Additional Problems for Assignment 7

1. New York has many tall buildings, but only some of them have a clear view of Hudson River. Suppose we are given an array $A[1, \ldots, n]$ that stores the height of $n$ buildings on a city block, indexed from east to west. Building $i$ has a good view of Hudson River if and only if every building to the west of $i$ is shorter than $i$.

Here is an algorithm that computes which buildings have a good view of Hudson River. What is the running time of this algorithm?

\textbf{Algorithm 1} GoodView($A[1, \ldots, n]$)

1: Initialize a stack $S$;
2: \textbf{for} $i = 1, \ldots, n$ \textbf{do}
3: \hspace{1em} \textbf{while} $S$ is not empty and $A[i] > A[\text{top}(S)]$ \textbf{do}
4: \hspace{2em} Pop($S$);
5: \hspace{1em} \textbf{end while}
6: \hspace{1em} Push($S, i$);
7: \textbf{end for}
8: \textbf{return} $S$.

2. Describe how to implement a queue using two stacks and $O(1)$ additional memory, so that the amortized time for any enqueue or dequeue operation is $O(1)$. The only access you have to the stacks is through the standard subroutines \texttt{Push} and \texttt{Pop}.