**Csi5387: Final Exam (Open Book)**

**Overview of concepts, algorithms and techniques that you are responsible for (in no particular order)**

[Please let me know if I have missed anything important!]

1. **Concepts that you need to be able to describe and explain:**
	1. **General Concepts:**
* Optimal Bayes Learning
* Classification, Regression, Concept Learning, Multi-class learning
* Concept, Instances, Classes, Generalization
* Inductive bias
* Occam’s Razor
* Version Space
* Overfitting
* Pruning
* Bias, Variance, Bias-Variance Dilemma
* Sample Complexity
* PAC Learning
* Curse of Dimensionality
* Outlier
* Parametric, Non-parametric
* Class Imbalance, Class Skew
* Nominal, Continuous Features, Feature Space, Instance Space
* No Free Lunch Theorem
* Class Noise, Attribute Noise
* Smoothing
* Linear classifier, nonlinear classifier
* Concepts used in various algorithms: Voting, Centroid, Kernel, Gaussian Mixture Model, Hidden Units, information gain, KKT conditions, Kernel trick, Slack variable
* Statistical concepts: probability distribution, Normal (Gaussian) distribution, posterior probability, prior probability, central limit theorem, conditional independence, Likelihood, Maximum Likelihood.
* Bayes theorem
	1. **Methods**
* Active Learning
* Online Learning
* Data Stream mining
* Semi-Supervised Learning
* Association Rule Mining
* Unsupervised Learning, Clustering
* Reinforcement Learning
* Feature Selection (Filter/Wrapper), Feature Extraction
* Deep Learning
* Bayesian Learning
* Multi-Label Classification
* Multi-task learning
* Probabilistic Model: Discriminative, Generative
* Ranking Classifiers, Scoring Classifiers
* Lasso
* Big Data Analysis
* Mining Social Networks
* Trust, Provenance and Privacy
1. **Algorithms that you need to understand in detail**
* Decision Trees
* Multiple Layer Perceptrons
* Naïve Bayes
* K-Nearest Neighbours
* Support Vector Machines
* Ensemble methods: Baggin, Boosting, Random Forests, Stacking, Error Correcting Codes
* Clustering algorithms: k-means, single/complete/average link clustering, EM Algorithm
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1. Evaluation metrics/methods that you need to understand in detail
* Evaluation Metrics:
	+ true positive, true negative, false positive, false negative, true positive rate, false negative rate
	+ Accuracy, Error rate
	+ Precision, Recall, F-Measure
	+ ROC Analysis, Area Under the Curve
* Re-sampling:
	+ Cross-validation, Stratified Cross validation, k-fold cross validation
	+ Leave-one-out (Jacknife)
	+ Bootstrapping
* Statistical Testing:
	+ General concepts: hypothesis testing, significance test, confidence interval, p-value, critical value, omnibus test, post-hoc test
	+ T-test
	+ Sign test
	+ McNemar test
	+ Wilcoxon Signed Rank test
	+ ANOVA
	+ Friedman Test
	+ Tukey’s test
	+ Nemenyi’s test