ESCI upf.
School of International Studies

TEACHING PLAN FOR INTRODUCTION TO BIOINFORMATICS

1. Basic description

Name of the course: Introduction to Bioinformatics
Module: **Introduction to Bioinformatics**
Academic year: 2018/2019
Year: 2018
Term: First
Degree / Course: First
Code: 51101
Number of credits: 6
Total number of hours committed: 150
Teaching language: English
Lecturer: Mireia Olivella, Ferran Sanz, Hafid Laayouni.
Timetable: See official calendar

2. Presentation of the course

This is a general Introduction to the field of Bioinformatics and to the word of the University. It has three different parts,

1. Introduction to Bioinformatics: talks given by expert of the field of Bioinformatics.

2. Introduction to the Computation and Databaes: Hands On on basic bioinformatics approaches and bash and python scripting.

3. Introduction to Data Analysis and Probability.

3. Competences to be worked in the course

General competences	Specific competences
CB1, CB3, CB4, CB5, CG1	CE7, CE8, CE9

I. General competences

CB1. That the students have demonstrated to have acquired the knowledge and understanding in a field of study that starts from the basis of general secondary education, and is typically at a level that although it is supported by advanced textbooks, includes some aspects that involve knowledge of the forefront of their field of study.

CB3. That the students have the ability to gather and interpret relevant data (usually within their field of study) to make judgments that include reflection on relevant social, scientific or ethical subjects.

CB4. That the students can convey information, ideas, problems and solutions to both specialist and non-specialist audiences.

CB5. That the students have developed those skills needed to undertake further studies with a high degree of autonomy.

II. Specific competences

CE7. To demonstrate knowledge, skills and appropriate practices in the area of the biology of organisms and biosystems.

CE8. To identify meaningful and reliable sources of scientific information to substantiate the state of arts of a bioinformatic problem and to address its resolution.

CE9. To apply statistical and computational methods to solve problems in the fields of molecular biology, genomics and medical research and population genetics

Learning outcomes

RA7.1. Describe models of evolution within and between species, and use the necessary tools for the study of molecular evolution.

RA7.2. Enumerate the evolutionary history of the human lineage from its relationship with other primates to the emergence of anatomically modern humans and their adaptation to different environments.

RA8.1. Use efficiently specific search tools and resources from databases and information related to biomedicine and bioinformatics.

RA8.2. Quote valid sources of scientific information to support the state of the arts of a bioinformatic problem.

RA9.1. Identify and use appropriate statistical methods to each type of data.

RA9.2. Use the appropriate methods for complex data, with an emphasis on dimensionality reduction approximations.

4. Contents

This subject will have three different parts:

1. Introduction to Bioinformatics (talks given by expert of the field of Bioinformatics). Seminars tend to deal with the current state of the art, areas of knowledge and challenges in the professional and productive field of bioinformatics. Basic and applied fields of research relevant to the context of bioinformatics and biomedicine. Seminars include some of following subjects

   - Big Data analysis
   - Clinical Data analysis
   - Bioinformatics in pharma
   - Evolutionary Genomics
   - Genomic Medicine
   - Agrogenomics
   - Business around bioinformatics
   - Systems and networks biology.
   - Genetic Epidemiology

   Responsible: Hafid Laayouni

2. Introduction to Bioinformatics (Hands-on sessions on Introductory Bioinformatics)
   Students will be challenged to solve biological problems combining information found in biological databases, basic bioinformatics approaches and bash and python scripting.

   The main databases and bioinformatics tools will cover:
   - PubMed. Mendeley.
   - Reference Sequence. Uniprot Database. SNPdb. Gene Ontology. OMIM
   - UCSC Genome Browser.
   - Sequence Alignments in Bioinformatics. Pairwise sequence alignments. Dot Plots. Local vs Global. Blast. Multiple Sequence Alignments.

