UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO INTERUNIVERSITARIO DI FISICA

General information	
Academic subject	Computing Technologies
Degree course	Physics
Academic Year	1
European Credit Transfer and Accumulation System (ECTS)	6
Language	English
Academic calendar (starting and ending date)	II semester
Attendance	Recommended

Professor/ Lecturer	
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Department and address	Dipartimento Interateneo di Fisica “Merlin”, Campus Universitario, Via Orabona, 4, Palazzina ReCaS
Virtual headquarters (Microsoft Teams code)	
Tutoring (time and day)	Monday (on request)

Syllabus	
Learning Objectives	Basic elements of computing theory and scientific computing, principles of Grid computing, computing for the LHC experiments and other applications of the Grid, Cloud computing, Big Data processing/handling. **Knowledge and understanding** Knowledge of the basic aspects of the scientific computing, in particular those connected to some specific applications in physics and the most widely used models (Grid and Cloud computing, Big Data handling) **Knowledge and understanding skills applied** ability to perform raw estimates of the computing power needs for some specific applications in the scientific computing **Autonomy of judgment** Ability to perform evaluations and rating of different solutions and models with respect to their capability to solve specific problems of scientific computing in physics . **Communication skills** Communication skills in Italian/English; specific ability in the presentation and dissemination of knowledge with appropriate scientific language; general ability to work in a group, and to be inserted quickly and effectively in the workplace; communication skills based on the specific terminology used in the field of scientific computing.
Course prerequisites	Basics of the computing theory, including concepts connected to the common usage of the computing machines.
Contents	1. Il calcolatore (Memoria, modello di Von Neumann, Tassonomia di Flynn, etc) 2. Principi di calcolo distribuito e ambiti di applicazione 3. Cluster Beowulf ed esempi di batch system reali (HTCondor) 4. Differenza fra Calcolo HTC e HPC 5. Concetti di sicurezza e crittografia 6. Principi di Grid computing (middleware, infrastruttura WLCG, etc) 7. Esempi di modelli di calcolo dei principali esperimenti LHC 8. Principi di Cloud Computing (virtualizzazione, paradigmi IaaS, PaaS, SaaS, cloud storage, etc) 9. Framework per il calcolo distribuito Big Data (Apache Spark, Apache Hadoop, MapReduce) Data center multi-disciplinari per calcolo scientifico: l’esempio di ReCaS Bari
Books and bibliography	Slides and references provided by the teacher.
Additional materials	

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
52	42	10	80
ECTS			

	5	1	

Teaching strategy	
	Lectures with slide presentations by the teacher, hand-on laboratory, and a final visit to the ReCaS Bari computing data center.

Expected learning outcomes	
Knowledge and understanding on:	Knowledge of the basic aspects of the scientific computing, in particular those connected to some specific applications in physics and the most widely used models (Grid and Cloud computing, Big Data handling)
Applying knowledge and understanding on:	ability to perform raw estimates of the computing power needs for some specific applications in the scientific computing

Soft skills	• **Making informed judgments and choices**
	  ○ Judge the value of acquired knowledge.
	  ○ Establish evaluation criteria and standards, both quantitative and qualitative
	  ○ Compare, contrast, distinguish, describe novel computing technologies and their possible usage in data analysis problems
	• **Communicating knowledge and understanding**
	  ○ Grasp communication accurately, become able to adopt different forms of presentation
	  ○ Master technological and science communication
	  ○ Make examples that are not misleading and foster technological understanding
	• **Capacities to continue learning**
	  ○ Summarize the acquired knowledge and identify central meaning and crucial points
	  ○ Continuously update technological knowledge.

Assessment and feedback	
Methods of assessment	Oral examination (100 %)

Evaluation criteria	• **Knowledge and understanding**
	  ○ Knowledge of the principles of computing technologies and their application to data analysis
	• **Applying knowledge and understanding**
	  ○ Applying the knowledge acquired during the course to solve scientific and more in general data analysis problems.
	• **Autonomy of judgment**
	  ○ Ability to understand which computing technology could be better solving scientific problems in the context of data analysis.
	• **Communicating knowledge and understanding**
	  ○ Clarity and precision of presentation
	• **Communication skills**
	  ○ Ability to identify interconnection between the subjects of study
	• **Capacities to continue learning**
	  ○ Ability to identify interconnection between the subjects of study

Criteria for assessment and attribution of the final mark	Conciseness Rigor Reproducibility of results
Additional information	