Exam questions: TKO 3108 Algorithm Design

(answers in english)

27-November-2017

(1) (8p) *Depth-First Search:* given a graph $G = (V, E)$ and a starting node s. Describe the *depth-first search* (DFS) traversal of G starting from node s. What is the difference between *depth-first-search* and *breadth-first-search.*

(2) (8p) Given a directed graph $G = (V, E)$, give an algorithm that constructs a *topological ordering* of the graph. What is the condition for a topological ordering to exist in G?

(3) (8p) *Interval Scheduling:* given a set of (job) requests $\{1, 2, ..., n\}$, where each request has a start $s(i)$ and a finish $f(i)$ time. Two requests are compatible if their time interval do not overlap. The *interval scheduling problem* asks to select the maximum number of compatible requests.

(4) (8p) *Sorting:* Given an array of n numbers, give an algorithm that sorts these numbers in increasing order and runs in $O(n \log n)$ time. Proove that the asymptotic running time of the algorithm is $O(n \log n)$.

(5) (8p) *Shortest paths:* Given a graph $G = (V, E)$ with non-negative edge lengths l_e for each edge $e \in E$. Give an algorithm to find the shortest path from a node s to all other nodes. Prove that the algorithm outputs the shortest path.