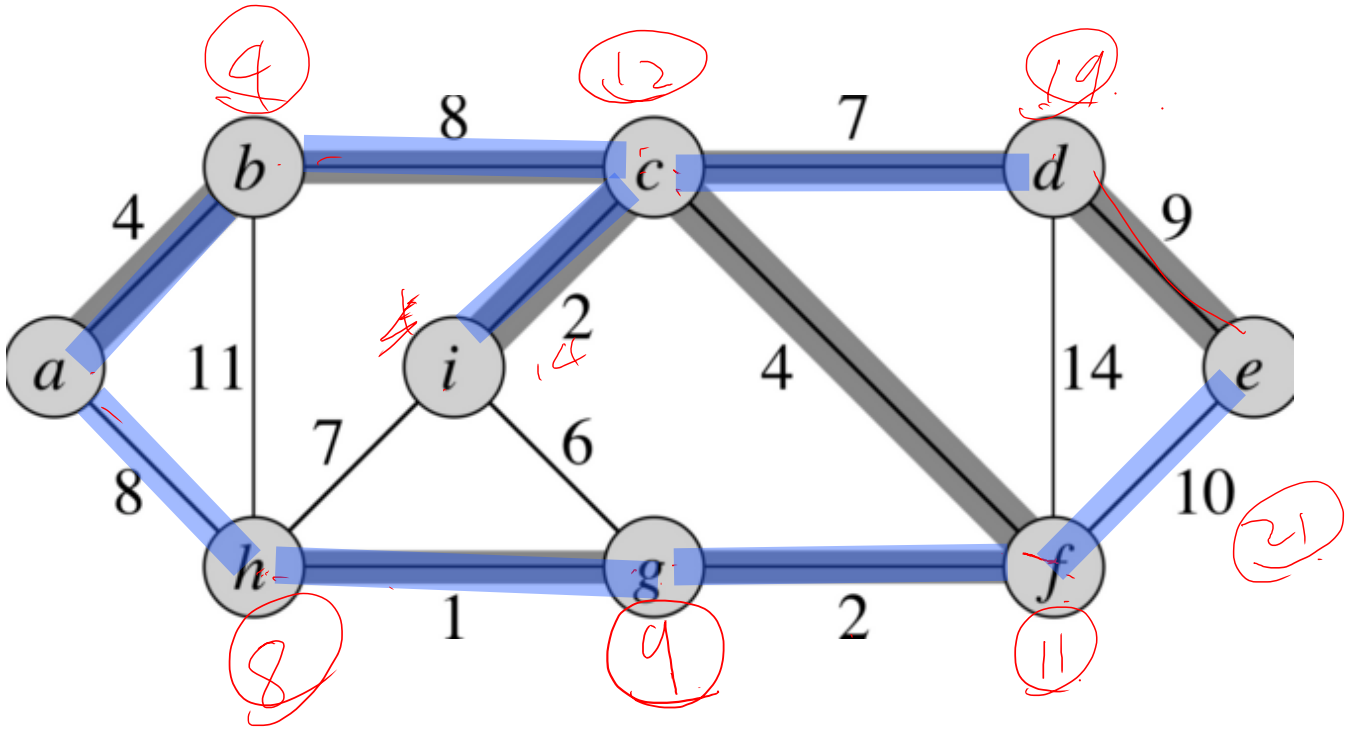
Quiz. 다음을 Array와 Linked List로 표현



Spanning Tree

