Unit 2: Unbounded Optimization Without 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
2.1 Intro	• definition of unbounded optimization • local vs global extremes • unimodal vs multimodal functions	• Algebra	0	SA	12	4	1
2.2 Three-Point Interval	• Programming a 3-point interval • Using an iteration counter for refinement	• Algebra • Coding	C+L	1.5	10	2	1.5
2.3 Minimum 1 (brute force)	• Definition of brute force • Writing a brute-force minimization program	• Pre-Algebra • Coding	C+L	SA	4	1	1
2.4 Minimum 2 (intervals)	• Minimizing using intervals • Golden Section	• Algebra • Coding	C+L	1.5	13	2	1
2.5 Minimum 3 (slopes)	• Using slopes to locate a minimum	• Algebra • Coding	C+L	SA	5	1	1
2.6 Max and min	• Converting minimization programs directly to maximization programs • Using “maximizing a negative” concept	• Algebra • Coding	C+L	2.2, 2.4, 2.5	13	4	1.5
2.7 Global 1 (testing points)	• need for horizontal boundaries • Finding a global minimum by testing points	• Algebra • Coding	C+L	2.2, 2.4	10	3	1.5
2.8 Global 2 (sawtooth)	• Curved functions and Slope • Sawtooth Method	• Algebra • Coding + arrays	C+L	SA	26	5-6	2
2.9 Intro to 3D	• Functions in 2 variables • 3D graphing	• Algebra	0	SA	11	3	1
2.10 Min in 3D 1 (brute force)	• Basic minimization in 2 variables • Grid search for starting point	• Algebra • Coding + arrays	C+L	2.9	19	5-6	2
2.11 Min in 3D 2 (Hooke-Jeeves)	• Hooke-Jeeves pattern search method	• Algebra • Coding + arrays	C+L	1.2, 2.9, 2.10	15	5	2
2.12 Min in 3D 3 (cyclic coord)	• Cross-sections of 3D graphs • Cyclic Coordinate Search method	• Algebra • Coding + arrays	C+L	1.2, 2.4, 2.9, 2.10	14	5	2-
2.13 Extensions	• Maximizing in 3D • Adjustments for 3+ variables	• Algebra • Coding	C+L	2.6, 2.9-2.12	9	2	1
2.14 Stochastic 1	• Definition • Convergence • Monte Carlo methods	• Algebra • Coding	C+L	SA	19	4	1.5+
2.15 Stochastic 2	• Simulated Annealing overview • Pseudocode and translation • Genetic Algorithms	• Algebra • Coding	C+L or GC	SA	22	5	2

Total time, not including assessment/extra: 22 days