

ASSESSMENT HANDOUT

Portfolio of Exercises 2



MODULE CODE	CCS1100
MODULE TITLE	Continuous Mathematical Foundations
PROGRAMME	Bsc (Hons) in Computer Science
DEPARTMENT	Computer Science
CREDITS	10
STAGE OF STUDY	1
SEMESTER/SESSION	Fall 2021-2022
LOCATION	Thessaloniki
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STAFF OFFICE	7th floor
ACCREDITATION	The programme is accredited: the British Computer Society



ASSESSMENT NUMBER	2
CONTRIBUTION	10% of the module final mark
ASSESSMENT TITLE	Portfolio of Exercises 2
ASSESSMENT TYPE	Portfolio
HAND-OUT DATE	Week 9: 6/12/2021
SUBMISSION DATE	Week 10: 18/12/2021
FEEDBACK DATE	Week 11: 25/11/2021

LEARNING OUTCOMES	
LO1	Convert problems into matrix form and apply relevant solution techniques. Apply derivatives in calculating rates of change.
LO2	Apply derivatives in calculating rates of change.
LO4	Explain the relationship of calculus with computer science.

ASSESSMENT CRITERIA
<p>The criteria on which the students will be assessed are as follows:</p> <ul style="list-style-type: none"> ● Comprehensiveness and clear understanding of the main theoretical perspectives and empirical methodologies employed in the relevant literature. ● Ability to use techniques and formulas from calculus and linear algebra in applied problems. ● Ability to solve algebraic problems within a computational programming environment.

DETAILED DESCRIPTION

Please provide solutions for the following exercises:

1. For an A matrix of dimension 500x500 and elements

$$a_{ij} = \begin{cases} 2i^2 & \text{for } i=j \\ 2i+1 & \text{for } i=j-1 \\ 2i-1 & \text{for } i=j+1 \\ 0 & \text{else} \end{cases}$$

provide the first 10x10 values of its inverse and its first 10 eigenvalues. **(20/100)**

2. Calculate the following limits. **(20/100)**

a. $\lim_{x \rightarrow 4} \sqrt{x}$

b. $\lim_{x \rightarrow \infty} \frac{x^{100} - x^{40}}{x^{30} - x^6}$

c. $\lim_{x \rightarrow \infty} \frac{x^e - x^\pi}{x^{2\sqrt{2}} - x^6}$

d. $\lim_{x \rightarrow \infty} \frac{e^{2x} + 1000}{x^3 - x^6}$

e. $\lim_{x \rightarrow \infty} \frac{e^{-x}}{x}$

3. Calculate the derivatives of the following functions (20/100)

a. $f(x) = x^{1000} + x^{-1000}$

b. $f(x) = xe^x + x^2 \log(x)$

c. $f(x) = \log(\log(x))$

d. $f(x) = \frac{x^\pi}{\sin(x)}$

e. $f(x) = \log(\log(\log(\log(x))))^2$

4. Check if the direct calculation of the limit

$$\lim_{n \rightarrow \infty} \frac{n}{\sum C(n, k)}$$

returns an indeterminate form. Use the formula

$$\sum C(n, k) = 2^n$$

in order to solve it. **(20/100)**

5. The life span of a hard disk can be described by the exponential distribution $\text{Exp}(\lambda)$. If for a model we have the following observations about its life span in years,
2.5, 5.1, 2.1, 1.8, 0.8, 1.1, 3.9, 1.2, 3.3, 2.2,
estimate the distribution parameter λ by the value that maximizes the likelihood for this sample and make inference about the estimated life span using the distribution mean. (life spans among devices are considered to be independent). **(20/100)**

SUBMISSION

Students are expected to submit:

- to Turnitin, by 18-12-2021, 21:00.

Late Submission Policy: All work submitted late, without an approved claim of extension or exceptional circumstances, will result in a 10 marks reduction for each day that the work is late, up to a total of five days, including weekends and bank holidays.

NOTE

This piece of assessment should be completed and submitted by the student (or group of students in group work) without assistance from or communication with another person either external or fellow student (outside the group). All sentences or passages cited in the assignment from other people's work should be specifically acknowledged by complete and accurate reference to the author, work and page(s). Failure to abide by the above regulation constitutes use of unfair means (collusion, plagiarism etc.) and will result in a fail mark for this work. It might also invoke disciplinary actions. It is at the instructor's discretion to conduct an oral examination, which will result in the award of the final grade for that particular piece of assessment.

TURN IT IN REQUIREMENT

This piece of assessment is required to be submitted to **turnitin** plagiarism detection software at:

www.turnitin.com

at a date no later than the submission date. This is an absolute requirement for releasing a mark. Brief instructions on how you can set up your profile and submit your work can be found at:

<https://help.turnitin.com/feedback-studio/turnitin-website/student/student-category.htm> (text)

<https://youtu.be/AC3GB-FOMvY> (video)

You are going to require:

CLASS ID:	32213954	ENROLLMENT PASSWORD:	m2wytgr
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If you have any problems in submitting your work, please contact the course administrator or the module leader.