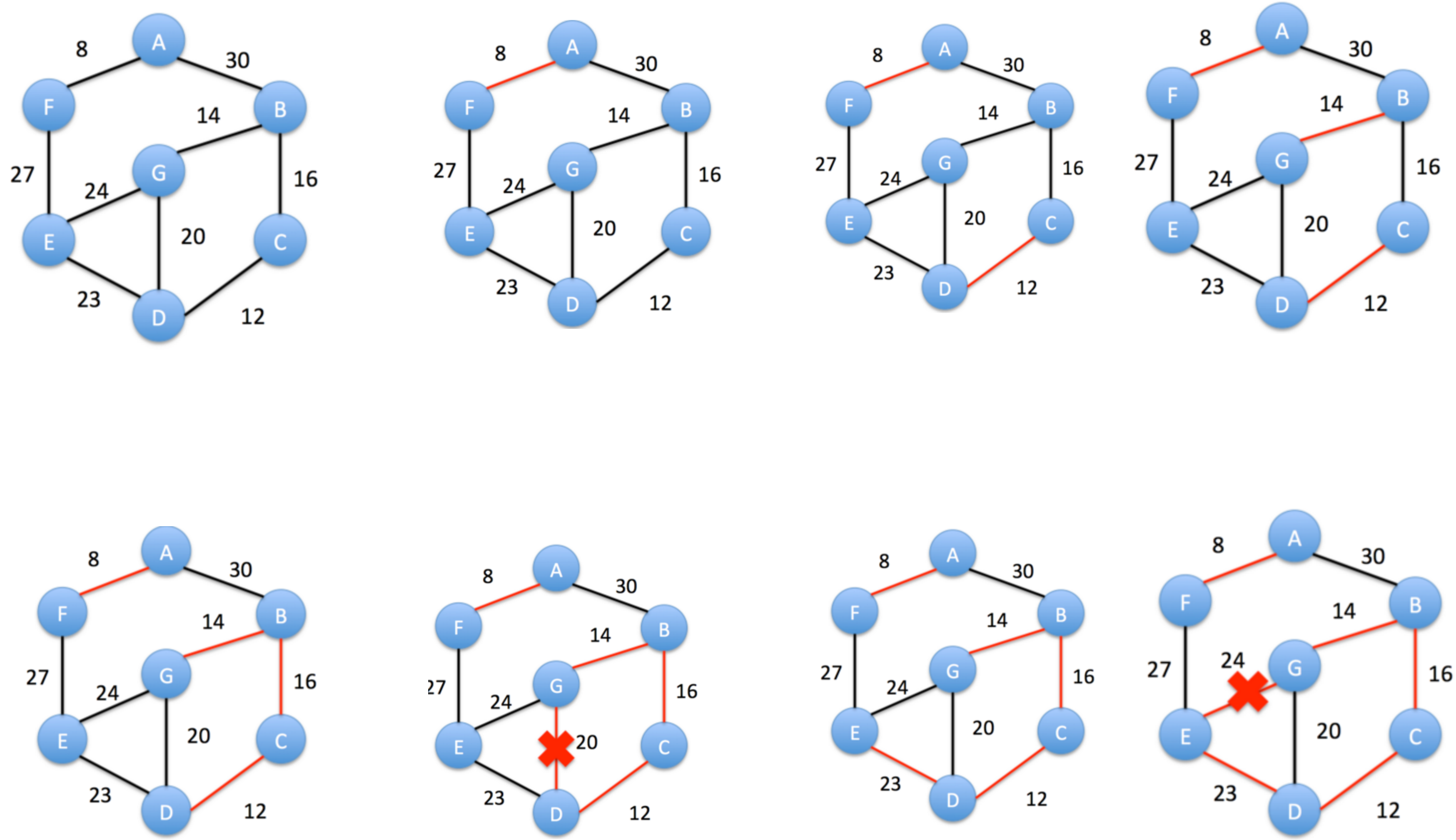
- G={V,E} undirected이고 각 edge (u,v)에 값이 있을때,

