CSCI2100: Quiz 2

Name: __________________________  Student ID: __________________________

There are 7 problems. Problems 1-5 bear 10 marks each, Problem 6 bears 20 marks, and Problem 7 bears 30 marks. A multiple-choice question has only one correct answer unless otherwise stated.

Problem 1. After applying the following operations to an empty stack:
push(35), push(36), push(43), pop, pop, push(8), push(51), pop
What is the content of the stack? Answer: [  ]
A. 8, 51
B. 36, 43
C. 35, 8
D. 35, 51

Problem 2. After applying the following operations to an empty queue:
enqueue(35), enqueue(36), enqueue(43), dequeue, dequeue, enqueue(8), enqueue(51), dequeue
What is the content of the queue? Answer: [  ]
A. 8, 51
B. 36, 43
C. 35, 8
D. 35, 51

Problem 3. Which of the following operations does not have $O(1)$ cost? Answer: [  ]
A. Pushing an element into a stack.
B. Inserting an element into a linked list.
C. Dequeueing an element from a queue.
D. Deleting an element 10 from a linked list without knowing which node contains 10.

Problem 4. Which of the following are true? There is more than one correct choice; no marks are given unless you identify all the correct ones. Answer: [  ]
A. Consider a stack implementation that supports push and pop each in $O(1)$ amortized time. Thus, any sequence of $t$ pushes followed by $t/2$ pops can be processed in $O(t)$ worst case time, regardless of the value of $t$.
B. Our dynamic-array implementation of the stack sometimes needs $O(n)$ time to process a push, when there are $n$ elements in the stack.
C. By choosing a hash function uniformly at random from a universal hash family, we guarantee $O(1)$ amortized lookup cost in dictionary search.

Problem 5. Consider $S = \{1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 15\}$. We build a hash table on $S$ with hash function $h(k) = 1 + k \mod 4$. If we look up an element $q$ in the hash table, which of the following value of $q$ would have the lowest look up cost? Answer: [  ]
A. 21  B. 22  C. 23  D. 24

- Please turn overleaf -
**Problem 6.** Consider the hash table in Problem 5. Show the content of the linked list for each possible hash key.

**Problem 7.** Let $S_1$ and $S_2$ be two sets of integers, such that $|S_1| = |S_2| = n$. Give an algorithm to report all the integers in $S_1 \cap S_2$ in $O(n)$ expected time.