Albert-Ludwigs-Universität, Inst. für Informatik
Prof. Dr. Fabian Kuhn
Mohamad Ahmadi

Theoretical Computer Science - Bridging Course
Summer Term 2019
Exercise Sheet 1

In case you wish to get feedback, submit electronically by 06:00 am, Friday, May 3.

Exercise 1: Induction   (7 Points)

Assume that there are n infinitely long straight lines lying on the 2-dimensional plane in such a way that no two lines are parallel, and no three lines intersect in a single point. Prove by induction that these lines divide the plane into $(n^2 + n + 2)/2$ regions.

Exercise 2: Any Even Degree Node?   (5 Points)

A *simple graph* is a graph without self loops, i.e., every edge of the graph is an edge between two distinct nodes. The degree $d(v)$ of a node $v \in V$ of an undirected graph $G = (V, E)$ is the number of its neighbors, i.e,

$$d(v) = |\{u \in V \mid \{v, u\} \in E\}|.$$

Show that every simple graph with an odd number of nodes contains a node with even degree.

Exercise 3: Counting Edges in Acyclic Graphs   (8 Points)

A tree is an acyclic, connected, simple graph. Show that a tree with $n \geq 1$ nodes has $n - 1$ edges. A forest is a (possibly unconnected) graph, where each connected component is a tree. Show that a forest consisting of k connected components has $n - k$ edges.