CSC212-Mid 1 – Spring2017

CSC 212 Midterm 1 - Spring 2017

College of Computer and Information Sciences, King Saud University
Exam Duration: 90 Minutes

16/03/2017

Question 1 [30 points]

1. Choose the most appropriate answer:

(1) To show that $2n^3 \log n + 2n^3$ is $O(n^3 \log n)$, we can take $c = 4$ and n_0:

(a) -1 (b) -2 (c) 1 (d) O (e) 2

(2) Which of the following is **not** $O(n^2)$

(a) $n^2 \log n$ (b) $2n^2 + 3$ (c) $n(n+2)/2$ (d) n^2 (e) n

(3) Given an n-element array A of integers, an algorithm searches for the integer '9' and returns true if found. What is the **best**-case running of this algorithm.

(a) $O(\log n)$ (b) $O(n \log n)$ (c) $O(1)$ (d) $O(n^2)$ (e) $O(n)$

(4) We want to implement the method `retrieveAtIndex(int i)` which returns the i^{th} element of a list. Which representation would have the method running in $O(1)$?

(a) *LinkedList* (b) *ArrayList* (c) *DoubleLinkedList* (d) *a, b, and c* (e) *None*

(5) In the **worst** case, the method *remove* of the class *DoubleLinkedList* is :

(a) $O(1)$ (b) $O(n)$ (c) $O(\log n)$ (d) $O(n \log n)$ (e) $O(n^2)$

2. Consider the following code:

```
1 System.out.println("glhf");
2 for (int i = 0; i < n * log(n); i++)
3         for (int j = 2; j <= n; j++)
4                 System.out.println("op");
5 System.out.println("gg");
```

Choose the correct answer (**select an answer for each line**):

Line	Frequency				
1	(a) n	(b) -1	(c) 0	(d) 1	(e) $\log n$
2	(a) n	(b) n^2	(c) $n \log n + 1$	(d) $n \log n$	(e) $\log n$
3	(a) n^2	(b) $n^2 \log n$	(c) $n^2 + 1$	(d) $n(n \log n + 1)$	(e) $n(n+1)/2$
4	(a) $n - 1$	(b) n^3	(c) n^2	(d) $n(n \log n)$	(e) $(n-1)n \log n$
5	(a) 0	(b) n	(c) $n \log n$	(d) n^2	(e) 1
Total O	(a) $O(n^2 \log n)$	(b) $O(n^2)$	(c) $O(n \log n)$	(d) $O(1)$	(e) $O(n)$

Question 2 [35 points]

1. Write the method `public static <T> int lastIndex(List<T> l, T e)`, user of the ADT List, which returns the index of the last occurrence of e in l, or -1 if e does not exist. The first element has index 0.

   Example 2.1. *If $l : A, B, C, A, B, D$, then $lastIndex(l, "A")$ returns 3, $lastIndex(l, "C")$ returns 2 and $lastIndex(l, "F")$ returns -1.*

2. Write the method
   `public static <T> reverseCopy(DoubleLinkedList<T> l1, DoubleLinkedList<T> l2)`, user of *DoubleLinkedList*, which copies the elements of $l1$ to $l2$ in reverse order. The list $l1$ must not change. Assume that $l2$ is empty.

   Example 2.2. *If $l1 : A, B, C, D$, then calling* reverseCopy(l1, l2) *results in $l2 : D, C, B, A$.*

Question 3 [35 points]

1. Implement the method `public void cut(int k)`, member of the class *DoubleLinkedList*, which removes the last k elements of the list. The method moves *current* to the first element if the resulting list is not empty. Assume that $0 < k \leq$ the length of the list. Do not call any method of the class *DoubleLinkedList* and do not use any extra data structures. The method *cut* must be $O(n)$.

   Example 3.1. *If $l : A \leftrightarrow B \leftrightarrow C \leftrightarrow D \leftrightarrow E \leftrightarrow F$, then calling* l.cut(3) *results in $l : A \leftrightarrow B \leftrightarrow C$. After calling* l.cut(6), *l becomes empty.*

2. Implement the method `public void remove(T e)`, member of the class *LinkedList*, which removes all occurences of e. The method moves *current* to the first element if the resulting list is not empty. Do not call any method of the class *LinkedList* and do not use any extra data structures. The method *remove* must be $O(n)$.

   Example 3.2. *If $l : A \rightarrow B \rightarrow C \rightarrow B \rightarrow E \rightarrow B$, then calling* l.remove("B") *results in $l : A \rightarrow C \rightarrow E$.*