CECS 451
Assignment 10
Total: 40 Points

General Instruction

- Submit your work in the Dropbox folder via BeachBoard. (Not email or in class)
- Use `Python 3`, any other programming language is not acceptable.
- You can import modules in the Python Standard Library (please check the full list *here*). If you want to use any other library, please consult with the instructor or TA.
- Your submission may be evaluated automatically using a script file, so if you would not follow the output format, you may receive zero point even though your program outputs correct answers.
- Submit the separate files as they are. (no zip file)

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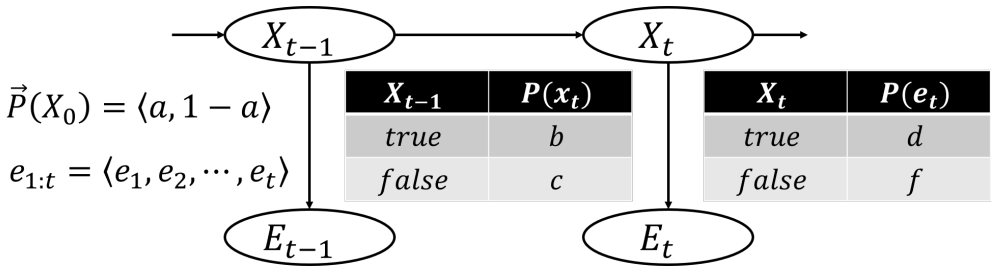
1. (40 points) Implement a `Python` program to perform filtering in the hidden Markov model (HMM).
   (a) Assume that hidden state variable and evidence variable are binary variables.
   (b) The program should compute $\vec{P}(X_t|\vec{e}_{1:t})$ when $\vec{e}_{1:t}$ is given.
   (c) The input to the program is a text file which includes multiple lines.
   (d) Each line contains independent variables $a, b, c, d, f, e_1, e_2, \cdots, e_t$ in Figure 1 in that order. For example,
   `0.5,0.7,0.3,0.9,0.2,t,t`
   means $a = 0.5, b = 0.7, c = 0.3, d = 0.9, f = 0.2, e_1 = t, e_2 = t$.



X_{t-1}	$P(x_t)$
true	*b*
false	*c*

X_t	$P(e_t)$
true	*d*
false	*f*

Figure 1: HMM of binary variables.

   (e) The program outputs the probability $\vec{P}(X_t|\vec{e}_{1:t})$. For example,
   `0.5,0.7,0.3,0.9,0.2,t,t--><0.8834,0.1166>`
   `0.5,0.7,0.3,0.9,0.2,t,t,f--><0.1907,0.8093>`
   Do not include white spaces in a line and fix the precision using `"{:.4f}".format()`

(f) The program should be able to executed on `Python 3` interpreter. I will test your program with this command:

```
> python hmm.py cpt.txt
```

Please note that the names of the program and the input file would be modified, therefore, your program should use `sys.argv` instead of "hard coding".

(g) About grading

- The output format should be same as the output example.
- No credit will be given if the program is not executable.
- The actual input file includes more lines.