**CS 3050 Quiz # 1, March 5, 2019**

**Time Limit: 75 Minutes**

**Name : Student ID:**

Note: (1) you can use a letter-sized sheet paper with notes; (2) closed-book quiz, no discussion, no use of cell phone; (3) use additional pages or reverse side of quiz pages if needed.

# Multiple Choices (5 points each, 20 points in total. Circle the correct selection, there is only one correct answer for each problem)

1. Which of the following is FALSE about a doubly linked list?



A - We can navigate in both the directions

B - It requires more space than a singly linked list

C -The insertion and deletion of a node take longer time than singly linked list

D - None of the mentioned

2. In a min heap



A - minimum values are stored.

B - child nodes have less value than parent nodes.

C - parent nodes have less value than child nodes.

D - maximum value is contained by the root node.

3. If several elements are competing for the same bucket in the hash table, what is it called?



A - Diffusion

B - Replication

C - Collision

D - None of the mentioned

4. What is the search complexity in direct addressing?



A - O(n)

B - O(logn)

C - O(nlogn)

D - O(1)

# Short Answers (10 points each, 20 points in total)

1. Given the following C program, which is a brute-force solution to the 4-sum problem. Suppose this program execution time is 1000 seconds, when N = 1000.

int brute(int a[], int N)

{

int i, j, k, m;

for (i = 0; i < N; i++)

for (j = i+1; j < N; j++)

for (k = j+1; k < N; k++)

for (m = k+1; m < N; m++)

if (a[i] + a[j] + a[k] + a[m] == 0) return 1;

return 0;

}



* 1. What is the running time (in seconds) when N = 10,000:



* 1. Please give a general mathematics formulas *T*=*f*(*N*) to estimate the running time (in seconds) for any size N:



2. Demonstrate what happens when we insert the keys 3, 11, 80, 74, 92, 32, 99, 293, 22, 104 into a hash table with collisions resolved by chaining. Let the table have 11 slots, and let the hash function be h(k) = k mod 11. You just need to show the final hash table.



C. Illustrate the max-heap operation of BuildHeap() on the array A = {6, 15, 8, 25, 7, 17, 23, 8, 4}. For each step, label its order in the sequence and its result. (20 points)



D. Develop an efficient algorithm in pseudo code to check if a Singly Linked List is Palindrome. Palindrome is a word, phrase, or sequence that reads the same backward as forward, e.g., madam, refer, racecar… or the following list:

List 1–>2–>1 is a palindrome.

List 1–>2–>3 is not a palindrome.

(20 points)



E. Suppose you want to build a hash table of items whose keys are strings of letters. Let the slots be numbered 0 through 6, and let the hash function consist of taking the sum of the letters mod 7 (where a=1, b=2, c=3, etc.). For example, "dog" hashes to (4 + 15 + 7) mod 7, that is, 5. Suppose your table contains the items "dog", "bug", "ant", "bee", and "gnu". (20 points)

(a) If you use linear probing to resolve collisions, what does the table look like? How many key comparisons will the longest possible failed search require?



(b) If you use chaining to resolve collisions, what does the table look like? How many key comparisons will the longest possible failed search require?

