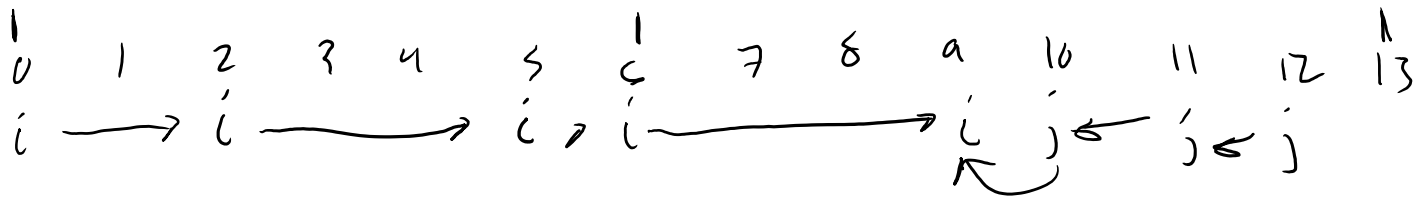
2018-12-06 Final Written Exam Review

Thursday, December 6, 2018 3:03 PM

1. [3] Show the result of quicksort after one iteration of the quicksort algorithm (until I >= J and pivot is swapped back).

3	9	12	1	2	15	11	8	10	17	4	6	5	13
3	9	5	1	2	6	4	8	10	11	13	15	12	17



2. [3] Perform radix sort on the following numbers:

101, 98, 27, 15, 333, 234, 531, 503, 122, 432, 199, 200, 155, 188, 79, 631

0	200	200, 101, 503	15, 27, 79, 98
1	101, 531, 631	15	101, 122, 155, 188, 199
2	122, 432	122, 27	200, 234,
3	333, 503	531, 631, 432, 333, 234	333,
4	234		432
5	15, 155	155	503, 531
6			631
7	27	79	
8	98, 188	188	
9	199, 79	98, 199	

3. [3] Order the following sorting algorithms from worst to best case algorithmic complexity:

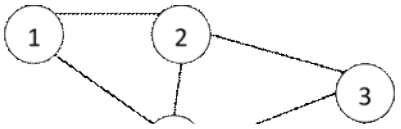
Merge Sort, Bubble Sort, Radix Sort, Quick Sort, Shell Sort, Insertion Sort, Heap Sort, Selection Sort, Tree Sort, Shaker Sort

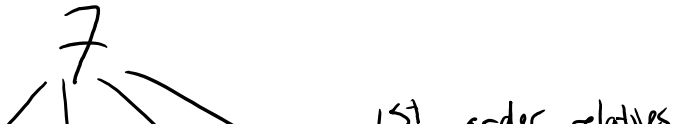
N^2 -> Insertion, Bubble, Selection, Shaker Sort

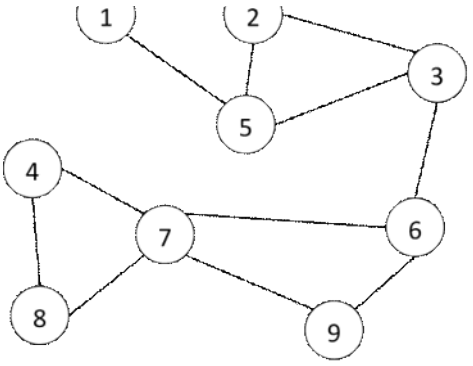
NLogN -> Merge, Quick, Tree, Heap, Shell

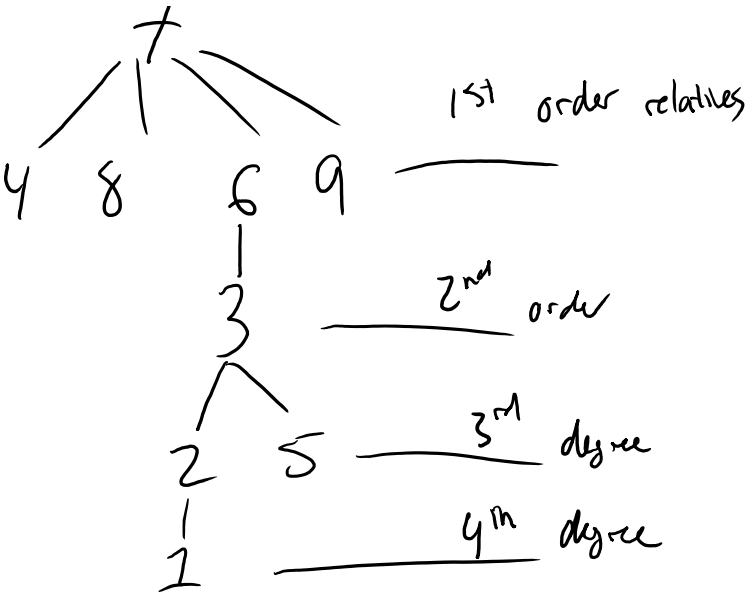
N*M -> Radix

4. [3] Draw the BFS search tree for the following graph starting at vertex 7.

