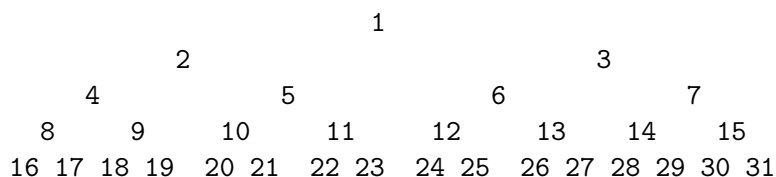


ADS 2021: Week 5 Exercises

Exercises for week 5 of Algorithms and Data Structures at ITU. The exercises are from *Algorithms, 4th Edition* by Robert Sedgwick and Kevin Wayne unless otherwise specified. Color-coding of difficulty level and alterations to the exercises (if any) are made by the teachers of the ADS course at ITU.

2.4.4 - Green Is an array that is sorted in decreasing order a max-oriented heap?

2.4.7 - Green Consider a max-oriented heap of size 31, where each position is numbered like:



Naturally, the largest item must be in position 1, and the second largest item can be in either position 2 or position 3. Make a list of positions where the third largest item can appear and a list of positions where it cannot. Then do the same for the fourth largest item.

2.4.9 - Green Draw all of the different max-oriented heaps that can be made from the five keys A B C D E, then draw all of the different max-oriented heaps that can be made from the five keys A A A B B.

2.4.15 - Yellow Design a linear-time certification algorithm to check whether an array $pq[]$ is a min-oriented heap.

2.4.21 - Yellow Explain how to use a priority queue to implement the stack and queue from week 2.

2.4.27 - Yellow Add a $min()$ method to $MaxPQ$ (shown on page 318). Your implementation should use constant time and constant extra space.

2.4.29 - Red Explain how you would design a data type that supports the following operations: *insert*, *delete the maximum*, and *delete the minimum* (all in logarithmic time); and *find the maximum* and *find the minimum* (both in constant time). Hint: Use two heaps.