

Project 1. Available

Project dates: **November 1th to June 30th**

Project Title: **Group Testing and It's Application to Information Networks and Data Storage.**

Adviser: **Vyacheslav Rykov**

**Abstract:**

Research will be carried out into the Boolean model of group testing that is used for the analysis of optimal procedures that search for defective units (defects) in a large population and optimal non-adaptive methods for the search of mutually eclipsing defects. The theory of static design screen experiments can be applied to multiple-access information transmission networks, to neural networks, and big data storage systems. The problem to find the information capacity of multiple-access and to neural networks will be considered.

**In this project we propose that the participating student engages in the following activities:**

**A .** Study the theoretical aspects of the problem by using following sources:

- 1 A.G.Dyachkov, V.V.Rykov, "The Survey of the Superimposed Codes Theory", *Problems of Control and Information Theory* , 1983, 12, N. 4, pp. 229-242.
2. D'yachkov A.G. and V.V.Rykov, "A Generalization of superimposed codes and its application to the Multiple-access channel". *The 6-th International Symposium on Information Theory* , Abstracts of Papers, part 1, 1984, pp. 62-64.
3. A.G.Dyachkov, V.V.Rykov, A.M.Rashad, "Superimposed distance codes", *Problems of Control and Information Theory* , 1989, 18, no. 4, pp. 237-250.
- 4 A.G.Dyachkov, A.J. Macula, Rykov, "New applications and results of superimposed code theory arising from the potentialities of molecular biology", *Numbers, Information and Complexity* , pp. 265-282, Kluwer Academic Publishers, 2000.
5. A.G.Dyachkov, A.J. Macula, Rykov, "New constructions of superimposed codes". *IEEE Trans. on Inform. Theory* , vol.46, N.1, 2000, pp. 284-290.
6. A.G.D'yachkov and V.V. Rykov, "Optimal superimposed codes and designs for Renyi's search model". *Journal of Statistical Planning and Inference* , vol. 100, 2002, pp. 281-302.
7. A.J.Macula, V.V Rykov, S.M.Yekhanin, "Trivial two-stage group testing for complexes using almost disjunct matrices, *Discrete Applied Mathematics* , 137, No.1, 97-107 2004.

8. D. Du and F.K.Hwang, "Combinatorial Group Testing and its Applications". *World Scientific*, 1993.

This will help her/him understand the research topic and serve as an introduction to the final, written, research report.

**B.** Develop new algorithms for group testing.

**C .** Write computer programs for design screen experiments and modeling multiple access information transmission systems.

**D.** Run the programs and help the adviser in analyses of generated designs and information transmission systems.

**E.** Put together her/his findings, written software, significant graphs, tables, and so on in the final research report to be presented at the MAM Symposium.

**OTHER REQUIREMENTS:** The students interested in the project above are expected to have taken and passed with maximal grades or close MATH 1950(Calc I), MATH 1960(Calc II), and MATH 4050 (Linear Algebra). They should be familiar with computers and MAPLE.

The student is also expected to meet with the adviser a couple of times a week, (or communicate actively by e-mail) for discussions, guidance, and progress reports during the preparation period of the project.