EE6435 online test 2

⚠ This is a preview of the draft version of the quiz

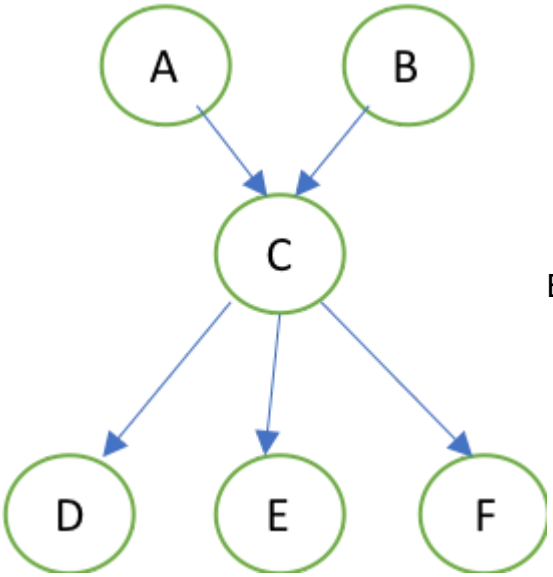
Quiz Instructions

The time limit for the test is **1 hour (9:15-10:15AM)**. Only one attempt will be allowed. This means that if you submit your answers, you cannot start a new test.

There are 6 problems in this test. Answer the **problems 1, 2, and 3 in the quiz (typing)**. For problems **4, 5, and 6**, **you should write your answers on pieces of paper and then scan/take a photo of them and submit the combined file to the assignment link "test 2 part 2"**. Please combine the pictures/scanned files into one file.

1. Upload your answers to part 2 by **10:25 AM (i.e. 10 minutes for taking pictures and uploading the file). Late submissions won't be graded.**
2. Join the zoom meeting using two devices. Turn on two cameras (from the two devices) so that I can see you from two angles.
3. If needed, I might make oral announcements during the test.
4. **Toilet break is allowed**. But you MUST let me know first via private chat in zoom.
5. Be sure to show recording evidence if you cannot submit your answers for technical reasons (power outrage, internet issues). This is STRICTLY REQUIRED to be fair to other students. We cannot grade your answers that are submitted in other ways if you don't have the recording to show the technical problems.
6. Although Quiz in Canvas provides auto-grading, we will manually check all your answers. So, please ignore the mark provided by Canvas for now.
7. For any emergency, you can use the following methods to contact us:

Question 1 4 pts



Bayes belief network

If P(X|Y, Z) = P(X|Y), we say that X is conditionally independent Z given Y.

Given the above **Bayesian belief network**, fill out "True" or "False" for each statement in the box based on conditional independence assumption of a Bayes belief network.

P(D|C,A,B) = P(D|C)

P(C|A,B,D)=P(C|A,B)

P(E|C,A,B)= P(E|C)

P(E|D,F)= P(E|D)

Question 2 — 6 pts

x_{i-1} \ x_i	A	C	G	T
A	0.1	0.2 P(C|A)	0.6	P(T|A)=?
C	0.3	0.4 P(C|C)	P(G|C)=?	0.1
G	0.15	P(C|G)=?	0.1	0.2
T	P(A|T)=?	0.1 P(C|T)	0.6	0.15

The above table shows the transition probabilities for a Markov chain model for 4 states named A, C, G, T. For example, according to this table, P(C|A)=0.2 (shown as 0.2 P(C|A)). There are several transition probabilities missing (denoted by ?). Please fill out the missing values using the given transition probabilities.

P(C|G)=

P(A|T)=

This is a 1st order Markov model, if we change it into a 2nd order Markov model, how many probabilities (cells) will be in this new table ?

Question 3

4 pts

Suppose there are 3 independent base classifiers (c1, c2, and c3) in an ensemble classifier. Their error rates are 0.3, 0.2, and 0.1, respectively . What is the probability that the ensemble classifier makes a wrong prediction?

Type the complete formula (equation) first and then input the final probability. (note: type directly in this box, no need to upload any file).

HTML Editor

0 words

Question 4

12 pts

Upload your answers using the assignment link. Ignore the blank here.

M1

	X	Y	Z
X	P(X|X)=0.7	0.2	0.1
Y	P(X|Y)=0.1	0.8	0.1
Z	P(X|Z)=0.1	0.1	0.8

M2

	X	Y	Z
X	0.33	0.33	0.34
Y	0.34	0.33	0.33
Z	0.34	0.33	0.33

You are given two Markov chain models M1 and M2. Both models can produce a sequence defined on a small alphabet containing only three symbols {X, Y, Z}. The transition probabilities of M1 and M2 are represented in the two tables, e.g. P(X|Z)=0.1. Both M1 and M2 have the same initial/prior probabilities: P(X)=P(Y)=P(Z)=1/3.

