Lecture	Topic	Subtopic
0	Matlab	Introduction
0	Matlab	Help
0	Matlab	Functions and Scripts
0	Matlab	Conditional Statements
0	Matlab	Branching
0	Matlab	Loops
0	Matlab	Basic Plotting
0	Matlab	Function Handles
1		Syllabus Review, Course Overview
1	Matlab	Review, Proper Comments/Indentation
2	Vectors	Introduction
2	Vectors	Operations
2	Vectors	Dot Product
2	Vectors	Norms
2	Vectors	Geometric Interp
2	Vectors	Schwartz and Triange Inequalities
2	Vectors	Linear Combinations
2	Vectors	Matlab
3	Matrices	Introduction
3	Matrices	Operations – 1
3	Matrices	Matrix Vec Uses
3	Matrices	Operations – 2
3	Matrices	Determinant
3	Matrices	Inverse
4	Matrices	Norms
4	Matrices	Matlab
4	Graphs	Introduction
4	Graphs	Adjacency Matrix
4	Graphs	Example
4	Graphs	Matlab
4	Markov Chains	Introduction
4	Markov Chains	Stochastic/Regular Matrix
4	Markov Chains	Example
5	Linear Systems	Introduction
5	Linear Systems	Existance and Uniqueness
5	Linear Systems	Gaussian Elimination
5	Linear Systems	RREF
5	Linear Systems	RREF – Inverse
5	Linear Systems	Matlab
5	Linear Systems	Gaussian Elimination Algorithm
6	Numerical Solutions	Introduction
6	Numerical Solutions	Accuracy vs Precision
6	Numerical Solutions	Numerical Errors
6	Numerical Solutions	Finite Precision
6	Numerical Solutions	Round-off errors

Lecture	Topic	Subtopic
6	Numerical Solutions	Condition Number
6	Interpolation	Introduction
6	Interpolation	Polynomial
6	Interpolation	Lagrange
7	Interpolation	Runge-Chebyshev
7	Interpolation	Spline – Intro
7	Interpolation	Cubic Splines
7	Interpolation	Hermite Splines
7	Interpolation	Radial Basis Functions
7	Integration	Introduction
7	Integration	Left-Right
7	Integration	Midpoint
8	Integration	Trapezoid
8	Integration	Simpson
8	Integration	Newton-Cotes
8	Integration	Gauss Quadrature
8	Integration	Matlab
8	Root Finding	Introduction
8	Root Finding	Bisection
8	Root Finding	Regula Falsi
8	Root Finding	Newton Rhapson
9	Root Finding	Secant
9	Root Finding	Fixed Point
9	Nonlinear Systems	Introduction
9	Nonlinear Systems	Fixed Point
9	Nonlinear Systems	Newton Rhapson
9	Nonlinear Systems	Damped Iteration
10	Nonlinear Systems	Example
10	Nonlinear Systems	Matlab Functions
10	Minimization	Introduction
10	Minimization	Brents
10	Minimization	1D Newton
10	Minimization	Steepest Gradient Descent
10	Minimization	Multi – Newton
11	Minimization	Multi – Quasi Newton
11	Minimization	Multi – Steepest Gradient
11	Minimization	Line Search
11	Minimization	Matlab
11	Linear Curve Fitting	
11	Nonlinear Regression	Introduction
11	Nonlinear Regression	Objective Function
11	Nonlinear Regression	Gauss-Newton
12		No Class
13		Midterm

Lecture	Topic	Subtopic
14	Vector Space	Introduction
14	Vector Space	Rules
14	Vector Space	Subspaces
14	Vector Space	Span
14	Vector Space	Independence
14	Vector Space	Orthogonality
15	Vector Space	Basis
15	Vector Space	Dimension
15	Vector Space	RREF/Basis Connection
15	Functions	Introduction
15	Functions	Terms
15	Functions	Composition
15	Functions	Inverse
16	Linear Transformations	Introduction
16	Linear Transformations	Action of
16	Linear Transformations	Matrix Vector Products
16	Linear Transformations	Geometric Operations
16	Linear Transformations	Kernel, Rank-Nullity Theorem
16	Matrix Subspaces	Introduction
16	Matrix Subspaces	Column Space
17	Matrix Subspaces	Null Space
17	Matrix Subspaces	Row and Left Null Space
17	Matrix Subspaces	Rank-Nullity Theorem
17	Matrix Subspaces	Example
17	Matrix Subspaces	Matrix Rank
17	Matrix Subspaces	Orthogonality
18	Projections	Introduction
18	Projections	Projection Matrix
18	Projections	Example
18	Projections	Onto Subspaces
18	Projections	Least Squares
19	LU	Introduction
19	LU	Via Gaussian Elimination
19	LU	Generic Algorithm
19	LU	OP Count
19	LU	Failure
19	LU	Pivoting
19	LU	Generic Algorithm – Pivoting

Lecture	Topic	Subtopic
20	QR	Introduction
20	Numerical Solutions	Normal Equation Revisited
20	QR	Normal Equations
20	QR	Gram Schmidt
20	QR	Classical
20	QR	Modified
20-21	QR	Householder
21	Eigensystems	Introduction
21	Eigensystems	Characteristic Equation
21	Eigensystems	Example
21	Eigensystems	Comments
21	Eigensystems	Complex Eigenvalues
21	Eigensystems	Repeated Eigenvalues
21	Eigensystems	Real, Symmetric Matrices
22	Eigensystems	Matrix Diagonalization
22	Eigensystems	Unitary Decomposition
22	Eigensystems	Defective Matrices
22	Eigensystems	Eigendecomposition Summary
22	Eigensystems	Positive Definite Matrices
22	Eigensystems	Power Iteration
22	Eigensystems	Inverse Iteration
22	Eigensystems	Rayleigh Quotient Iteration
23	Eigensystems	Spectrum Calculations
23	Eigensystems	Spectrum Calculations – QR
23	Eigensystems	Spectrum Calculations – Upper Hessenberg
23	Eigensystems	Spectrum Calculations – Summary
24	SVD	Introduction
24	SVD	Formal Definition
24	SVD	Relation to Eigendecomposition
25	SVD	Example
25	SVD	Uses – Psuedo-Inverse
25	SVD	Uses – Low Rank Approximation
26	Probability and Statistics	Review
26	Probability and Statistics	Distribution Functions
26	Probability and Statistics	Covariance
27	Probability and Statistics	Covariance Matrix
27	Probability and Statistics	PCA
27	Probability and Statistics	PCA Example
27	Probability and Statistics	Monte Carlo