KOENIG SOLUTIONS · COURSE OUTLINE

Algorithms for AI/ML: Dynamic Programming & Q-Learning

Learn to design, analyse and apply algorithms from sorting and recursion to dynamic programming and Q-Learning for AI/ML.

48 Hours	4	22	16
DURATION	MODULES	TOPICS	HANDS-ON ACTIVITIES

COURSE OVERVIEW

This comprehensive course on Algorithms offers a structured progression from foundational concepts to real-world applications, tailoring skills for AI and ML. It begins with Fundamentals of Algorithms, exploring sorting, searching, recursion, and data structures, alongside hands-on exercises like implementing sorting algorithms and analysing Big-O complexity. In Core Algorithmic Techniques, learners tackle intermediate concepts such as divide-and-conquer methods, greedy strategies, dynamic programming, and graph algorithms, supported by labs like Huffman coding and graph traversal simulations. The Advanced Algorithms for AI/ML module delves into innovative areas, including genetic algorithms, reinforcement learning, and probabilistic methods, complemented by practical experiments in Bayesian inference and Q-Learning. Finally, the Expert-Level Applications focus on integrating algorithms in data science workflows, optimizing hyperparameters, and addressing ethical considerations, culminating in end-to-end ML pipeline projects and scenario-based evaluations. This course equips learners with theoretical insights and practical expertise to excel in AI/ML-driven environments.

WHO THIS COURSE IS FOR

- **AI/ML Enthusiasts & Data Scientists**
- **Software Developers & Engineers**
- **Competitive Programmers & Researchers**
- **Business Analysts & AI Practitioners**

TOOLS AND REQUIREMENTS

Tools and Lab Platform

- Python
- Jupyter Notebook/Colab

LEARNING OBJECTIVES

What You Will Learn

- Analyse time and space complexity using Big-O notation
- Implement basic sorting and searching algorithms
- Apply recursion and backtracking to solve problems
- Compare divide-and-conquer and greedy algorithm strategies
- Apply dynamic programming to problems such as Knapsack
- Implement graph algorithms including Dijkstra's and A*
- Develop Q-Learning and DQN solutions for reinforcement learning
- Evaluate hyperparameter optimisation techniques in ML pipelines

COURSE SYLLABUS

4 Modules, 22 Topics

01

4 Practice exercises

Fundamentals of Algorithms (Beginner Level)

TOPICS

- Introduction to Algorithms in AI/ML
- Time & Space Complexity (Big-O)
- Basic Sorting (Bubble, Selection, Insertion)
- Searching (Linear, Binary)
- Recursion & Backtracking Basics
- Data Structures Intro (Arrays, Linked Lists)

02

4 Practice exercises

Core Algorithmic Techniques (Intermediate Level)

TOPICS

- Divide & Conquer (Merge Sort, Quick Sort)
- Greedy Algorithms (Huffman Coding, Kruskal's Algorithm)
- Dynamic Programming (Fibonacci, Knapsack)
- Graph Algorithms (DFS, BFS, Dijkstra's, A*)
- Hashing & Hash Maps
- Tree & Heap Algorithms

03

4 Practice exercises

Advanced Algorithms for AI/ML (Pro-Level)

TOPICS

- Advanced DP Patterns
- Randomized & Monte Carlo Algorithms
- Genetic Algorithms & Simulated Annealing
- Neural Network Optimizations
- Reinforcement Learning (Q-Learning, DQN)
- Probabilistic Algorithms (Bayesian Networks, Markov Chains)

04

4 Practice exercises

Expert Level (Real-World Applications & Certifications)

TOPICS

- Algorithms in Data Science Pipelines
- Ethics in Algorithmic Decision-Making
- Hyperparameter Optimization Techniques (Grid/Random Search, Bayesian Opt)
- Model Deployment Pipelines

HANDS-ON ACTIVITIES

Practise What You Learn

#	MODULE	ACTIVITY
01	**Fundamentals of Algorithms (Beginner Level)**	■ Sorting algorithm implementations ■ Recursive function exercises ■ Big-O complexity analysis with code ■ Linked list traversal & manipulation
02	**Core Algorithmic Techniques (Intermediate Level)**	■ **DP problems:** Memoization & Tabulation ■ Graph traversal simulations ■ Huffman coding lab ■ Hash map collision handling
03	**Advanced Algorithms for AI/ML (Pro-Level)**	■ Implement Genetic Algorithm for optimization ■ Simulate Q-Learning for simple environment ■ Bayesian inference experiments ■ ARIMA-based time-series lab
04	**Expert Level (Real-World Applications & Certifications)**	■ End-to-end ML workflow optimization ■ A/B testing with algorithm variants ■ Ethics simulation scenarios ■ Real-world case study

WHAT IS INCLUDED

Everything You Need to Succeed

- Koenig course material for every module
- Delivery by certified instructors and subject matter experts
- Hands-on exercises throughout the course
- Course completion certificate from Koenig

ABOUT KOENIG

Who We Are

Established in 1993, Koenig Solutions is a globally recognised training provider with 35+ technology partnerships, 5,000+ training programmes and a network of certified instructors and subject matter experts, supporting individuals and enterprise teams worldwide.

FLEXIBLE DELIVERY

Learn the Way That Suits You

Classroom Training | Live Online Classes (ILO) | Fly-Me-A-Trainer (FMAT) | Flexi (Self-Paced) | 1-on-1 Training

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Talk to a learning advisor about schedules, group training and customised delivery.

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