Data Structures Quiz 4

Please go through the instructions before attempting the quiz:

1. Once you start attempting, you should complete the quiz in thirty minutes.
2. You should attempt the quiz on your own without the help of anyone else or referring to any material.
3. If it is learnt that you violated either of the above, you will be awarded an FR for the course.
4. You must submit your answers by 17:00 on 4 December 2020. Any submissions beyond this time will be disregarded.
5. There is no negative marking.

The respondent's email address (**subruk@cse.iith.ac.in**) was recorded on submission of this form.

Suppose all the natural numbers from 1 to 1000 are inserted into a skip list in some arbitrary order. Suppose the bottom list is L1 that contains all the elements. The lists above that are L2, L3 etc. Let both the numbers 31 and 200 be present in the list L4. What is the expected number of numbers present between 31 and 200 in L4? (provide the answer in the numerical form)

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Suppose there is a sequence of n operations. For operation i, the actual cost is 1 if i is not a power of 2. The actual cost is i if it is a power of 2. Which of the following best describes the amortized cost of the operations?

- (●) O(1)
- ( ) O(log n)
- ( ) O(log^2 n)
- ( ) O(n)

Suppose all the n elements of a skip list are promoted to exactly k levels. What is the search time of such a skip list?

- ○ O(log k)
- ○ O(log n)
- ○ O(k)
- ○ O(k log n)
- ◉ O(n)

We want to determine if a certain element x is present in a skip list. Which of the following is the most accurate statement?

- ○ We need to search till the lowest level (regardless of whether x is present)
- ○ If x is present in the skip list, we need to search till the lowest level. If x is not present, then the search need not extend till the lowest level.
- ◉ If x is not present in the skip list, we need to search till the lowest level. If x is present, then the search need not extend till the lowest level.
- ○ We do not need to search till the lowest level (regardless of whether x is present).

A binomial heap with 20 elements contains which of the following binomial trees?

- ☐ B1
- ☑ B2
- ☐ B3
- ☑ B4

A binomial heap H contains the binomial trees B3 and B4. After calling ExtractMin on H, which of the following will be the set of binomial trees in the resulting heap?

- [x] B0
- [x] B1
- [x] B2
- [x] B4

Assume the depth of the root node of a binomial tree to be 0. The number of nodes at depth k of a binomial tree :

- (●) n choose k
- ( ) n choose (k-1)
- ( ) 2^k
- ( ) (1/k) * (2^n)

The worst case, and amortized running time for ExtractMin on a binomial heap with n nodes is:

- ( ) O(n) and O(log n) respectively
- (●) O(log n) and O(log n) respectively.
- ( ) O(n) and O(n) respectively
- ( ) O(n log n) and O(n) respectively.

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