

Unit 5: Constrained Optimization with Calculus

KEY

SA	could be used as a stand alone lesson, provided prior knowledge is met
Time	approximate # of 45-50 min periods
Coding	These lessons are geared towards Julia; lessons will need modification for other languages. “Coding” includes: basic commands, loops, if/else.
C+L	Computer with desired language installed
SC/GC	Scientific/Graphing calculator
(T)	May need extra time for tech troubleshooting

Title	Topics	Prior knowledge	Equipment	Sequence	Slides	Practice Problems	Time
5.1 intro	<ul style="list-style-type: none">backgroundsetup + graphing feasible region	<ul style="list-style-type: none">Algebra3D graphing	C+L	SA	19	5	1.5
5.2 foundations	<ul style="list-style-type: none">descent and feasible conesconditions for optimality	<ul style="list-style-type: none">gradients and Hessiansvectors	0	5.1	20	6	2
5.3 phase 1	<ul style="list-style-type: none">finding steepest descent vectorlimiting the scalarminimizing	<ul style="list-style-type: none">gradients and Hessiansvectors	C+L	2.4, 1.10 or 4.3, 5.1, 5.2	16	6	2
5.4 phase 2	<ul style="list-style-type: none">vector normalizationmoving along constraint boundary to minimizehandling corner regions	<ul style="list-style-type: none">gradients and Hessiansvectors	C+L	5.1-5.3	21	5	2
5.5 big problems	<ul style="list-style-type: none">solving from equations to finish	<ul style="list-style-type: none">gradients and Hessiansvectors	C+L	5.1-5.4	7	2	2
5.6 penalty functions	<ul style="list-style-type: none">quadratic loss functions: set up and solve	<ul style="list-style-type: none">Algebra 2	C+L	2.3, 2.4	21	5	2
5.7 interior penalty	<ul style="list-style-type: none">barrier functions: set up and solve	<ul style="list-style-type: none">Algebra 2	C+L	5.6	13	4	1.5
5.8 Pareto	<ul style="list-style-type: none">design and criterion spacePareto front and improvements	<ul style="list-style-type: none">Algebra 2	0	3.1	22	6	2
5.9 MDPs	<ul style="list-style-type: none">Markov PropertyMarkov Decision ProcessesPartially Observable MDPs	<ul style="list-style-type: none">Algebra	C+L	SA	24	6	2

Total time, not including assessment/extra: 17 days