You must hand in this homework. Please work alone on this assignment. As always, please show your work.

1. Problem 3.2 from [DPV]
2. Problem 3.3 from [DPV]
3. Problem 3.4 from [DPV]
4. Problem 3.12 from [DPV]

5. Global sink:
   Let $G = (V, E)$ be a directed graph given its adjacency list representation. A vertex $v$ is called a global sink if and only if:
   
   (a) $v$ has no outgoing edges
   (b) for every other vertex $w$, there is a path from $w$ to $v$.

   Give an algorithm that determines if $G$ has a global sink and, if the answer is yes, returns the global sink. Your algorithm should have running time $O(|V| + |E|)$.

6. Binary heap:
   Starting from an empty binary heap, perform the following sequence of operations, and draw the final binary heap data structure.

   • Insert $a$; 7 (that is, an element $a$ with key 7).
   • Insert $b$; 4.
   • Insert $c$; 9.
   • Insert $d$; 12.
   • Insert $e$; 10.
   • Insert $f$; 3.
   • Decrease-key of $e$ to 2.
   • Delete-min.

7. Problem 4.19 from [DPV]
8. Problem 4.21 from [DPV]