

Operations research
Final exam questions
2022

- 1. Linear algebra** (pivot tableau, elementary row operations, Gauss-Jordan elimination, generating system, linearly independent, Steinitz theorem, basis, matrix rank, system of linear equalities, Orthogonality theorem, Rouché-Kronecker-Capelli lemma)
- 2. Geometry of linear systems** (hyperplane, halfspace, polyhedron, convex set, supporting hyperplane, face, vertex, edge, extremal point, bounding hyperplane, equivalent definitions of extremal point, convex hull, polytope, Krein-Milman theorem, cone, ray, Minkowski-Weyl theorem)
- 3. Separation and Farkas' lemma** (separation, closest point, obtuse angle criterion, separating hyperplane theorem, Farkas' lemma, alternative theorems)
- 4. Introduction of linear programming** (standard, canonical form, solution, feasible solution, optimal solution, basis, basic solution, basic solutions and extremal solutions, adjacent vertices)
- 5. Simplex algorithm** (pivoting, reduced cost, unbounded ray, the algorithm, terminal tableaux, finding an initial feasible solution, Trichotomy theorem)
- 6. Degeneracy and cycling** (index selection rules, complexity of the simplex algorithm)
- 7. Revised simplex algorithm, sensitivity analysis**
- 8. Duality** (dual problem, dual feasible basis, shadow price, Weak duality theorem, Strong duality theorem)
- 9. Network flow problem** (special problems, Ford-Fulkerson algorithm, Dijkstra algorithm, Prim algorithm, connection between the linear programming model and the graph, Network simplex algorithm)
- 10. Transportation problem** (finding feasible solution – North-West corner method, Least cost method, Vogel's method; finding optimal solution – MODI algorithm)
- 11. Assignment problem** (Kőnig's theorem, Hungarian method, Critical path method)
- 12. Integer programming I** (different type of problems, modelling logical constraints, continuous relaxation, Gomory cut, dual simplex algorithm)
- 13. Integer programming II** (branch and bound technique, solving knapsack problem: branch and bound method, dynamic programming)