DEPARTMENT OF MARINE TECHNOLOGY, NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

TDT4171 Exercise 2

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1 PART A

- For a given time-slice t, the set of unobserved variables is simply the weather, which is locally unobservable.
- For a given time-slice t, the set of observable variables is the umbrella, which is the basis for our calculations.
- The dynamic model would look like this:

$$P(X_t|X_{t-1}) = \begin{bmatrix} 0.7 & 0.3 \\ 0.3 & 0.7 \end{bmatrix} \tag{1.1}$$

  and the observation model on the other hand would look like this:

$$P(E_t|X_t) = \begin{bmatrix} 0.9 & 0 \\ 0 & 0.2 \end{bmatrix} \tag{1.2}$$

- There is made one Markov Assumption here, that is that the current state depends only on a finite number of previous states, in this case, the process is assumed to be a first order Markov-process. This is obviously not a reasonable assumption, as we are talking about weather. At the least, seasons, temperature, humidity and pressure, as well as at least three or more days dependency should be considered to model this properly.

2 PART B

Running my code, I get the following output:

```
fv =

    0.5000    0.8182    0.8834    0.1907    0.7308    0.8673
    0.5000    0.1818    0.1166    0.8093    0.2692    0.1327
```

Figure 2.1: Forward result

This is the desired result from the assignment text, and generally makes sense. Note that the first column contains the initial probability values, for practical purposes.

3 PART C

Running this code, we get the following output:

```
sv =

         0    0.8673    0.8204    0.3075    0.8204    0.8673
         0    0.1327    0.1796    0.6925    0.1796    0.1327


b =

    0.0444    0.0661    0.0906    0.4593    0.6900    1.0000
    0.0242    0.0455    0.1503    0.2437    0.4100    1.0000
```

Figure 3.1: Forward-Backward results.

Note again that the initial values are included.
Below you will find a comparison of the Forward and the Forward-Backward algorithms:

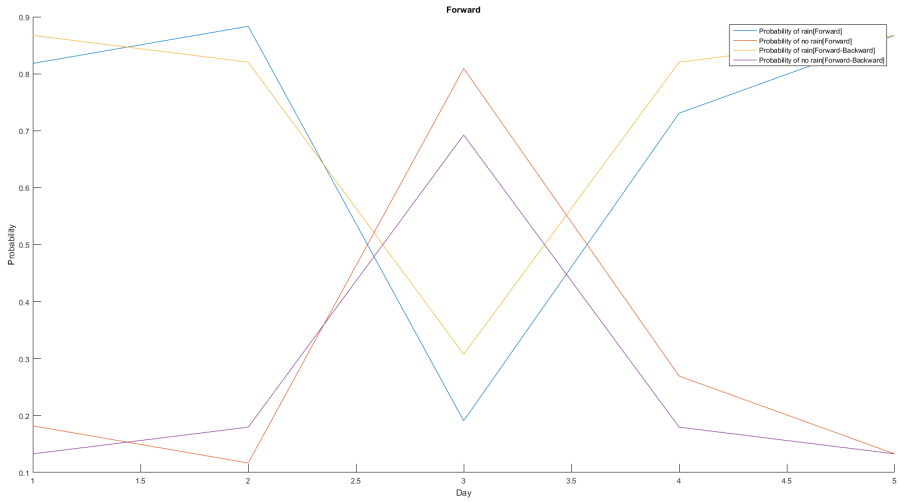

Figure 3.2: Comparison of the two algorithms presented in the assignment.

4 PART D

See attachment for code.