Task 1:

One real-world application that can be formulated as an MDP is hiring decisions for a company. For this MDP, the state space is every combination of either hiring or not hiring each candidate for a certain role.

The action space would be either hiring or not hiring each candidate.

Since the action and state spaces are closely related to each other, the transition model is simple in that it moves a certain state to another with 100% probability according to the action and its corresponding state. For example, if two potential hires is the starting state, taking the action of hiring the third candidate as well would transition to the state of three potential hires with a probability of 1.

The reward would be a function of the salary package for each hire and their expected value to the company. This would vary for each state because some candidates could be requesting more money or may not bring as much value to the company as others.

Task 2:

In healthcare, DTRs is a prominent application of reinforcement learning. It addresses the problem of making treatment plans for patients with long-term illnesses or conditions. This problem is always essential to tackling because people will always have medical needs and new treatments will always be discovered or revised for these needs. In this problem, relating to reinforcement learning, the patient and the drug would be the environment of the problem, the patient’s condition would make up the states, and the reward would depend on the changes in the patient and other miscellaneous factors, such as the amount of drug to purchase or the number of hospital visits required.

One open-source project that has addressed this issue is the pydtr python library (link in Resources section below). The library allows users to build DTRs using their training methods, with one method built on sklearn and the other built on statsmodels. It enables iterative Q-learning to create the DTR and requires some external preprocessing on data before carrying out the learning. It is a fairly recent project and is on version 0.0.2.

Resources:

[Source for DTR information](https://www.capestart.com/resources/blog/reinforcement-learning-in-health-care-why-its-important-and-how-it-can-help/)

[pydtr](https://github.com/fullflu/pydtr)