Neuroengineering 2022-2023

June 14th 2023

Part II

How to submit your answers.

Most answers can be typed in the Exam.net editor.
Write the answers in the same sequence as the questions (A1, A2, …) and write the same headers as the test on a separate line just above your answer, e.g.:

> Problem
> A1
> *<your answer to question A1 goes here>*
> A2
> *<your answer to question A2 goes here>*
> …

Textual answers must be typed in the editor. When graphical elements are required in the answer, the latter can be written on paper and scanned using your mobile phone at the end of the exam.

Keep your answers tidy. Messy, hard-to-read answers may penalize your mark.

The maximum total score for part II is **7**.

A: To evaluate the outcome of a motor rehabilitation intervention on a post-stroke patient, she is subjected to two sessions of **neurophysiological (EEG) assessment**: one immediately before (**PRE**) and one immediately after (**POST**) the rehabilitative intervention (Fig. 1). **Five cortical regions** are selected for a connectivity study of **causality in the statistical sense**. The goal is to understand if the **brain organization** has changed after the rehabilitation.

Fig. 1 – Temporal organization of the study

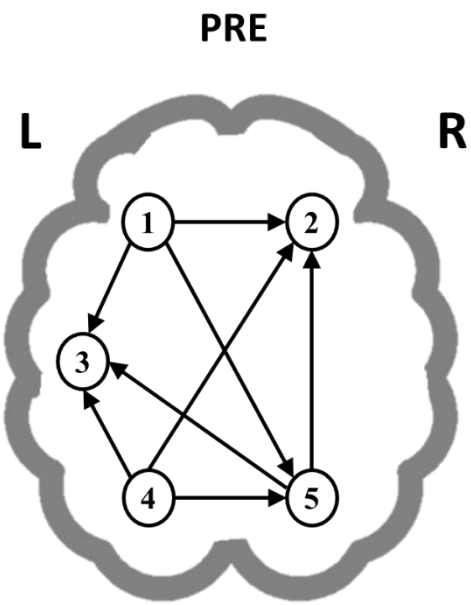

Fig. 2-A

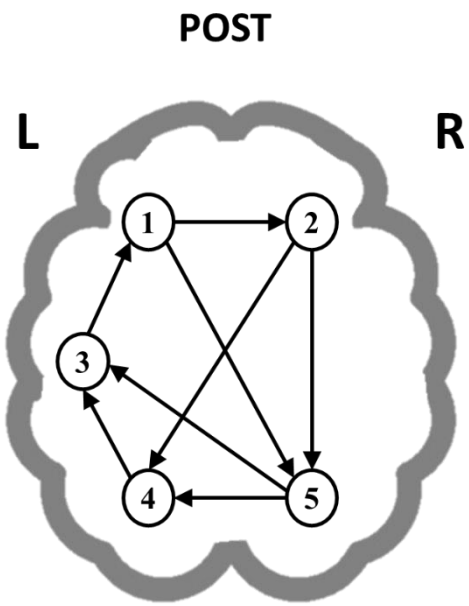

Fig. 2-B

Questions *(unless otherwise specified, write the answer in the exam.net editor)*

A1. Given the functional connectivity networks obtained for the two sessions, as reported in **Fig. 2-A** and **Fig. 2-B:**

A1.1. Compute the **Global Efficiency** for each of the two graphs *(3 points) (write the answer on paper and scan the solution)*

A1.2. Comment on the results obtained at point A1.1 and indicate if the **efficiency of the communications** in the network is **changed** between the two sessions and **how**. (1 *point*)

B. Problem

The EEG signal of an experimental subject is recorded from 32 channels, monopolar montage. The recording lasts 30 seconds and is sampled at $200\ samples/s$. The analysis necessary to interpret the neurophysiological phenomena object of the study requires that the EEG spectrum estimate has a frequency resolution of at least $0.5\ Hz$

Questions

B1. What signal processing method would you choose to comply with the specifications? *(1 point)* *(state only the name of the method)*

B2. Does the selected method have one or more parameter(s) to be assigned? If yes, what value would you assign to each of them? *(2 points)*
(write one parameter per line. State the name followed by the value)

(End of the test)