

Final Exam: CGBL 2015

You have to solve 2 of 4 tasks from each section to pass exam.

Otherwise you should answer theoretical questions corresponding to the section you do not know by June, 17.

Combinatorics (3)

№1

$$\sum_k \binom{n}{3k+2} = ?$$

№2 How many decimal sequences of a length N with no neighboring even numbers exist?

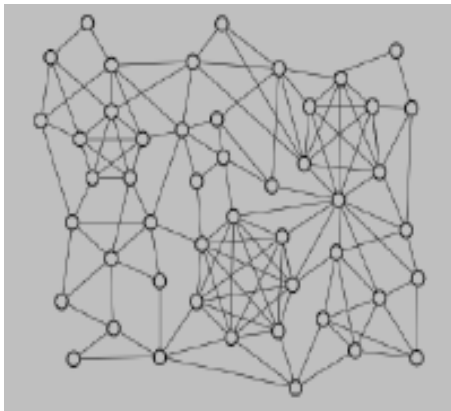
№3 Find a general solution of

$$\begin{cases} x_n = x_{n-1} + y_{n-1} - 1 \\ y_n = 3y_{n-1} + x_{n-1} + 1 \end{cases}, x_1 = y_1 = 2.$$

№4 Find a number of colorings in RGB palette for Tetrahedron Faces (with respect to all possible symmetries).

Graphs (4)

№1 Prove that for every connected graph without loops and multiple edges there exists two vertices with the same degree value.



For a given graph:

№2 Identify vertices with local and global maximal descriptive characteristics and detect possible communities and graph cuts.

№3 Verify power-law and fit linear model with linear regression.

№4 Identify vertices with maximal values of centrality metrics and detect possible communities and graph cuts.

Logic (3)

№1 Determine functional completeness of the system $\{0, x \oplus y \oplus z, x \equiv y\}$.

№2 Find finite system of axioms for $\{\{1, x \oplus y \oplus z, x \vee y\}\}$.

№3 Write a finite system of axioms for the closure of a system $\{\neg x, x \vee y\}$ based on a finite system of axioms constructed for full disjunctive normal form for generating system $\{\neg x, x \vee y, x \wedge y\}$.

№4 Find polynomial algorithm for 2-SAT problem – whether a given 2-CNF is feasible (possess value 1 on some tuple).