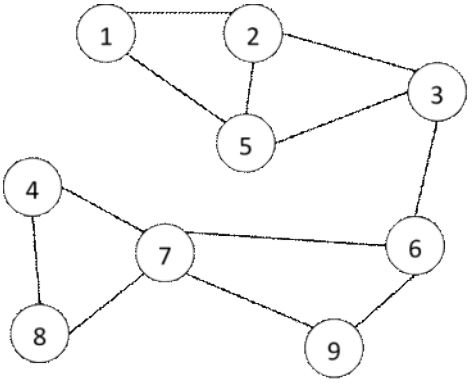


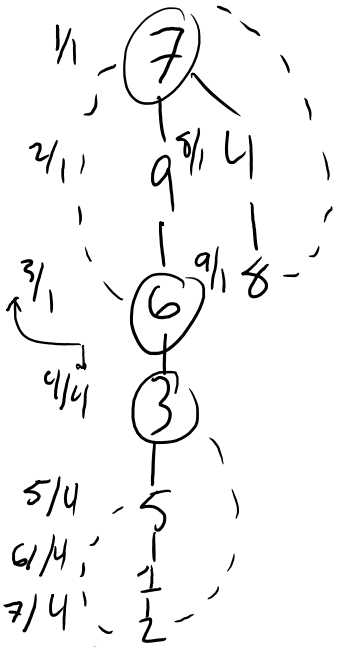






5. [3] Articulation Points. Draw the DFS articulation tree for the following graph starting at vertex 7. Circle any articulation points in your tree.





6. [1] What data structure allow us to perform a DFS on a graph?

7. [1] What data structure allows us to perform a BFS on a graph?

10. [1] Which of the following is a **<u>false</u>** statement about hash tables:

A) Hash tables provide O(1) lookup

B) Hash table entries are ordered based on when they are placed into the data structure (i.e. FIFO, similar to a vector)

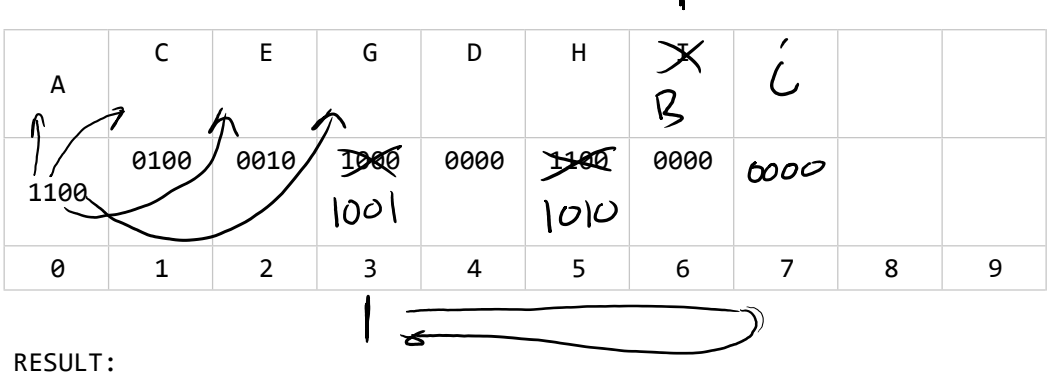
C) Hash tables allow for random access (i.e. similar to a vector)

D) Under normal circumstances, hash tables take up more memory than a vector.

11. [3] List the three key factors that affect the runtime performance of a hash table:

- Hashing Algorithm
- Collision Resolution Mechanism
- Load factor (% fullness)

14. [3] The item "B" hashes to array index 3. Insert B into the following **hopscotch** hashtable whose max distance is 4.



RESULT:

0	1	2	3	4	5	6	7	8	9

[4] Given a hashing function hash(x) = ((x * x) + x) % 11, Insert the value 4 into each hash table using the rules specified below. Note that some of the boxes in each hash table are already full.

Linear Probing having probe(i) = (i + 1) % 11

where i = index location

10	11	1	9			2			6	4
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Quadratic Probing having probe(i) = ((i^2 + i) + 1) % 11

where i = index location

10	11	1	4			2	9		6	

0	1	2	3	4	5	6	7	8	9	10

Cuckoo Hashing

A		C		D		F	
0	1	2	3	4	5	6	7
B		E					

A: 0, 1
B: 0, 0
C: 2, 5
D: 4, 2
E: 0, 2
F: 6, 4
G: 5, 2
H: 4, 4

~~A~~ E		C		~~D~~ H	G	F	
0	1	2	3	4	5	6	7
B	A	~~E~~ D					