모든 노드들을 연결하며 최소 edge값들을 갖도록 연결한 트리



Kruskal's Algorithm

1. 모든 edge들을 작은 값부터 정렬;
2. 작은 값의 edge부터 하나씩 뽑아서, cycle을 만들지 않으면 포함;
3. 모든 vertext가 연결될 때까지 2를 반복;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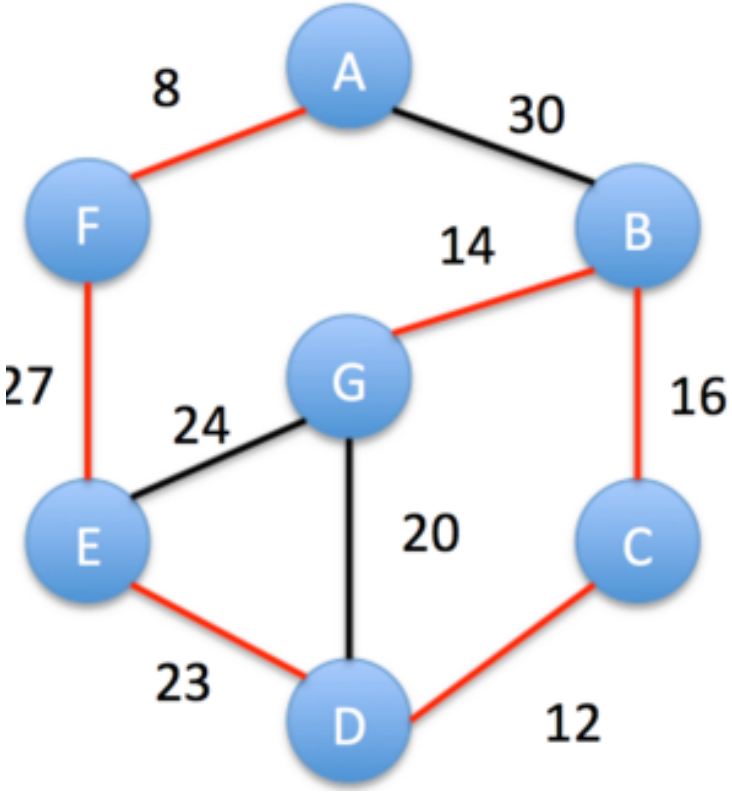
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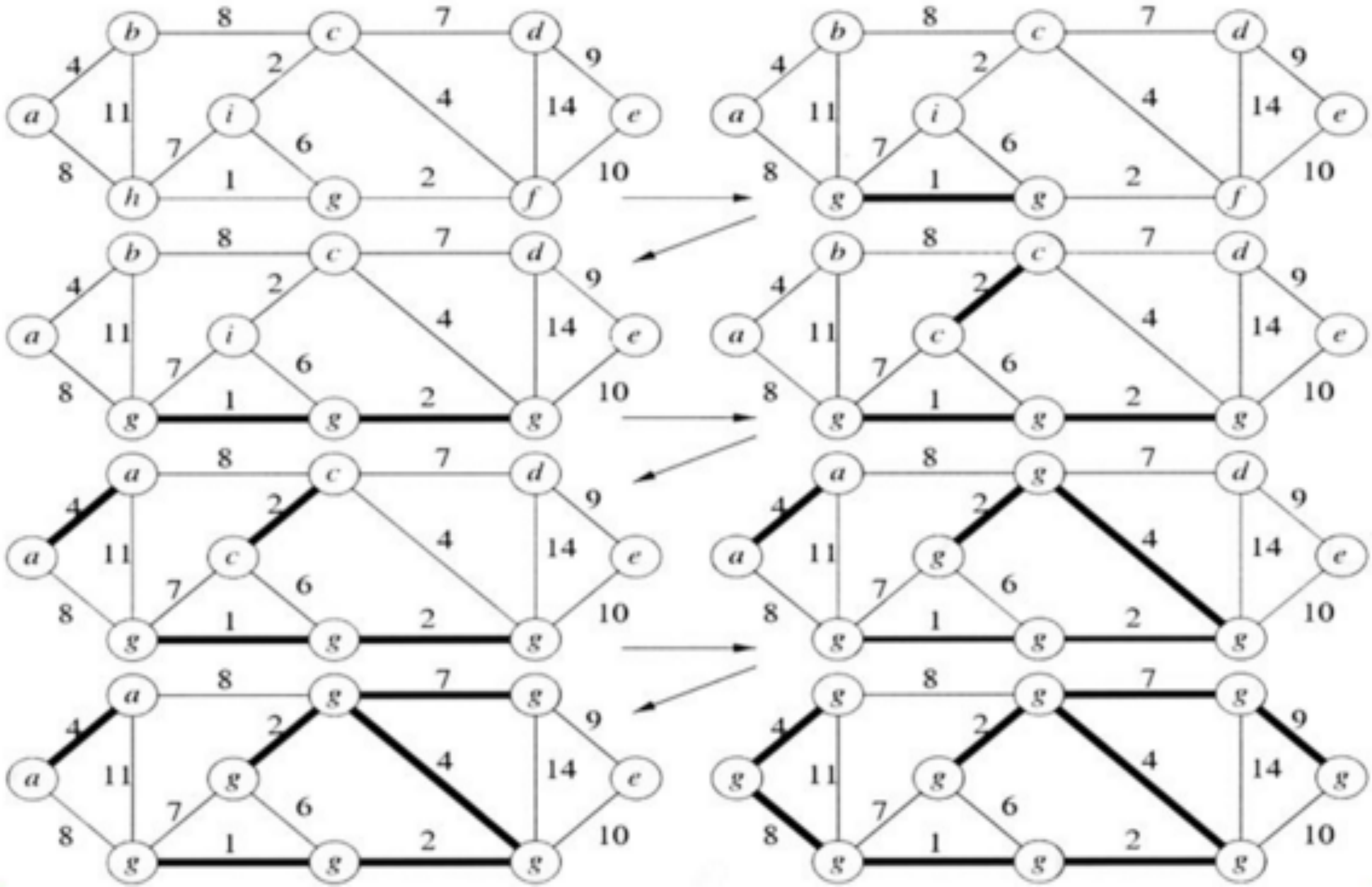
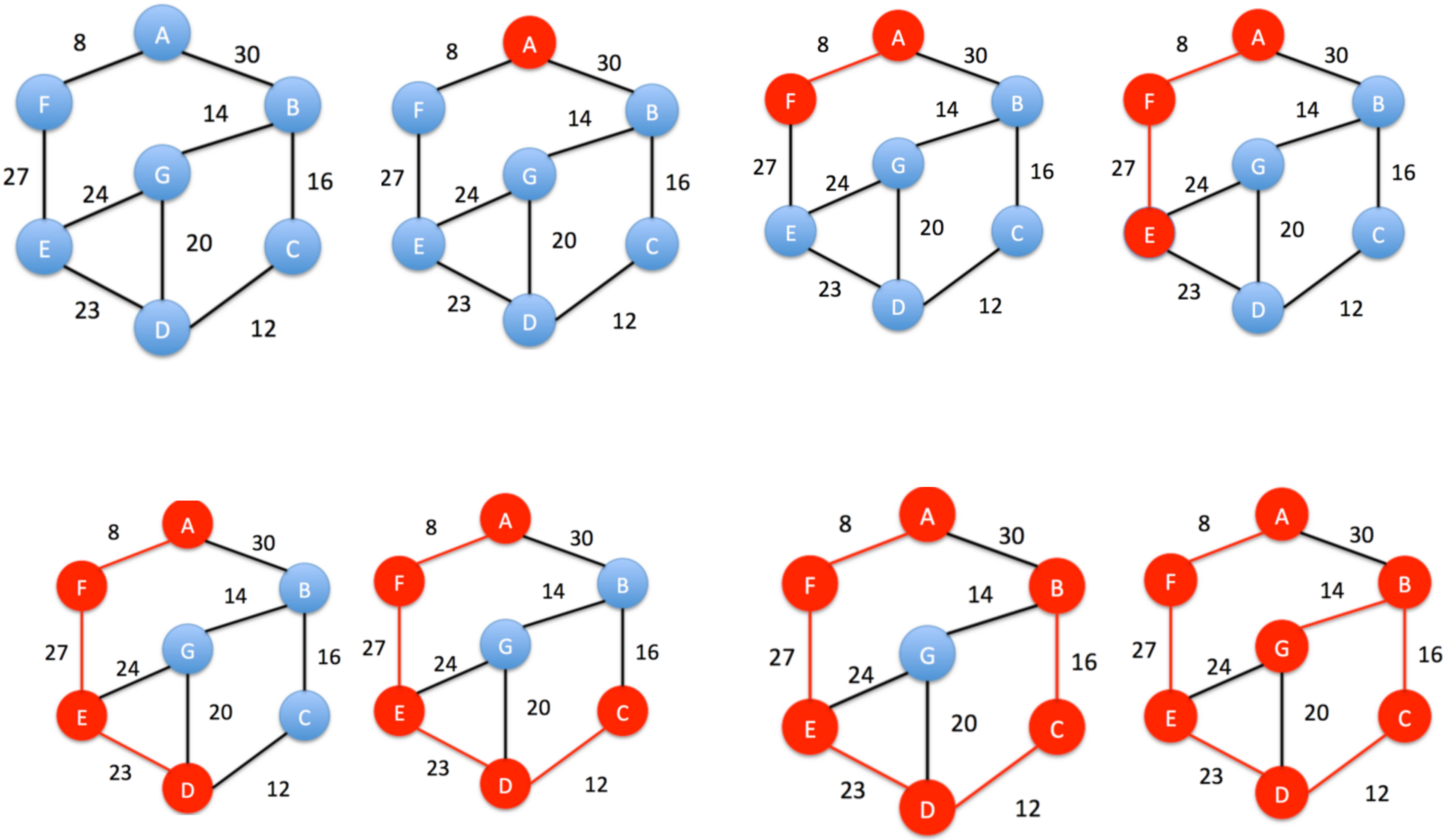


