

MATH 4990V/5990V – Mathematical Foundations of Machine Learning

Fall 2026 Course and Assessment Schedule

MWF (50 minutes) | Time 8:35 AM–9:25 AM, CHPN 425 | Aug. 17–Dec. 3, 2026

Week	Dates	Material and Learning Focus	Lab / Homework / Project	Quiz / Exam
1	Aug. 17–21	Course overview; AI vs. ML vs. DL; supervised and unsupervised learning; start linear regression; data, model, loss, optimization, evaluation, and reproducible workflow.	Lab 0: Setup, Git, and Data Workflow	None
2	Aug. 24–28	Linear-regression pipeline and generalization; logistic regression; logits, sigmoid/softmax, cross-entropy, decision boundaries, classification metrics, and the one-neuron ANN bridge.	<i>Lab 0 due 8/26</i> ; Lab 1: Linear Regression; HW 1 assigned; <i>due Mon. Aug. 31</i>	Quiz 1: Regression workflow and learning curves
3	Aug. 31–Sep. 4	Gradient descent for supervised learning; stochastic gradient descent, mini-batches, Adam intuition, scaling, convergence, loss curves, and training diagnostics.	<i>Lab 1 due 9/2</i> ; Lab 2: Logistic Regression and Optimization; HW 1 due Mon. Aug. 31; HW 2 assigned; <i>due Tue. Sep. 8</i>	Quiz 2: Learning rate, conditioning, and convergence
4	Sep. 7–11	Regularization: ridge and lasso; validation sets, cross-validation, train/validation/test workflow, model selection, and overfitting diagnosis. <i>No class Sep. 7 (Labor Day) — HW 2's usual Monday deadline shifts to Tuesday.</i>	<i>Lab 2 due 9/9</i> ; Lab 3: Regularization and Model Selection (<i>due 9/11</i>); HW 2 due Tue. Sep. 8; HW 3 assigned; <i>due Mon. Sep. 14</i>	Quiz 3: Metrics, cost-sensitive thresholds, and AUC
5	Sep. 14–18	ANN bridge and first-unit synthesis; Exam 1; one training loop across linear regression, logistic regression, and a one-neuron PyTorch model, delivered as a recorded lecture. <i>No in-person class Sep. 18 (conference) — recorded lecture; Blackboard reflection due Sun. Sep. 20.</i>	HW 3 due Mon. Sep. 14	Exam 1: Wed. Sep. 16; no quiz; recorded class Fri. Sep. 18
6	Sep. 21–25	K-nearest neighbors, distance metrics, and kernel functions; k-means clustering; scaling and choosing k .	Lab 4: KNN and k-Means; HW 4 assigned; <i>due Mon. Sep. 28</i>	Quiz 4: KNN, cross-validation, and honest evaluation
7	Sep. 28–Oct. 2	Principal component analysis; explained variance; t-SNE; brief probability review (Bayes' rule, distributions) seeding the generative-model weeks later in the course.	<i>Lab 4 due 9/30</i> ; Lab 5: PCA and t-SNE; HW 4 due Mon. Sep. 28; HW 5 assigned; <i>due Mon. Oct. 5</i>	Quiz 5: PCA and t-SNE practice
8	Oct. 5–9	Support vector machines; maximum-margin classification; soft margins, kernels, and hyperparameters.	<i>Lab 5 due 10/7</i> ; Lab 6: SVM and Kernels; HW 5 due Mon. Oct. 5; HW 6 assigned; <i>due Mon. Oct. 19</i>	Quiz 6: C , kernels, and margins
9	Oct. 12–16	<i>No class Oct. 12–13 (Fall Break) — Lab 6's and HW 6's usual Wednesday/Monday deadlines both shift into Week 10.</i> Exam 2 covers Weeks 6–8; Friday is a coding reinforcement day.	None	Exam 2: Wed. Oct. 14; coding day Fri. Oct. 16; no quiz
10	Oct. 19–23	Decision trees for classification and regression; recursive splitting, impurity, pruning, and overfitting; ensemble learning: bagging, random forests, gradient boosting, and ensemble bias–variance tradeoffs.	HW 6 due Mon. Oct. 19; <i>Lab 6 due 10/21</i> ; Lab 7: Decision Trees and Ensembles; HW 7 assigned; <i>due Mon. Oct. 26</i>	Quiz 7: Depth, impurity, and overfitting
11	Oct. 26–30	Neural networks revisited; multilayer models; backpropagation; PyTorch modules, losses, optimizers, and training loops, the last delivered as a recorded lecture. <i>No in-person class Oct. 30 (conference) — recorded lecture; Quiz 8 taken online.</i>	<i>Lab 7 due 10/28</i> ; Lab 8: Neural Networks; HW 7 due Mon. Oct. 26; HW 8 assigned; <i>due Mon. Nov. 2</i>	Quiz 8: PyTorch training diagnostics — online, Fri. Oct. 30
12	Nov. 2–6	Convolutional neural networks: convolution, pooling, parameter sharing, and architecture design.	<i>Lab 8 due 11/4</i> ; Lab 9: CNNs; HW 8 due Mon. Nov. 2; HW 9 assigned; <i>due Mon. Nov. 9</i>	Quiz 9: CNN parameters and training
13	Nov. 9–13	Recurrent neural networks: sequence modeling, hidden state, and training through time.	<i>Lab 9 due 11/11</i> ; Lab 10: RNNs; HW 9 due Mon. Nov. 9; HW 10 assigned; <i>due Mon. Nov. 16</i>	Quiz 10: RNN training process
14	Nov. 16–20	Variational autoencoders: latent-variable models, the reparameterization trick, and the ELBO. <i>No in-person class Nov. 16 (conference) — recorded lecture; Blackboard note due Wed. Nov. 18.</i>	<i>Lab 10 due 11/18</i> ; Lab 11: VAEs; HW 10 due Mon. Nov. 16; HW 11 assigned; <i>due Mon. Nov. 30</i>	Quiz 11: VAE/generative training process
15	Nov. 23–27	Generative models (introduction). <i>Class meets only Mon. Nov. 23; no class Nov. 25–27.</i>	None	None
16	Nov. 30–Dec. 3	Final lecture Mon. Nov. 30: generative models (continued) and cumulative mathematical review; Exam 3 Wed. Dec. 2.	HW 11 due Mon. Nov. 30; <i>Lab 11 due 11/30</i>	Exam 3: Wed. Dec. 2; no quiz

Assessment key: **HW** 35%; Labs 15%; Blackboard notes 10%; **Quizzes** 5%; **Exams** 35%. No final project. **Homework is due Monday; labs are due Wednesday** (both shifted around Labor Day, Fall Break, and Thanksgiving as noted above; Lab 11 also moves to Mon. Nov. 30, since the last Wednesday of the term is Exam 3). **Labs have a firm deadline; exceptions require an approved excused absence or emergency as stated in the syllabus.** Exact Blackboard-note and quiz deadlines are posted in Blackboard. The schedule is subject to announced changes.