DS-301 Final Exam Study Guide
Spring 2024

ML Performance Concepts
Confusion matrix, accuracy, F1, true positive rate, false positive rate, ROC curve, overfitting, generalization, bias, variance, regularization (L1 and L2), logistic regression, linear separability

Deep Learning Basics
Single and multi-layered feedforward neural networks, activation functions, cross entropy loss, training and inference, forward pass, backpropagation, gradient descent, batch size, learning rate, learning rate decay, early stopping, dropout, batch normalization, momentum, Nesterov momentum,

Convolutional Neural Networks
CNN layers, padding, pooling, stride, sparse connections, parameter calculations, compute and memory requirements, receptive field, receptive field equivalence of stacked convolutions, power of small filters, contrastive loss, Siamese networks, pseudo labeling

Recurrent Neural Networks and Transformers
RNN and LSTM architectures, parameter calculations, Transformer architecture components, encoder and decoder block architectures, different weight matrices in transformers, concept of query, key, and value, multi-head attention, attention calculation

Hyperparameter optimization
Successive halving, Hyperband algorithm

Distributed Training
Data parallelism, Synchronous SGD, Asynchronous SGD, Parameter Server aggregation, straggler problem, stale gradients, Ring all-reduce, scaling efficiency

Generative Adversarial Networks (GANs)
Generator, discriminator, GAN training, GAN loss function

Federated Learning
Federated learning challenges, Federated Averaging algorithm, problem of non-IID data