Prim's Algorithm

1. 임의의 vertex선택;
2. 선택된 vertex들 중 최소 값을 갖는 edge와 연결된 vertext를 선택;
3. 모든 vertext가 연결될 때까지 2를 반복;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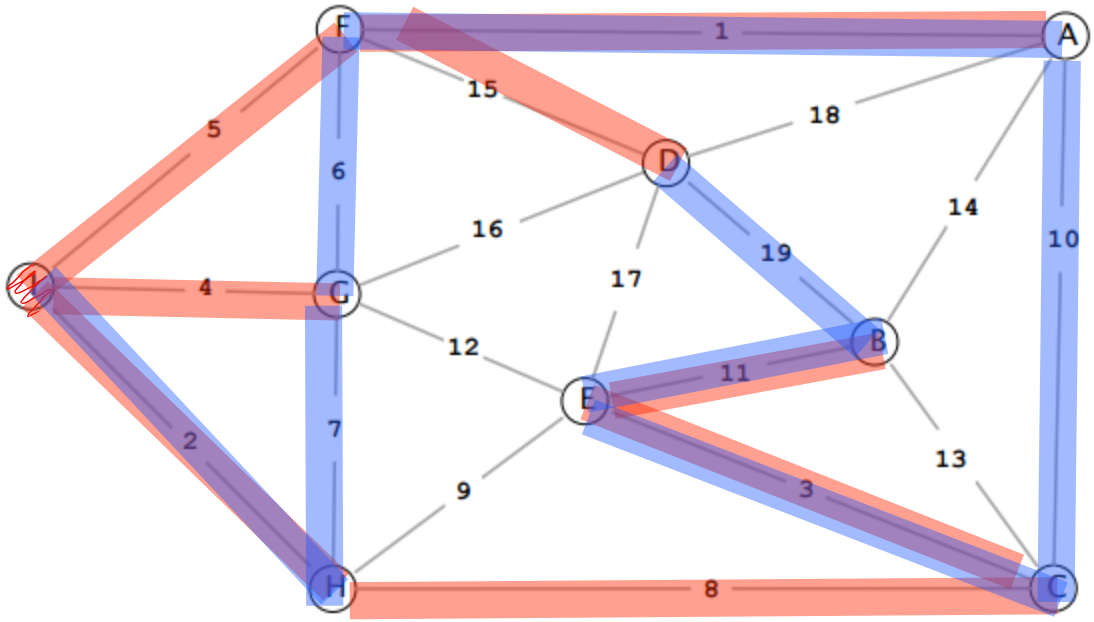
Quiz. www.cs.princeton.edu/courses/archive

