LESSONS 3: RELATIONS AND FUNCTIONS

☐ Convert natural numbers into binary representations

☐ Convert binary numbers into natural numbers

☐ Apply the gray scale function for storing shades of gray in a computer

LESSONS 4: VECTORS AND MODELING

☐ Use column vectors to create a vertex model of points in $R^{2}$

☐ Use column vectors to describe data from Hooke’s law experiment

☐ Use column vectors to capture position data for mass-spring chain

☐ Use column vectors to model Ohm’s law experiment

☐ Apply Ohm’s Law to describe relations between voltage and current in circuit.

LESSONS 5: VECTORS ARITHMETIC

☐ Use scalar-vector multiplication and vector addition to model for Hooke’s law

☐ Use vector-vector addition to create the displacement vector for a mass-spring system with *n* masses and *(n+1)* springs where n = 2, 3, 4, 5

LESSONS 6: INNER PRODUCTS

☐ Use inner products to calculate the voltage across a circuit element given the node voltage potentials on either side of that circuit element

☐ Use inner products to write Kirchoff’s current law for any node of an ideal circuit

LESSONS 7: MATRIX MODELING

☐ Create the incidence matrix for a given undirected graph

☐ Create incidence matrix for a given directed graph

☐ Identify and use the 2D wireframe model for given polygon

☐ Set up matrix model for a given mass-spring chain with *n* masses and *(n+1)* springs

☐ Properly identify and apply matrix model for digital image

LESSON 12: MATRIX-VECTOR MULTIPLICATION

☐ Use matrix-vector multiplication to analyze mass-spring chains

☐ Use matrix-vector multiplication to calculate voltage drops across ideal circuit elements

☐ Use matrix-vector multiplication to state KCL at all nodes of a circuit

☐ Use matrix-vector multiplication to state Ohm’s Law for all resistors in a circuit

LESSON 12: NONSINGULAR LINEAR-SYSTEMS PROBLEM

☐ Set up and solve a nonsingular linear-systems problem for a given mass-spring chain with $n$ masses and $(n+1)$ springs where $n=2, 3, 4, 5, 6$

☐ Set up a linear systems problems using a Vandermonde matrix for polynomial modeling.

LESSON 22: LEAST-SQUARES PROBLEM

☐ Given a list of data $\left\{ (x\_{i} , y\_{i }) \right\}\_{i=1}^{m}$, set up a least-squares problem associated with a linear model: $f\left(x\right)=a\_{0}∙1+a\_{1}∙x$ by creating the proper Vandermonde matrix $A\in R^{m×n}$ and the appropriate right hand side $b\in R^{m}$ vector properly identify and apply the definitions of the four fundamental subspaces.

☐ Use least-squares technique to find the linear of best fit for data from Hooke’s law experiment

☐ Use least-squares technique to find the linear of best fit for data from Ohm’s law experiment

LESSON 29: INTRODUCTION TO EIGENVALUES

☐ Starting from the matrix-version of the differential equation for undamped simple harmonic oscillators given by $M\ddot{u}+Ku=0$**,** derive the statement of the eigenvalue problem $Ax=λ x$ associated with this differential equation