**CS 5316–Natural Language Processing**

Final Exam

May 13, 2018

Duration: 2 hours (8.15 to 10.15)

**Instructions:**

1. Please write legibly. Unreadable answers will NOT be graded. Use a (dark) BALL-POINT and write in a readily readable font size.
2. This is a closed books/notes exam. You may use a help sheet and a calculator.
3. Distribute your time properly as some questions might be more involved than others.
4. There are 8 questions in this exam.
5. (15 points) Consider a HMM for predicting hot and cold weather based on observed number of ice creams eaten. Let and . The HMM is given as

State transition matrix,

0.7 0.3  
0.4 0.6

Also,

Emission probability  
0.2 0.6  
0.4 0.3  
0.4 0.1

Calculate the best labels for the sequence 2, 1, 3.

1. (15 points) Consider the HMM defined in question 1 above, compute the likelihood of the sequence 2, 1, 3.
2. (15 points) Given the following 4 sentence:, (a) Construct the word-sentence co-occurrence matrix using word count (lemmatize words to their to root form)s. (b) Compute the similarity between sentences s1 and s2. (c) Compute the similarity between words ‘university’ and ‘science’.

S1:Lahore University of Management Sciences

S2: University of Management and Technology

S3: National University of Science and Technology

S4: National University of Emerging and Computing Sciences

1. (15 points) Refer to the previous question: (a) construct the word-context matrix with word counts and contexts defined by +2 and -2 words around ‘university’ and ‘science’. (b) Compute the PPMI values for vectors for words ‘lahore’ and ‘computer’.

1. 15 points) Describe how you would create a dense representationss of size 300 for words when given sparse word-context matrix of size where . Be precise and use mathematical notations.
2. (10 points)Consider a CRF for POS tagging (NN, VB, ADJ) that uses (in addition to other features) the preceding predicted tag as input for predicting the following tag. If the top 3 tags at the nth position is NN, ADJ, and VB, then describe how to predict the tag for the n+1 position using beam inference (beam length of 3).
3. (10 points) Give an example of (a) dependency grammar, and (b) constituency grammar.
4. (10 points) Using the Resnik and Lin methods find the similarity between two concepts A and B given P(A) = 0.001, P(B) = 0.0015, P(lcs(A, B)) = 0.002.