3. **Minimum spanning trees. (8 points)**

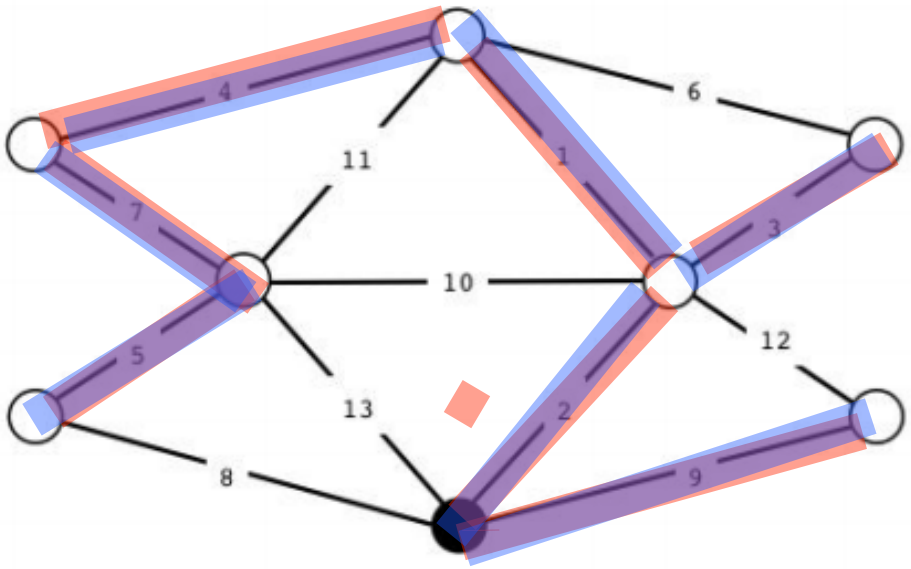
Consider the following edge-weighted graph with 9 vertices and 19 edges. Note that the edge weights are distinct integers between 1 and 19.



(a) Kruskal's algorithm

(b) Prim's algorithm

1. **MST** (10 points). Consider the following graph (numbers are edge weights):



Kruskal?

