

Mathematics 2: Static and Dynamic Optimization

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Syllabus

Static Optimization

Preliminaries: differentiability; convex sets, convex and concave functions, quasi-concave and pseudo-concave functions; implicit function theorem.

Unconstrained optimization: definitions; first order necessary and sufficient conditions; second order necessary and sufficient conditions; applications.

Constrained optimization: definitions; optimality criteria of nonlinear programming with differential functions; optimality criteria of nonlinear programming with equality constraints.

Dynamic Optimization

Preliminaries: complex numbers; series, difference equations, systems of difference equations; integral calculus, differential equations, systems of differential equations.

Discrete time dynamic optimization: illustrative examples in economics; fundamental equations of dynamic programming for finite-horizon problems; Bellman equation for infinite-horizon problems.

Continuous time dynamic optimization: illustrative examples in economics; calculus of variations, Takayama sufficient condition; Pontriagin maximum principle, Arrow and Mangasarian sufficient conditions.

References

Takayama, A. *Mathematical Economics*. Cambridge University Press. 2010.

de la Fuente, A. *Mathematical Methods and Models for Economists*. Cambridge University Press. 2000.

Kamien, M.I. and Schwartz, N.L. *Dynamic Optimization*. North-Holland. 1991.

Sydsaeter, K., Hammond, P., Seierstad, A. and Strom, A. *Further Mathematics for Economic Analysis*. Pearson College. 2008.

Lectures slides.