

Continuous Assessment Test (CAT) – II (March 2025)

Programme	: B.Tech. Computer and Science Engineering	Semester	: Winter-2025
Course Code & Course Title	: BCSE409L & Natural Language Processing	Class Number	: CH2024250501967 CH2024250501965
Faculty	: Dr.Krithiga.R Dr. Vijayaprabakaran K	Slot	: D2+TD2
Duration	: 1½ Hours	Max. Mark	: 50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary.
- Use graph sheets supplied from the exam cell as necessary.
- Only non-programmable calculator without storage is permitted.

Answer all questions

Q. No	Sub Sec. Description	Marks
1	<p>Consider the following grammar: $S \rightarrow NP VP$ [1.0] $NP \rightarrow Det Noun$ [0.6] Proper-Noun [0.4] $VP \rightarrow Verb NP$ [0.7] Verb PP [0.3] $PP \rightarrow P NP$ [1.0]</p> <p>Parsing the sentence "Astronomers saw stars with telescopes" leads to ambiguity:</p> <ul style="list-style-type: none"> • Did astronomers use telescopes to see stars? • Were the stars associated with telescopes? <p>Explain why Probabilistic Context-Free Grammars (PCFGs) alone cannot resolve such ambiguity effectively. What additional information or techniques can be used to address this issue?</p>	10
2	<p>A tech company wants to analyze user reviews of their new smartphone to identify which features are associated with positive or negative sentiments. They plan to use Dependency Parsing to extract these relationships.</p> <p>Example review:</p> <p><i>"The camera is excellent, but the battery life is disappointing."</i></p> <p>Using Dependency Parsing, how would you identify and extract the positive and negative sentiments associated with the features mentioned in the sentence? Provide a step-by-step explanation of the parsing process and how you would use the resulting dependency tree to extract the desired information.</p>	10

Apply Lesk word overlap disambiguation method on the given sentences using any dictionary.

- 3
1. "Time flies like an arrow". [5 Marks]
 2. "A bat flew in the sky". [5 Marks]
- 10

Assume that the words are to be disambiguated one at a time, from left to right.

Given the query word "fruit" and the list of words ["cat", "dog", "apple", "strawberry", "building", "car"], determine the most semantically similar word to "fruit" using vector embeddings.

Each word is represented by a five-dimensional vector:

Word	Vector Embedding
Cat	[1.5, -0.4, 7.2, 19.6, 20.2]
Dog	[1.7, -0.3, 6.9, 19.1, 21.1]
Apple	[-5.2, 3.1, 0.2, 8.1, 3.5]
Strawberry	[-4.9, 3.6, 0.9, 7.8, 3.6]
Building	[60.1, -60.3, 10, -12.3, 9.2]
Car	[81.6, -72.1, 16, -20.2, 102]
Query (Fruit)	[-5.1, 2.9, 0.8, 7.9, 3.1]

Using any appropriate similarity metric, identify the word most similar to "fruit" and explain the reasoning behind your choice.

Using the training data below, explain how a Naïve Bayes model is trained for Word Sense Disambiguation (WSD). What role do context words play in classifying the sense of "bat"? [5 Marks]

Sentences	Sense	Key Context Words
"A bat flew out of the cave at night."	Animal	Flew, cave, night
"The bat flapped its wings and disappeared."	Animal	Flapped, wings, disappeared
"Bats use echolocation to navigate in the dark."	Animal	Echolocation, navigate, dark
"He swung the bat and hit a home run."	Sports	Swung, hit, home run
"The wooden bat broke during the game."	Sports	Wooden, broke, game
"She gripped the bat tightly before hitting the ball."	Sports	Gripped, hitting, ball

Apply the trained Naïve Bayesian classifier to classify two new sentences by computing the probability for each sense and selecting the most likely one.

- a. "A colony of bats was found in the cave." [5 Marks]
- b. "He picked up the bat and prepared to swing at the ball." [5 Marks]