

# AIN SHAMS UNIVERSITY FACULTY OF ENGINEERING

Specialized Credit Hours Engineering Programs  
Mechatronics Engineering Program



Midterm – Fall 2022

Course Code: CSE473

Time allowed: 60 mins.

## Computational Intelligence

The Exam Consists of **THREE** Questions in **ONE** Pages.

Maximum Marks: 20 Marks 1 / 1

### Important Rules:

- Having a "turned ON" mobiles inside the examination hall is forbidden and is considered as a cheating behavior. If you should have your mobile with you, it must be turned off in your own bag.
- Any kind of devices with wired/wireless connectivity is forbidden.
- It is forbidden to have any materials even if it is not related to the exam content with you in the examination hall.
- Clarify your answer with all data, sketches, and annotations.

### تعليمات هامة

- حيازة التليفون المحمول مفتوحاً داخل لجنة الامتحان يعتبر حالة غش تستوجب العقاب وإذا كان ضرورياً الدخول بالمحمول فيوضع مغلق في الحقيبة.
- لا يسمح بدخول الأجهزة أو الملحقات ذات خاصية الإتصال السلكي/اللاسلكي.
- لا يسمح بدخول أي كتب أو ملازم أو أوراق داخل اللجنة والمخالفة تعتبر حالة غش.
- وضح جميع إجابتك بذكر كافة المعلومات والأبعاد اللازمة.

### Try All Questions and Assume Any Missing Information

#### Question 1:

[7 Marks]

- a- Find the max and the min of  $f(x, y, z) = x + y + z^2$  subject to  $x^2 + y^2 + z^2 = 1$  and  $y = 0$ .
- b- Starting from initial point  $P_0 = (0, 0)$ , Minimize the following function using Newton's method
- $$f(x, y) = x^2 + 6xy - 2y^3 + 24y$$
- Do at least two iterations.

#### Question 2:

[8 Marks]

Given an eight labelled vectors data set shown in the opposite table: -

- a- Use the least squares closed form regression problem solution to estimate the parameters of a linear classifier. You must visualize the classification boundary. How much is the accuracy?
- b- Use the gradient descent optimization, estimate the parameters of a linear classifier system. You must visualize the steady state classification boundary.

i	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	y
1	-1	-1	-1	-1
2	+1	-1	-1	-1
3	-1	+1	-1	-1
4	+1	+1	-1	-1
5	-1	-1	+1	-1
6	+1	-1	+1	-1
7	-1	+1	+1	-1
8	+1	+1	+1	+1

#### Question 3:

[5 Marks]

Find and derive the closed form solution that fits the following polynomial function on a data set of labelled 2D vectors in a regression problem assuming a suitable regularization strategy: -

$$y = \sum_{i=0}^2 \sum_{j=0}^2 a_i a_j x_1^i x_2^j.$$

END of Exam, Good Luck

Examination Committee

Prof. Dr. Hossam Abdelmunim, Computer & Systems  
Engineering Department.

Exam. Date : 25<sup>th</sup> of Nov, 2022