Message passing - Due to a chronic health condition, an individual can be in one of two states xt = 1 (normal) and xt = 2 (poor health) at each day t. A sensor monitoring the symptoms of the patient is sending an indication for its state at each day yt and provide three different measurement values 'Healthy' (yt = 3), 'Ambiguous' (yt = 2) or 'Poor' (yt = 1). The corresponding Hidden Markov Model for the health condition of the patient has the following transition probabilities from day to day:

p(xt+1 = 1jxt = 1) = 0:8

p(xt+1 = 1jxt = 2) = 0:5

The sensor reading probabilities for the different states are,

p(yt = 1jxt = 1) = 0:1

p(yt = 2jxt = 1) = 0:3

p(yt = 3jxt = 1) = 0:6

p(yt = 1jxt = 2) = 0:8

p(yt = 2jxt = 2) = 0:1

p(yt = 3jxt = 2) = 0:1

We know that on the 1st day the patient is healthy in 70% of cases. A dataset of 100 points in the file SumProductObserve.xlsx. The dataset provides the observation yt in one of the three states 1; 2 or 3 (left to right - 3 columns).

a) Use the Sum-Product algorithm on a directed graph to infer the state of the patient at all 100 days, given the observations. Briefly explain the algorithm that is used.

b) a dataset of 100 points in the file SumProductTrueState.xlsx. These represent the true state of the system (one column, 1 or 2). Find the success rate of your inferred values with respect to the true states.

c) Explain which software package that is used and how it implements the algorithm described in (a) and provide the code written. Provide the raw data of Inferred vs True states.