Syllabus and Suggested Curriculum for
Candidacy Exam in Artificial Intelligence and Machine Learning
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Suggested curriculum:

CS 260 Fundamentals of the Design and Analysis of Algorithms
CS 271 Introduction to Artificial Intelligence
2 additional Core Classes (from departmental requirements)

At least 3 of the following 4 courses
CS 273A Machine Learning
CS 274A Probabilistic Learning
CS 275A Network Based Reasoning/ Constraint Networks
CS 275B Network Based Reasoning/Belief Networks

Additional courses can include:
CS 273B Kernel Methods
CS 274B Learning in Graphical Models
CS 276B Seminar in Models of the Brain
CS 276C Cognitive and Computational Neuroscience
CS 277A Representation and Algorithms for Molecular Biology
CS 277B Probabilistic Modeling of Biological Data
CS 277C Computational System Biology
CS 278 Data Mining
CS 282 Scientific Computing

The candidacy exam will be based on three components:

a) fundamental AI concepts that are covered in the Russell and Norvig text
b) fundamental mathematical concepts that are widely used in AI
c) advanced concepts covered in two elective courses that the student selects from the list above, not including CS 260, CS 271, or CS 282.

Topics and Reading for Candidacy Exam

A) Fundamental AI Concepts: CS 271
All these readings are from Russell and Norvig, 2nd Edition

Problem Solving:

Chapter 3: uninformed search methods,
Chapter 4: informed search methods
Chapter 5: constraint satisfaction

Logical Representation and Inference:

Chapter 7: Propositional logic and inference
Chapter 8: Semantics of First Order Logic
Chapter 9: Inference in FOL

Representation of uncertainty and probabilistic inference:

Chapter 13: Probabilistic Representation
Chapter 14: Probabilistic Reasoning [14. 1 and 14.2]

Learning

Chapter 18: Learning Framework: 18.1-18.3
Chapter 20: Statistical Learning – 20.1 and 20.2

Texts

Artificial Intelligence: A Modern Approach 2nd Edition
Stuart Russell and Peter Norvig
Prentice-Hall

B) Fundamental Mathematics

a. Linear Algebra**:** matrix and vector algebra, solving linear system of equations, matrix inversion, eigenvalues and eigenvectors. Singular Value Decomposition.

Suggested reading: Linear Algebra and its Applications by Strang.

b. Probability**:** Bayes rule, conditional independence, well-known distributions for discrete and continuous univariate random variables (including multinomial, Poisson, exponential, geometric), expected value and variance, the multivariate Gaussian density, limit theorems (central limit theorem and strong law of large numbers), entropy and information, basic principles of discrete-time Markov chains, basic concepts in simulation.

Suggested reading: Sheldon Ross, Introduction to Probability Models, 8th edition, Addison Wesley.

C) Material from Elective Courses

The syllabi from the selected courses define the content here.