CMPSC 465 Fall 2025 — Data Structures & Algorithms — Ke Chen and Yana Safonova

Quiz 3

Lecture Section: **Monday, Sep 22, 2025**

Student Name: **PSU Email ID:**

1. (2 pts.) In a **min-heap**, what is the relationship between the value of a parent node and its children?

(a) The parent node is always greater than its children.
(b) The parent node is always greater than or equal to its children.
(c) The parent node is always smaller than or equal to its children.
(d) There is no specific relationship.

Answer

2. (2 pts.) Performing an IncreaseKey operation on the root of a max-heap can violate the heap property, which requires a HeapifyDown operation to restore.

(a) True
(b) False

Answer

3. (2 pts.) Consider a max-heap stored in an array $A[1..7] = [7,6,4,1,5,2,3]$. After performing the following two operations in sequence, what is the resulting heap?

- IncreaseKey(6, 17)
- Insert(12)

(a) $[7,6,4,1,5,17,3]$
(b) $[17,7,12,4,1,5,2,3]$
(c) $[17,12,7,6,5,4,3,1]$
(d) $[17,12,7,5,6,4,3,1]$

Answer

4. (2 pts.) What is the **minimum number of nodes** a **binary heap** can have, given that its height is h?

(a) 2^{h-1}
(b) $2^h - 1$
(c) 2^h
(d) $2^{h-1} + 1$

Answer

5. (2 pts.) A programmer implemented the HeapSort algorithm discussed in lecture, but accidentally used a **min-heap** instead of a max-heap. Which of the following is the most likely outcome?

(a) The algorithm will fail to sort the array.
(b) It will sort the array in ascending order, the same as with a max-heap.
(c) It will sort the array in descending order, the opposite as with a max-heap.
(d) It will produce a correct sort, but with higher time complexity.

Answer