

**Test #1 of lecture „Bioinformatics III“  
WS13/14  
topic: protein interaction networks**



Monday 11.11.2013

Duration: 2:15 pm - 3.00 pm = 45 Minuten

no external tools/material allowed

Maximal number of points: 50. Test is passed from 25 points onwards.

You may use front and back page of each sheet.

**Name:**

**First name:**

**MatrikelNr:**

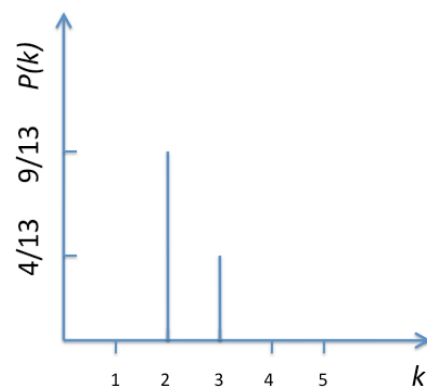
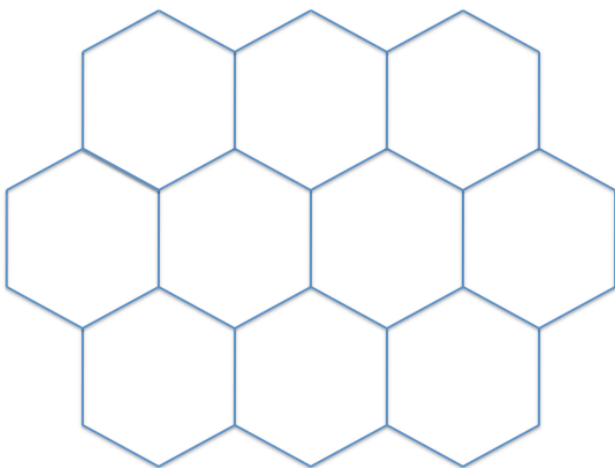
Nr.	1	2	3	4	$\Sigma$
Possible points	10	16	14	10	50
Your points					

**Problem 1 (Degree distribution, lecture 2)**

**(10 points)**

(a) Define the **degree** of a node in an unweighted graph. (4 points)

(b) Encircle in the hexagonal lattice below (on the left) a subgraph that has exactly the degree distribution shown below (on the right). (6 points).



## Problem 2 (lecture 4) Communities (16 points)

For a given graph  $G = (V, E)$  with  $|V| = n$ ,  $|E| = m$ , we have introduced in lecture V4 the Girvan-Newman algorithm to construct communities. However, this algorithm has an unfavorable complexity of  $O(mn^2)$ . The resulting slow performance is overcome by the **Radicchi algorithm** that was also introduced in V4.

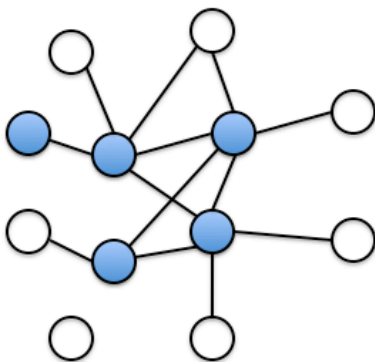
(a) What property does the Radicchi algorithm assign to edges? (4 points)

(b) Why does this lead to a more efficient runtime? (4 points)

(c) Give the mathematical definitions of a **strong community** and of a **weak community** (4 points).

(d) Is the set of **dark nodes** a **strong community** in the graph shown below? (4 points)

Explain your answer (yes/no) in a few words.



**Problems 3 and 4**

were removed from this example test