

## **INF552: Programming Assignment 7 [Hidden Markov Models]**

### **Part 1: Implementation [7 points]**

Consider a variable  $x$  with domain  $\{1, 2, 3 \dots 10\}$ . Let  $v_t$  be the value of  $x$  at timestep  $t$ .  $v_{t+1}$  is equal to  $v_t - 1$  or  $v_t + 1$  with probability  $0.5$  each, except when  $v_t = 1$  or  $v_t = 10$ , in which case  $v_{t+1} = 2$  or  $v_{t+1} = 9$ , respectively. At each timestep  $t$ , we also get noisy measurements of  $v_t$ . That is,  $v_t - 1$ ,  $v_t$  or  $v_t + 1$  can be returned with equal probabilities. Your task is to use a Hidden Markov Model to figure out the most likely sequence of values  $v_1 v_2 \dots v_{10}$  when the observation sequence is **8, 6, 4, 6, 5, 4, 5, 5, 7, 9**. At timestep  $t = 1$ ,  $v_1$  can be any value in  $\{1, 2, 3 \dots 10\}$  with equal prior probabilities.

You can write your program in any programming language. However, you will have to implement the algorithms yourself instead of using library functions. In your report, please provide a description of the data structures you use, any code-level optimizations you perform, any challenges you face, and of course, the requested outputs.

### **Submission Guidelines**

In your report, please include the names of all group members and mention their individual contributions. The maximum number of the members in a team is 2. The report should be in PDF format. Your submission should include the code as well as the report. It is due before **11/20, 11:59pm** in an archive in zip, tar.gz or tar.xz format. Only one submission is required for each group by one of the group members. Please submit your homework on **BlackBoard** (do NOT email the homework to the instructor or the TA).