**Exercise 1**

Describe the umbrella world as an HMM:

• What is the set of unobserved variable(s) for a given time-slice t (denoted Xt in the book)?

• What is the set of observable variable(s) for a given time-slice t (denoted Et in the book)?

• Present the dynamic model P(Xt|Xt−1) and the observation model P(Et|Xt) as matrices.

• Which assumptions are encoded in this model? Are the assumptions reasonable for this particular domain? (See 14.1 Time and Uncertainty on Page 479).

* The main assumption here is that the weather of today depends only on yesterday’s weather, and not on any earlier days.
* It also assumes that the umbrella is a direct consequence of rain in the outside world, which might not always be the case. For example, the manager could have woken up late and forgot to check if it was raining before leaving and decided to take his umbrella anyways.
* Time-Homogeneity: The probability given in the matrix earlier does not change over time. This is often not the case for most occurrences in the real world.
* Weather depends on more than just the previous day’s condition. But in this case, this is not a terrible model given the lack of information the security guard has. Therefore, I argue this model is reasonable given the settings described in the umbrella world.

**Exercise 2**

**A screen shot of a computer

AI-generated content may be incorrect.**

* The first red line confirms that our model has the same results for day 1 and 2 as shown in the book.
* The second red line represents the filtered belief at day 5. It shows that there is an 87% chance of rain on day 5, given that we started with a uniform initial belief (50% chance of rain and 50% chance of no rain) and given the sequence of (true, true, false, true, true)