Prim

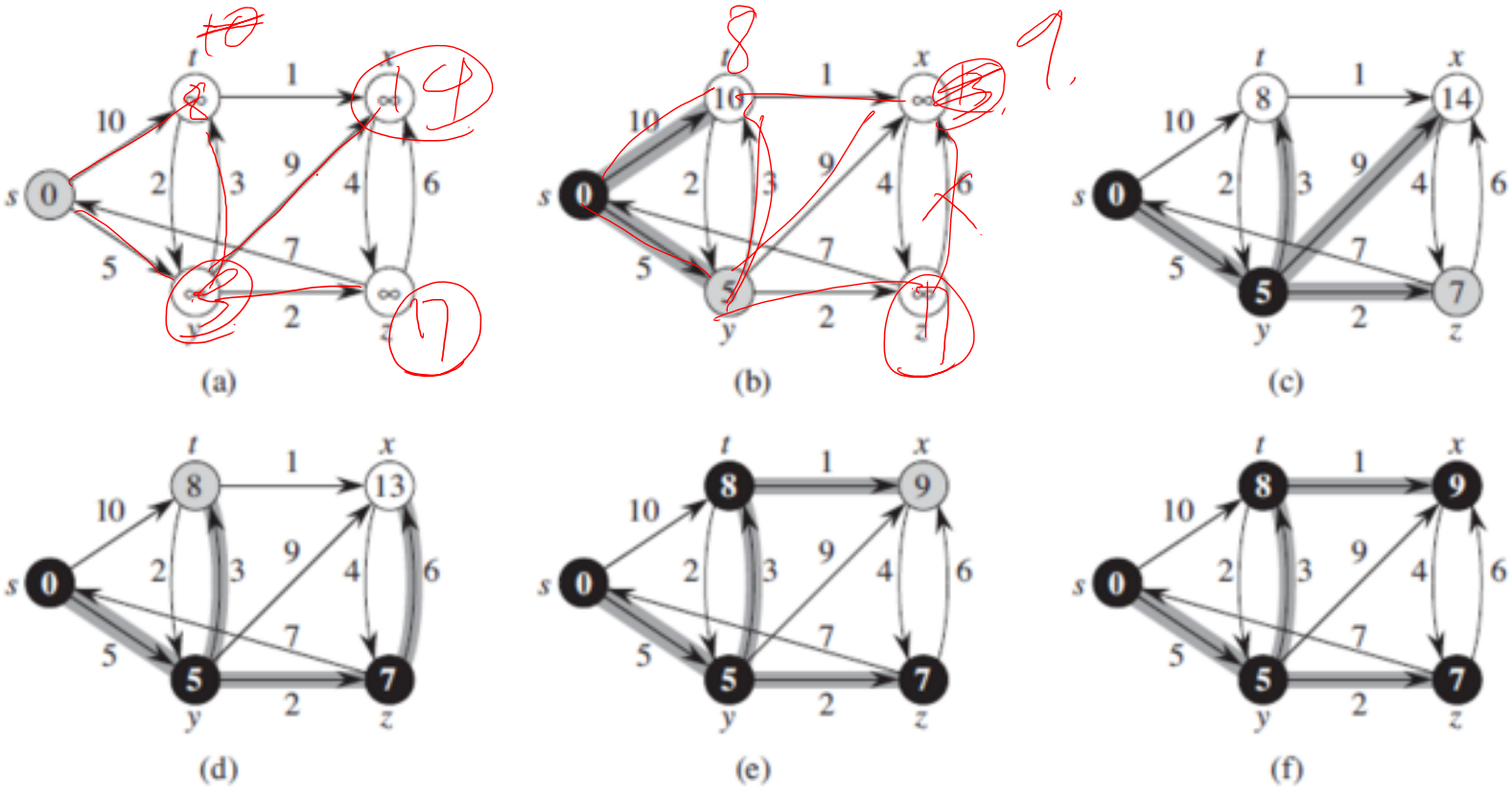
A. Give the list of edge weights in the MST in the order that *Kruskal's algorithm* inserts them.

B. Give the list of edge weights in the MST in the order that *Prim's algorithm* inserts them, assuming that it starts at the black vertex.

Single Source Shortest Path

- Dijkstra's Algorithm
- Weighted, directed, positive graph

```
1  Initialization:
2   N' = {u}
3   for all nodes v
4    if v adjacent to u
5        then D(v) = c(u,v)
6    else D(v) = ∞
7
8  Loop
9   find w not in N' such that D(w) is a minimum
10  add w to N'
11  update D(v) for all v adjacent to w and not in N' :
12     D(v) = min( D(v), D(w) + c(w,v) )
13  /* new cost to v is either old cost to v or known
14   shortest path cost to w plus cost from w to v */
15 until all nodes in N'
```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P.S. 34 Oliver H Perry
Norman Dental Center in Greenpoint
Nassau Av [G]
Nassau Ave
Palace Cafe
Msgr. McGolrick Park
Met Food
Variety Cafe
No Name Bar
Caribo Baby
Three Kings Tattoo
Warsaw
Bar Matchless
Broome St
Driggs Ave
Manhattan Ave
Leonard St
Eckford St
McGuinness Blvd
Newell St
Diamond St
Humboldt St
Russell St
Monitor St
Kingsland Ave
Lorimer St
N Henry
Leaves

그 외 shortest path algorithms

- Bellman-Ford Algorithm
- Edge 값이 negative도 가능

- Floyd-Warshall Algorithm
- All pairs shortest paths, no negative