This homework is due by 6:00pm on Friday, April 16 in North 01 (you can slide it under the door if necessary). Problem numbers for this assignment refer to [CLRS] (our course textbook).

**Problem 1.** Problem 16-1 (p. 402).

**Problem 2.** Problem 30.2-3 (p. 838) and problem 30.1-1 (p. 829).

**Problem 3.** Problem 31.5-1 (p. 876).

**Problem 4.** *(Extra Credit)* A professor has developed a hardware priority queue for his computer. The priority queue can store up to \( p \) records, each consisting of a key and a small amount of data (such as a pointer). The computer to which it is attached can perform \textsc{Insert} and \textsc{ExtractMin} operations on the priority queue, each of which takes \( O(1) \) time, no matter how many records are stored in the device. The professor wishes to use the hardware priority queue to help implement a sorting algorithm on his computer. He has \( n \) records stored in primary memory of his machine. If \( n \leq p \), the professor can certainly sort the keys in \( O(n) \) time by first inserting them into the priority queue, and then repeatedly extracting minimum. Design an efficient algorithm for sorting \( n > p \) items using the hardware priority queue. Analyze your algorithm in terms of both \( n \) and \( p \).