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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2022/2023**

COURSE NAME : MACHINE LEARNING

COURSE CODE : BIT 34303

PROGRAMME CODE : BIT

EXAMINATION DATE : JULY / AUGUST 2023

DURATION : 3 HOURS

- INSTRUCTION
1. ANSWER ALL QUESTIONS
  2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.
  3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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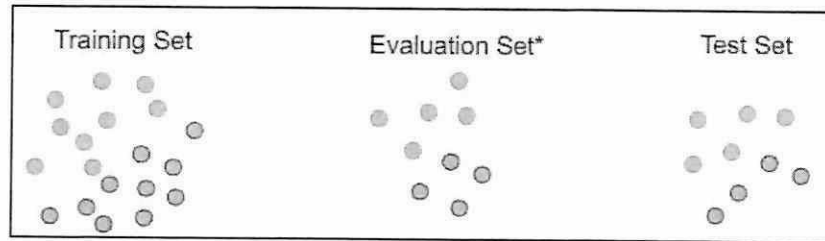
**TERBUKA**

**Q1** Dimensionality reduction aims to simplify data by reducing the number of features while preserving as much of the original information as possible.

(a) List **TWO (2)** techniques for dimensionality reduction. (4 marks)

(b) Discuss **ONE (1)** similarity and **ONE (1)** difference between dimensionality reduction and feature selection. (8 marks)

**Q2** Based on **Figure Q2**, answer **Q2(a) – Q2(b)**.



**Figure Q2**

(a) Write the role of each set. (12 marks)

(b) Suggest **TWO (2)** proportions for data partition that can be used in a Machine Learning model. (6 marks)

**Q3** Consider a dataset with 100 observations and 6 features, where the target variable is a binary value representing whether a customer is likely to purchase a product or not. You want to use a Random Forest algorithm to make a prediction. You decide to use 5 decision trees in the ensemble model.

(a) Calculate the bootstrap samples used for each tree. (5 marks)

(b) Calculate the total predictions made by the ensemble model. (5 marks)

- Q4 (a) Illustrate and explain the concept of margin, separating hyperplane and support vectors in **Figure Q4(a)**.

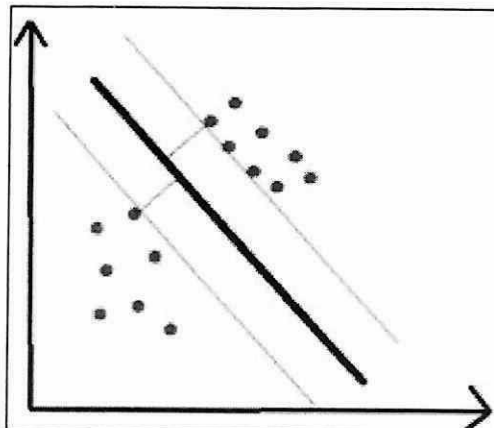


Figure Q4 (a)

(12 marks)

- (b) Suppose you are given two different SVM classifiers with different separating hyperplanes, as shown in **Figure Q4(b)(i)** and **Figure Q4(b)(ii)**. Compare and explain which hyperplane would do better for classifying the data.

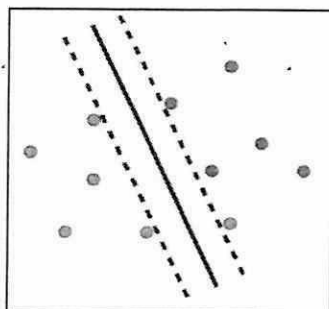


Figure Q4(b)(i)

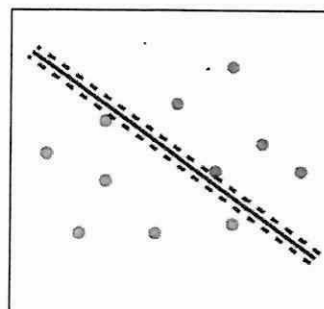


Figure Q4(b)(ii)

(10 marks)

Q5 Figure Q5 shows the architecture of a Convolutional Neural Network. Discuss the role of these layers:

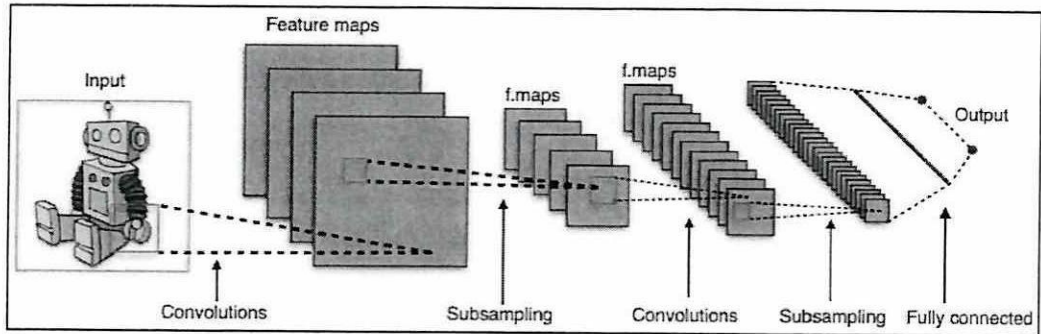


Figure Q5

(a) Subsampling layer.

(6 marks)

(b) Convolutional layer.

(6 marks)

(c) Fully-Connected layer.

(6 marks)

Q6 The e-commerce and streaming services shown in Figure Q6 use a combination of content-based and collaborative filtering algorithms for their product recommendation. Based on Figure Q6, answer Q6(a)-Q6(b).

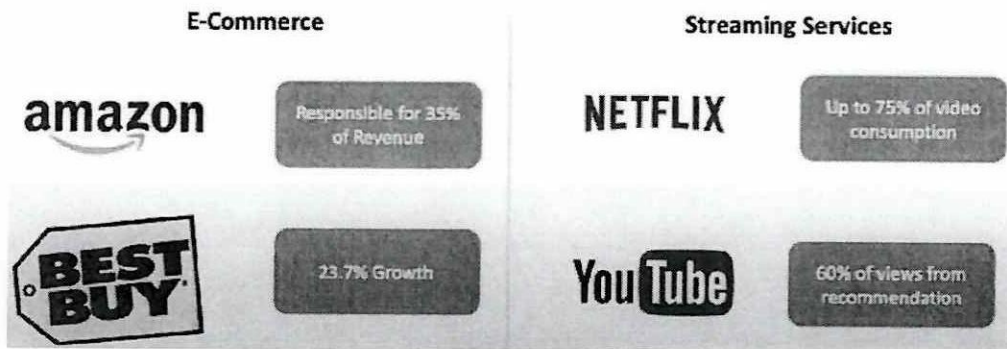


Figure Q9

(a) Choose **ONE (1)** from the e-commerce or streaming services in Figure Q9. Write and discuss how Machine Learning algorithms are used to help their business in product or system recommendation.

(10 marks)

(b) Differentiate between content-based and collaborative filtering algorithms in product recommendation.

(10 marks)

-END OF QUESTIONS-

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