582636 Probabilistic Models Learning Objectives				
Principal theme	Prerequisite knowledge	Approaches the learning objectives	Reaches the learning objectives	Deepens the learning objectives
Role of probability theory in knowledge representation and uncertain reasoning	Basics of first-order logic and probability theory	PT1. Can explain the basic concepts like joint probability distribution, conditional distribution, Bayes rule, and conditional independence, and by using these concepts, can formulate the basic probabilistic inference problems	PT3. Can compute conditional distributions from a fixed discrete, Naïve Bayes classifier, finite mixture model or a Hidden Markov Model	PT5. Can implement a probabilistic inference algorithm for a discrete multi-connected Bayesian network
		PT2. Can explain the meaning of a Bayesian network model as a parametric model (set of probability distributions), factorization of a joint probability distribution, and as an independence model (using d-separation, and local and global Markov properties)	PT4. Can implement a probabilistic inference algorithm for a fixed singly-connected Bayesian network	PT6. Can justify the use of probability theory based on theoretical arguments like the Dutch book or the Cox theorem
Parameter learning and Bayesian reasoning	Introduction to Machine Learning	PL1. Can derive the maximum likelihood parameters, the maximum posterior parameters (with conjugate prior), and the expected parameters for the Multinomial distribution	PL3. Can learn a Naïve Bayes classifier from a set of data and use the model for predictive inference	PL5. Can learn the parameters of continuous models
		PL2. Can explain the role of the parameter prior in parameter learning	PL4. Can learn the parameters of a Bayesian network from a set of data and use the model for predictive inference	PL6. In the discrete case, can implement the EM algorithm for learning the parameters of a finite mixture model
Parametric model structure learning	Introduction to Machine Learning	SL1. Can explain the model structure learning problem and how that differs from the parameter learning problem	SL4. Knows how to compute the marginal likelihood for discrete Bayesian networks and can explain how to use that for model structure selection	SL6. Can derive the formula for computing the marginal likelihood
		SL2. Can explain over-fitting	SL5. Can implement an algorithm for learning a discrete Bayesian network, given complete data	SL7. Knows other model selection criteria in addition to marginal likelihood
		SL3. Can explain the concept of equivalence class and say whether two networks are equivalent or not		