

GENERAL COURSE

COMP3315: Artificial Intelligence

MID-EXAM Practice

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IMPORTANT NOTE

- This material is only a supporting resource and **may or may not appear on the exam**. The actual exam questions **can be entirely different**.
- Rather than memorizing answers, please focus on understanding the core concepts of each method.
- Practicing these questions will help you understand the exam format and key concepts.

ID3

A robot gardener classifies plants as either "Needs Water" or "Does Not Need Water" based on:

- Soil Type (Dry, Moist)
- Leaf Color (Yellow, Green)

- (a) What is entropy, and why is it essential in ID3?
- (b) Which attribute (Soil Type or Leaf Color) would be a better first split if:
50% of Dry Soil plants need water, but only 20% of Moist Soil plants do.
80% of Yellow Leaf plants need water, but only 30% of Green Leaf plants do.
Explain your choice without doing full entropy calculations.

KNN

An innovative cooking assistant recommends dishes based on two factors:

- Spice Level Similarity
- Ingredient Similarity

A customer asks for a mild, vegetable-based dish, and the assistant recommends something similar using KNN ($K=3$).

- (a) Explain how KNN finds the best recommendation.
- (b) Why might a high K value make recommendations less personalized?
- (c) What challenge might arise if the dataset grows to 1 million? Explain.

Centroid Classifier

A music recommendation system suggests songs based on two numerical features: Tempo (beats per minute) and Energy Level (scale of 1 to 10). The system has stored past user preferences as follows:

Tempo (BPM)	Energy Level	User Likes?
120	8	Yes
130	6	No
110	7	Yes
125	9	Yes
140	5	No

A new song has a Tempo of 128 BPM and an Energy Level of 7. Classify the new song using centroid classifier.

Bayesian Classifier

A spam filter analyzes words in emails. The company found:

- $P(\text{Spam}) = 0.3$
- $P(\text{Not Spam}) = 0.7$

The word "discount" appears in 40% of spam emails and 5% of non-spam emails.

Compute the $P(\text{Spam}|\text{Discount})$ and $P(\text{Discount}|\text{Spam})$.

Perceptron

A warehouse robot decides whether to pick up an item (1) or leave it (0) based on two inputs:

- Weight (x1): Heavy (1) or Light (0)
- Size (x2): Large (1) or Small (0)

The initial perceptron weights are $w1 = 0.3$, $w2 = -0.2$. The learning rate is 0.1, and the threshold is 0.4.

Weight	Size	Decision
1	1	1
1	0	0
0	1	0

What are the new weights after one training epoch?