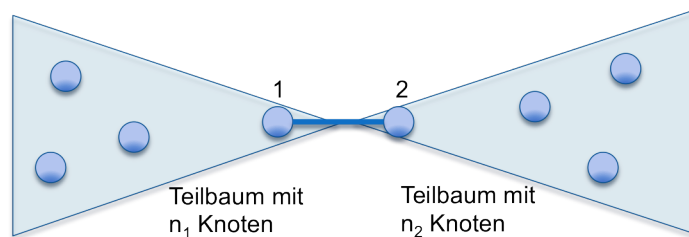


Übungen zur Vorlesung  
**Algorithmische Methoden zur Netzwerkanalyse**  
 WS 2015/16  
 Blatt 4

**AUFGABE 9** (2 Punkte):

Consider an undirected tree of  $n$  vertices. A particular edge in the tree joins vertices 1 and 2 and divides the tree into two disjoint regions of  $n_1$  and  $n_2$  vertices as sketched below. Show that the closeness centralities  $C_1$  and  $C_2$  of the two vertices are related by:

$$\frac{1}{C_1} + \frac{n_1}{n} = \frac{1}{C_2} + \frac{n_2}{n}$$

**AUFGABE 10** (2 Punkte):

Consider an undirected (connected) tree of  $n$  vertices. Suppose that a particular vertex in the tree has degree  $k$ , so that its removal would divide the tree into  $k$  disjoint regions, and suppose that the sizes of those regions are  $n_1, \dots, n_k$ . Show that the unnormalized betweenness centrality  $x$  of the vertex is

$$x = (n-1)(n-2) - \sum_{l=1}^k n_l(n_l-1).$$

Abgabe bei Elisabetta Bergamini per E-Mail bis Mo., 14.12., 16 Uhr.

Gruppenarbeit von max. 2 Personen ist bei allen Aufgaben zulässig und erwünscht.