

Name: .....

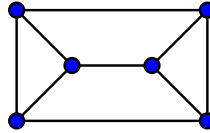
**SAMPLE EXAM #2**

**1. DEGREE SEQUENCES**

- a) When do we say that a sequence of numbers can be realized by simple graph?
- b) Using Havel–Hakimi-algorithm, decide if the following sequence can be realized by simple graph or not: 1, 1, 1, 2, 4, 5, 5, 5.

**2. HAMILTONIAN CYCLE, TRAVELING SALESMAN PROBLEM**

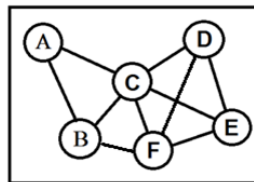
- a) What do we mean on Hamiltonian cycle?
- b) Give a Hamiltonian cycle in the following graph.



- c) State Dirac's theorem.
- d) Present the traveling salesman problem.

**3. VERTEX COLORING**

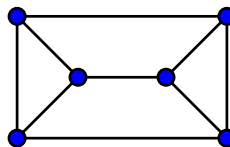
- a) What do we mean on proper vertex coloring? What is the chromatic number of a graph?
- b) Color the vertices of the graph below by the greedy coloring algorithm, in the following order:  $A, B, C, D, E, F$ .



- c) State the four color theorem.
- d) What is the connection between the chromatic number of  $G$  and the parameter  $\omega(G)$ ? Prove your answer.

**4. MATCHINGS**

- a) Find a perfect matching in the following graph:



- b) What do we mean on Kőnig set? State the marriage theorem (about perfect matching in biparite graphs), and prove its easy direction.
- c) What do we call augmenting path? Why does the existence of an augmenting path imply that the current matching is not a maximum matching?