BINUS University

Academic Career: ~~***Undergraduate***~~ ***/ Master /*** ~~***Doctoral***~~ ****)***			**Class Program:** ~~***International***~~***/Regular/Smart*** ~~***Program/Global Class***~~****)***		
☐ **Mid Exam** ☑ **Final Exam** ☐ **Short Term Exam** ☐ **Others Exam : _____**			**Term :** ~~**Odd**~~**/Even/**~~**Short**~~ ***)**		
☑ **Kemanggisan** ☐ **Alam Sutera** ☐ **Bekasi** ☐ **Senayan** ☐ **Bandung** ☐ **Malang**			**Academic Year :** **2021 / 2022**		
Faculty / Dept.	:	BGP / MTI	Deadline	Day / Date	: Monday, 30 May 2022
				Time	: Pk 13.00
Code - Course	:	COMP8039041 – Selected Topics in Computational Intelligence II	Class		: LTY2, LTZ2
Lecturer	:	Team Teaching	Exam Type		: Take Home Exam
*) *Strikethrough the unnecessary items*					
The penalty for CHEATING is DROP OUT!!!					

1. [40%] Case: Simulated Annealing and Genetic Algorithm

Given the following function:

$$f(x) = 5x^2 - (1 - x)^2 - 5$$

Find its global minimum value and the point (x, y) that produces it using **Simulated Annealing** and **Genetic Algorithm**. You can use any library or publicly available code to implement it (please cite the source if you do). Alternatively, you may create your own program. Conduct a number of experiments by tuning its hyperparameters in order to achieve the most optimum result you can get. Please be careful in defining the decision space (search space). Otherwise, you might end up getting result that is far away from optimum. Compare and analyze the results produced by the two algorithms. Submit the code along with your explanation regarding the code and the experimental results, along with your analysis and conclusions. *(Code without explanation and analysis won't get full mark even if the code produces the correct answer)*

2. [10%] Essay: Artificial Neural Network

Artificial Neural Network (ANN) can be used for classification and regression. Describe a number of aspects that highlight the architectural differences between ANN used for classification and that used for regression!

3. [35%] Case: Cluster Analysis Using Fuzzy C-Means

Verified by,

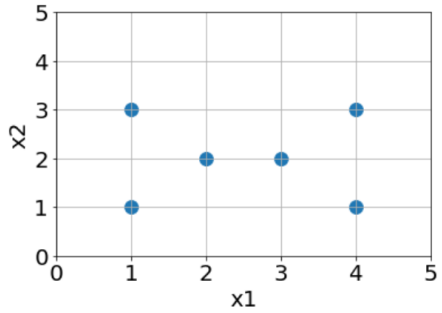
Dr. Eng. Antoni Wibowo, S.Si., M.Kom., M.Eng (D5664) and sent to Department/Program on April 26, 2022

You are given a dataset obtained from the results of measurements of alcohol in five different concentrations passed through the two-channel QCM sensors, so the dataset has 10 attributes. The dataset can be accessed via the address: https://archive.ics.uci.edu/ml/machine-learning-databases/00496/QCM%20Sensor%20Alcohol%20Dataset.zip. The dataset consist of 5 types of dataset: QCM3, QCM6, QCM7, QCM10, and QCM12. In each of dataset, there is alcohol classification of five types: 1-octanol, 1-propanol, 2-butanol, 2-propanol, 1-isobutanol. Based on this data, can the sensor be used to identify the five types of alcohol even though they are at different concentrations? For this purpose, you are asked to perform a cluster analysis using fuzzy c-means (FCM). Write down your codes in Jupyter Notebook or Google Colab along with its explanation. You may employ the relevant Libraries. Try your best to do clustering parameter tuning to find the best clustering result. Evaluate the results of the clustering by performing cluster validity, using silhouette plots, purity index, estimating the number of clusters with the appropriate method, and PCA for visualization of data distribution. Report your experimental, perform analysis on them, and withdraw some relevant **conclusions**.

4. **[15%] Case: Clustering Using Genetic Algorithm**

Observe thoroughly unlabeled data points as in the figure below.

If the genetic algorithm (GA) is used for clustering the data into 3 clusters: (a) write the initial centroids in the representation of a chromosome; (b) Select the best solutions (with the highest fitness values) as parents. You can calculate the fitness value using the objective function as k-Means.



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