



**Answer any TEN Questions**  
**(10 X 10 = 100 Marks)**

1. Explain the various stages of language required for natural language understanding in NLP system with neat diagram with examples and also talk about the computational challenges in NLP.

2. a) Consider the following sentences

- The locations were very beautiful
- Flights that leave in the morning
- The cat was very large in size
- The boy's cars are different colors

[5]

Tokenize the sentences and identify the Parts of Speech (such as noun, verb, etc...) from these sentences. Perform Morphological analysis and explain it.

b) Draw the parse tree and also Perform a top down parsing based derivation for the sentence:

Sentence : The large can can hold the water

[5]

- $S \rightarrow NP VP$
- $NP \rightarrow ART ADJ N$
- $NP \rightarrow ART N$
- $NP \rightarrow ADJ N$
- $VP \rightarrow AUX V NP$
- $VP \rightarrow V NP$

3. Draw a Finite State Transducer for the verb 'talk', 'test' and 'sing' with maximum possibility inflections.

4. It is hard to understand something without knowing the exact purpose. Let's sketch a specific problem and talk about possible solutions. There is a patient, who visited you for 3 days in a row. To simplify things a bit, the patient can be in one of 2 states: (Healthy, Fever) and he can tell you 3 feelings: (Normal, Cold, Dizzy). During these 3 days, he told you, that he feels Normal (1st day), Cold (2nd day), Dizzy (3rd day). Find out the maximum probability using Viterbi algorithm with necessary steps. You also have some scientific results, which can help you guess the state of the patient:

**Start:**

In general, 50% of people are Healthy, 50% have Fever

**Transition:**

When Healthy, there is 60% chance of remaining Healthy the next day (40% chance of Fever). When Fever, there is 30% chance of becoming Healthy the next day (70% chance of Fever)

**Emission:**

When Healthy, he reports: 60% Normal, 20% Cold, 20% Dizzy. When Fever, he reports: 20% Normal, 30% Cold, 50% Dizzy.

5. a) Compare and contrast the inflectional morphology with derivational morphology with examples.

[5]

b) Draw a FSA for accepting the strings containing even number of a's and even number of b's that begins with 'a' for the alphabet a, b. Explain the number of states and specify start state and accepting states.

[5]



[5]

- 6 ✓ a) Explain in detail with suitable example  
 ① Word sense disambiguation  
 ② Semantic role labelling  
 b) Difference between POS tagging and shallow parsing.

[5]

7 ✓ Explain the real-time application of NLP using Text classification based on spam filtering in e-mails with system architecture and also illustrate the technical challenges.

- 8 ✓ a) Consider a simple three-state Markov model of the weather. Any given day, the weather can be described as being, state 1 as rainy, state 2 as cloudy and state 3 as sunny. Transitions between states are described by the transition matrix as, [5]

$$A = \{a_{ij}\} = \begin{bmatrix} 0.4 & 0.3 & 0.3 \\ 0.2 & 0.6 & 0.2 \\ 0.1 & 0.1 & 0.8 \end{bmatrix}$$

Draw the state diagram for representing these three states transition matrix.

- ② Given that the weather on day  $t=1$  is sunny, what is the probability that the weather for the next 7 days will be "sun, sun, rain, rain, sun, clouds, sun"? [5]

9 ✓ Develop a NLP system for Chatbot (Online Banking Services) with diagrammatic representation.

- 10 ① Write a note on  $n$ -gram? Also if a machine wants to get the meaning of the sentence "The dog smelled like a skunk." by separating it into small pieces, how should it do that using unigram, bigram, and trigram? [5]

- ② Estimate the likelihood of the sentence "I want to eat British food". What do we need to calculate these likelihoods? [5]

Early Bigram Probabilities from BERP

<start> I	.25	Want some	.04
<start> I'd	.06	Want Thai	.01
<start> Tell	.04	To eat	.26
<start> I'm	.02	To have	.14
I want	.32	To spend	.09
I would	.29	To be	.02
I don't	.08	British food	.60
I have	.04	British restaurant	.15
Want to	.65	British cuisine	.01
Want a	.05	British lunch	.01

11 ✓ How will you apply NLP techniques for relevant information retrieval from web?

