# Review of Coursera Reinforcement Learning Specialization [NOTES]

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1. **Reinforcement Learning Specialization**
   * <https://www.coursera.org/specializations/reinforcement-learning>
   * From University of Alberta, Canada
   * Taught by professors Martha White and Adam White, a husband/wife team.
   * Highly rated: 4.7/5.0 overall
   * First 3 Courses: 4.8/5.0
   * Capstone project 4.6/5.0
   * Course says 4-6 hrs/week work, however, my experience is 10 hrs/week, but I am reading more of the book, taking detailed notes and thinking about how to use the material for presentations and future projects.
2. **If you are interested in reinforcement learning, this is a high-quality resource.**
   * The course provides a broad overview of RL presenting basic principles and a survey of fundamental algorithms.
   * It finishes with a soup-to-nuts project combining RL and neural networks.
   * It closely follows the book: “Reinforcement Learning: An Introduction” by Sutton and Barto, the “bible” of RL.
   * Rich Sutton is a professor at University of Alberta and is a resource for the course.
   * The teachers are clear and organized.
   * The quizzes and projects are substantial and help you learn the material.
   * While the course does not cover every aspect of the book, it gives you enough background so that you can read the rest of it.
   * The course provides Python software called **rl-glue**, which provides a framework for combining an RL agent and an environment for development and testing.
3. **Video:**
   * Course 3: 2.10 Deep Reinforcement Learning – David Silver
4. **The Book: *Reinforcement Learning: An Introduction***
   * [**http://incompleteideas.net/book/RLbook2020.pdf**](http://incompleteideas.net/book/RLbook2020.pdf)
5. **First Two Courses Use State Tables**
   * **Course 1: Fundamentals of Reinforcement Learning**
     + <https://www.coursera.org/learn/fundamentals-of-reinforcement-learning>
     + From chapters 2, 3, 4
     + K-armed Bandits
     + Markov Decision Processes
     + Value Functions and Bellman Equations
   * **Course 2: Sample-based Learning Methods**
     + <https://www.coursera.org/learn/sample-based-learning-methods>
     + From chapters 5, 6 and 8
     + Monte-Carlo Methods
     + Temporal Difference Learning
     + Model-free algorithms
       - SARSA algorithm (on-policy, learn optimal policy)
       - Q-learning algorithm (off-policy, learn optimal policy)
       - Expected SARSA algorithm (off-policy, learn expected policy)
     + DynaQ algorithm (Q-learning with sample-based model)
6. **Last Two Courses Use Function Approximation**
   * **Course 3: Prediction and Control with Function Approximation**
     + <https://www.coursera.org/learn/prediction-control-function-approximation>
     + From chapters 9, 10 and 13
     + Parameterized functions
     + Gradient descent
     + State aggregation
     + Constructing Features
       - Coarse coding
       - Tile coding
       - Neural Networks
       - Deep NNs
     + Algorithms
       - Episodic SARSA with function approximation
       - Expected SARSA with function approximation
     + Average Reward
     + Policy Gradient
       - Learn policies directly
       - Actor-Critic algorithm
   * **Course 4: A Complete Reinforcement Learning System (Capstone)**
     + <https://www.coursera.org/learn/complete-reinforcement-learning-system>
     + Formalize problem as a Markov Decision Process
     + Choose an algorithm
     + Identify key performance parameters
     + Implement an agent
     + Study parameters
7. **RL-GLUE**
   * Example: assignment C2M3
   * A set of classes for combining an RL agent and an environment for development and testing.
   * The code simple and clean.
   * Gives you a simple model that you can use directly and to help understanding more sophisticated frameworks.
   * *agent.py* provides an abstract class *BaseAgent* that you instantiate.
   * *environment.py* provides abstract class *BaseEnvironment* that you instantiate.
   * *rl\_glue.py* joins them together.
8. **Videos: The reward hypothesis (15m 10s)**
   * Course 1: 2.3 The goal of reinforcement learning (3m 8s)
   * Course 1: 2.4 The reward hypothesis – Michael Littman (12m 2s)
9. **Videos: Temporal Difference Learning (11m 14s)**
   * Course 2: 3.1 What is Temporal Difference Learning? (4m 56s)
   * Course 2: 3.2 The Importance of Temporal Difference Learning (6m 28s)
10. **Videos: The History of Reinforcement Learning: Barto and Sutton (20m 6s)**
    * Course 1: 3.3 Rich Sutton and Andy Barto: A Brief History of RL (7m 57s)
    * Course 2: 3.5 Andy Barto and Rich Sutton: More on the History of RL (12m 9s)