

# Chapter 3 Solutions

## Reinforcement Learning: An Introduction

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### Table of contents

<b>1</b>	<b>3.12</b>	<b>1</b>
<b>2</b>	<b>3.13</b>	<b>1</b>

#### **1 3.12**

$$v_\pi = \mathbb{E}_\pi[G_t | S_t = s] = \sum_{a \in \mathcal{A}} \pi(a | S_t = s) \mathbb{E}_\pi[G_t | S_t = s, A_t = a] = \sum_{a \in \mathcal{A}} \pi(a | S_t = s) q_\pi(s, a)$$

#### **2 3.13**

$$\begin{aligned} q_\pi = \mathbb{E}_\pi[G_t | S_t = s, A_t = a] &= \int_{S'} \int_R G_t p(s', r | s, a) ds dr = \int_{S'} \int_R (r_t + \gamma G_{t+1}) p(s', r | s, a) ds dr \\ &= \int_{S'} \int_R r_t p(s', r | s, a) + \gamma G_{t+1} p(s', r | s, a) ds dr \end{aligned}$$