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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

END SEMESTER EXAMINATION-2015

B.Tech VI Semester

COURSE CODE: 10B11BI612 MAX. MARKS: 45

COURSE NAME: Machine Learning for Bioinformatics

COURSE CREDITS: 04 MAX. TIME: 3 HRS

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

Section A **(9 marks)**

1. How can we represent PROSITE patterns using regular grammars? (2)
2. Why is quick propagation better than backpropagation for optimization of weights in neural networks? (2)
3. How are Mealy and Moore machines interconvertible? Illustrate with example. (2)
4. Differentiate between the E and M-steps of Baum-Welch algorithm. (2)
5. Why is Chomsky normal form required for modeling stochastic context-free grammar? (1)

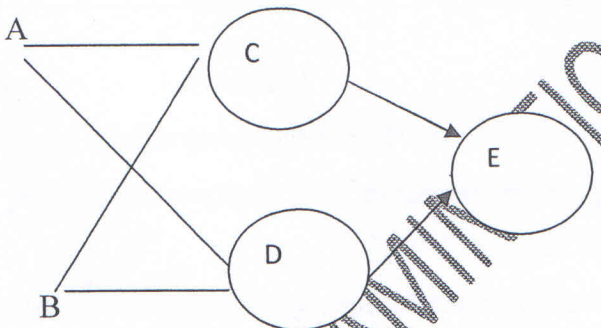
Section B **(13.5 marks)**

1. You are given 100 sequences from a cohort of individuals with a certain disease. You design an HMM to model these sequences. How will you calculate the log likelihood of this model? How can you use this to optimize the model? (4.5)
2. Derive the various palindromic strings from the following context-free grammar with lengths ranging between 8 and 16. S-> aSa|bSb|aa|bb (4.5)
3. Distinguish between liberal and conservative performance in ROC analysis. Which zone should be used for test case prediction? (4.5)

Section C

1. How does the committee of decision trees circumvent the problem of fragmentation and single coverage constraint? Elaborate the different algorithms of constructing this committee? (5)
2. Convert the production rule W-> aWbW to Chmosky normal form. Explain the significance of this form. (2.5)

3. HMMs can be used for protein secondary structure prediction. One simple way would be to use three states-helix, sheet and coil as the hidden states of emitting observable amino acids. How many parameters (sum of transition, emission and prior probabilities) would be present for such an HMM assuming a left-to-right topology? Support using an automaton. (5)
4. Given that target=1, learning rate=1. Perform a forward pass and reverse pass on the neural network shown here. The two inputs are A= 0.1 and B=0.7. The connection weights are w_{AC}= 0.1, w_{BC}=0.5, w_{AD}= 0.3, w_{BD}=0.2. w_{CE}= 0.2, w_{DE}=0.1 (5)



5. Explain the three typical problems in Hidden Markov models along with the algorithms which are used to solve it. Compare these problems to the analogous problems in transformational grammars. (5)