Q1

5 Points

Mark Zuckerberg, the CEO of Facebook, has hired you to lead the Facebook Algorithms Group. He has asked you to use various graph algorithms to analyze the world's largest social network.

The Facebook Graph has 2.8 billion vertices, with each vertex being a Facebook user. Two vertices are connected provided those two users are "friends".

The first decision you need to make is how you want to model the Facebook graph.

Determine whether you should use an adjacency-list representation or an adjacency-matrix representation.

For this question, I think the adjacency-list is my preferred choice. As the connection for those too many vertices(2.8 billion) or we call the facebook users will be very sparse. And the space will be a proportional to O(m+n) of adjacency-list compared to O(n^2) of adjacency-matrix. So, if we iterate through all the neighbors and to check our friends for a specific user.

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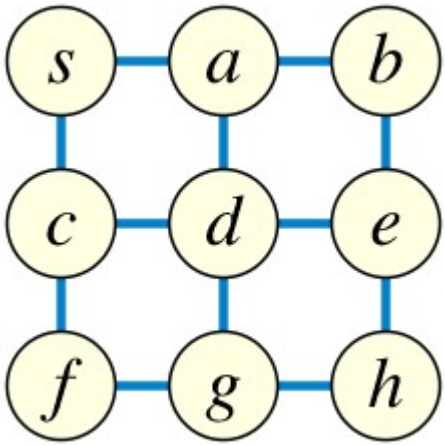
Q2

10 Points

Consider the following graph with 9 vertices and 12 edges.



Starting with vertex s, we can use a search algorithm to pass through all nine vertices in this graph. Whenever we have more than one option, we always pick the vertex that appears earlier in the alphabet.

For example, from vertex s, we go to a instead of c, since the letter a appears before the letter c in the alphabet.

Q2.1
5 Points

Determine the order in which the nine vertices are reached using Depth-First Search (DFS)

s-a-b-e-d-c-f-g-h

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Q2.2
5 Points

Determine the order in which the nine vertices are reached using Breadth-First Search (BFS)

s-a-c-b-d-f-e-g-h

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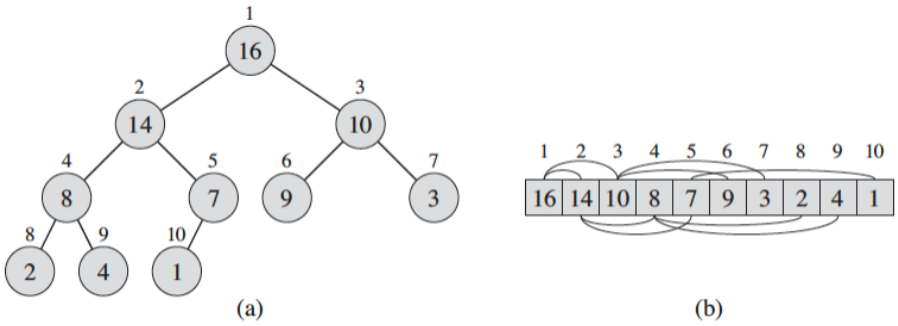
Q3

5 Points

A binary heap is called a `max heap` if it has the property that for every node i other than the root, the value of the node is at most the value of its parent.

Here is an example of a max heap with 10 nodes (i.e., 10 elements), presented both as a binary tree and as an array.



Q3.1

5 Points

The $height$ of a heap is defined to the number of edges on the longest downward path from the root node to a leaf node. Thus, in the example above, the height of the heap is $h = 3$.

If a (binary) heap has height $h = 6$, determine the minimum number and maximum number of elements that can be in this heap. Clearly justify your answer.

Since we have given height of the heap is 6.
the minimum numbers of elements possible in a heap of height is 2^h
so h = 6
Then, the minimum number of elements is 2^6=64
maximum numbers of elements possible in a heap of height is 2^(h+1) - 1
so for the height = 6,
Then , the maximum number of elements is 2^(7) - 1 = 127

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Quiz 2 -Graphs

GRADED

STUDENT
Kejian Tong

TOTAL POINTS
20 / 20 pts

QUESTION 1
(no title) **5** / 5 pts

QUESTION 2
(no title) **10** / 10 pts

2.1 (no title) **5** / 5 pts

2.2 (no title) **5** / 5 pts

QUESTION 3
(no title) **5** / 5 pts

3.1 (no title) **5** / 5 pts