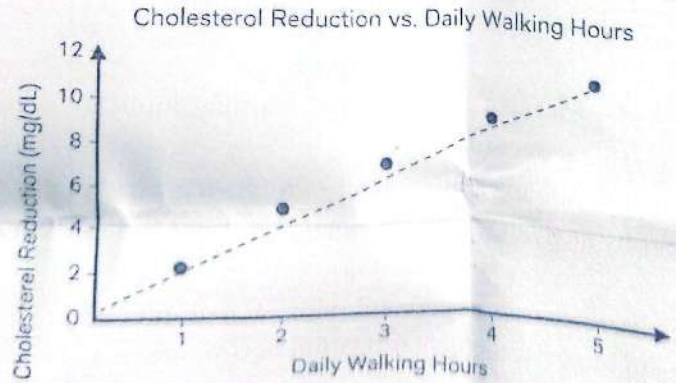
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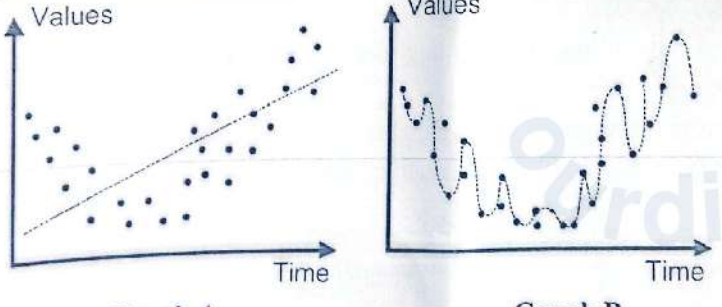
Daffodil International University
Faculty of Science & Information Technology
Department of Software Engineering
Midterm Examination, Spring 2026
Course Code: SE 544; Course Title: Introduction to Machine Learning
Sections & Teachers: (A,C,D)(ZH); (B,G,H)(FA); (E,F,I,K)(MSA); (J,L,M)(NAJ); N(FF)
Time: 1:30 Hours — Marks: 25

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	A hospital is developing an intelligent healthcare analytics system to improve patient care and operational efficiency. The system includes a model trained using labeled patient data to predict whether a patient is at risk of developing diabetes. Another component of the system processes unlabeled patient data to automatically group patients based on similar symptoms and lifestyle patterns. Additionally, the hospital deploys an autonomous medical robot that learns optimal routes and actions within the hospital environment by interacting with its surroundings and receiving feedback in the form of rewards or penalties. **(a) Identify** the appropriate type of machine learning used in each component of the system described above. **(b) Compare** these learning approaches in terms of data requirements, learning process, and application objectives, using relevant healthcare examples.	[Marks- 2+3 = 5]	CO-1 *Level-4*
2.	 Graph: Cholesterol reduction measured after one month of lifestyle intervention for five hospital patients walking 1 to 5 hours per day.	[Marks- 5 +5 = 10]	CO-2 *Level-5*

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	a) Using a linear regression model, **predict** cholesterol reduction for all five patients and for a new patient who walks 4.5 hours per day. Briefly interpret the meaning of the regression coefficients in this healthcare context.		
	b) Using the actual cholesterol reduction values and the predicted values from part (a), **calculate** the MSE, MAE, RMSE, and the coefficient of determination, and briefly **interpret** these metrics to comment on the performance of your regression model.		
3.	A machine learning model was developed to classify chest X-ray images as either Pneumonia or Healthy. The model was tested on a dataset of 810 images, where 678 images were Healthy and 132 images were Pneumonia. Out of the Healthy images, the model correctly classified 665 images, while for Pneumonia, it only correctly identified 38 images, misclassifying the remaining 94 Pneumonia cases as Healthy. Analyze the performance of this model by constructing the Confusion Matrix based on the given results. **Compute** the Precision and Recall for the Pneumonia class and interpret their significance in this medical diagnosis scenario. Considering the high number of misclassified Pneumonia cases, critically evaluate which type of error (false positive or false negative) is more critical in this case. **Justify** your reasoning by discussing the potential consequences of each type of error in a real-world healthcare setting.	[Marks-5]	CO-3 *Level-3*
4.	 **Graph A** **Graph B** The figure above shows the performance of two machine learning models (Graph A and Graph B) during training over time. **(a) Identify** which graph represents overfitting and which represents underfitting. Justify your answer by analyzing the pattern and behavior of the data points. **(b) Explain** the bias–variance characteristics associated with each graph and recommend suitable techniques to improve the generalization performance of both models.	[Marks-2+3 = 5]	CO-4 *Level-4*