1) For input S1=XXXXZ, compare P(S1|M1) and P(S1|M2), which one is bigger and why? Show your intermediate steps.

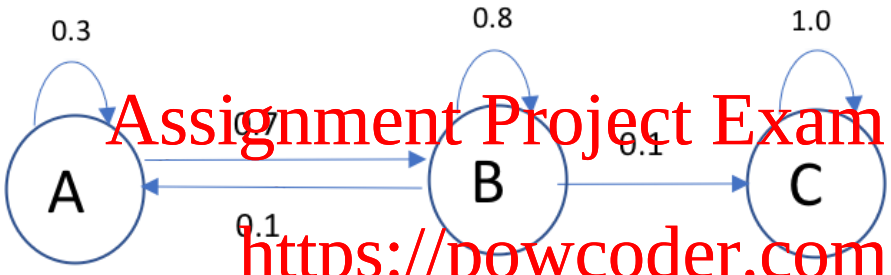
2) Now, I will change the prior probability of M1 and M2 as follows. For M1, P(X)=0.01, P(Y)=0.1, P(Z)=0.89. For M2, P(X)=P(Y)=P(Z)=1/3. Compute P(S1|M1) and P(S1|M2).

3) Based on the parameters in M1 and M2, what is the main difference between the sequences produced by M1 and M2?

Question 5

24 pts

Upload your answers using the assignment link. Ignore the blank here.



State	0	1	2
A	0.5	0.5	0
B	0.2	0.8	0
C	0	0	1.0

Emission probabilities

Above is a diagram for a hidden Markov model (HMM). This HMM has three states: A, B, and C. So, Q={A,B,C}. And the symbol set is {0,1,2}. Their initial probabilities are: P(A)=0.4, P(B)=0.4, and P(C)=0.2. The transition probabilities are marked beside the edge between the states (each state is a node). For example, the transition probability from A to B is 0.7. The emission probability table is shown below the HMM diagram. For example, the probabilities that state A emitting 0, 1, and 2 are 0.5, 0.5, and 0, respectively.

1) What is the probability that this HMM generating sequence “0120”? Why is it?

2) For an observed sequence “010112222222222”, how many different state paths can generate this sequence with a probability >0?

3) Apply the Viterbi algorithm to derive the optimal state path for input sequence "001". **Show the table for the Viterbi algorithm**. Then, **show the optimal state path** that can generate this observed sequence.

4) For the following two observed sequences:

111222222222222222

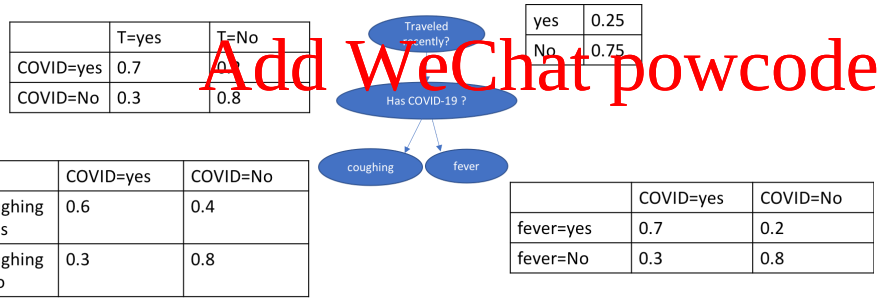
001222222222222222

Which of the above sequences can be generated by this HMM with a larger probability? How did you get your conclusion?

Question 6

5 pts

Upload your answers using the assignment link. Ignore the blank here.



	T=yes	T=No
COVID=yes	0.7	0.2
COVID=No	0.3	0.8

yes	0.25
No	0.75

	COVID=yes	COVID=No
coughing =yes	0.6	0.4
coughing =No	0.3	0.8

	COVID=yes	COVID=No
fever=yes	0.7	0.2
fever=No	0.3	0.8

All the events in the given Bayes belief network has only two outcomes: Yes or No. All the associated probabilities for each node are shown in the tables. For brevity, **T=traveled recently**.

A student is having fever. We will use the network to decide whether this student has COVID-19. Given the Bayes Belief network, compare P(COVID=Yes|fever=yes) and P(COVID=No|fever=yes). Show your intermediate steps.

Not saved Submit Quiz