Responsible: Mireia Olivella

3. Introduction to Data Analysis

Theme 1: Introduction. The nature and impact of variability in biological data. Observational studies and experiments. Random sampling.
Theme 2: Description of distributions. Frequency distributions, descriptive statistics, the concept of population versus sample.
Theme 3: Probability and the binomial distribution. The normal distribution.
Theme 4: Sampling distributions.
Theme 5: Confidence intervals for a single mean and for a difference in means.

Responsible: Hafid Laayouni

5. Assessment

Assessment of the three modules is independent and students must pass each part separately to pass the whole subject.

Part I

This part consists of a weekly lecture on a relevant issue related to Bioinformatics. After each conference will be time for discussion. This is a subject that should made a strong impact: a series of 5-8 lectures given by recognized specialists. After each session, each student will do a short (maximum of 600 characters with spaces) abstract that will deliver within one week. The abstract must summarize the key points of the talk. The file is in pdf format and will be delivered through a ESCI-UPF Module with the title: SEMxx-surname, where xx is the number of seminar (01, 02, 10 ...) and last name is the name of the student.

Participation in the seminars is a key objective of the course. Given the number of students, a turn of participation will be set at random and previously communicated to students. Students who have done their question should send everyone to the ESCI-UPF Module a file explaining the question asked and when possible response received by the speaker. If there are opportunities to do more of the questions assigned, students who wish can do so. These additional participations will also be taken into account in the final mark.

This part does not include any re-evaluation exam as all the scores are based on the continuous assessment.

Part II

Assessment of this part will consist in a final practical exam. The students will have to solve a biological problem using basic bioinformatics tools.

Part III

The competencies of this module will be evaluated by continuous assessment, including written, practical examinations and individual work.
Theory
Evaluation by two partial tests. The first part will weigh 20% -40% and the second part will weigh 30% -50%. The final test is aimed at students who have

not passed the partial tests and the weight in the final grade is no more than 70%.

Seminars: evaluating problems section is carried out by

- Making Short problems in the classroom, these tests last approximately 25 minutes
- Delivery of answers before resolution in class. Delivery can be made by sending the work to module or in paper before class problem-solving of the first group (regardless of the group to which the student belongs).

This section represents represent 10%-15% of the final grade for the course.

Hands On: the evaluation of this section is carried out by a practical test at the computer lab in one to two hour session. In this exam session, the student must use the appropriate statistical program, enter the data of a study, propose an analysis of it and answer specific questions. The weight of this test is about 10% to 20% of the final grade of the course.

The average grade for the course is calculated by weighting coefficients for each section (theory, problems and practices). However, a minimum score of 4 in the second partial test or recovery test is required to calculate the average final grade.

Students who have passed the module by partial assessments and would like to improve their final note, could take the recuperation test. Students who take part of recuperation exam to increase their marks renounce to the mark obtained in the partial exams.

Students who have not participated in the continuous assessment and delivery of work problems may be evaluated by the final test. Also, their final grade cannot exceed 70% of the maximum score.

It is necessary to obtain a final grade equal to or greater than 5 to pass the subject, by partial recovery or testing, in any case weighing with problems and practices work.

It is considered that a student has the qualification of "not evaluable" when the number of evaluation activities is less than 50% of those scheduled for the course.

Students who repeat the course must carry out all assessment activities including delivery of problems and evaluation of the practical test.
Copy in any exam or plagiarism in the essay implies failing the course.

Extraordinary exam will take place according to the schedule fixed by the Degree Coordination. Failure to attend this exam implies student will keep his initial score.

Assessment elements	Time period	Type of assessment		Assessment agent			Type of activity	Grouping		Weight (%)
		Compulsory	Optional	Lecturer	Self-assess	Co-assess		Indiv	Group (#)	
Delivery of abstracts (part I)	Approximately weekly sessions	x		x			Conceptual and pursuit of the subject	x		15
Participation in lectures, questions and comments (part I)	After each talk session	x		x				x		10
Evaluation part II	Exam	x		x			Conceptual and pursuit of the subject		x	30
Evaluation I, part III,	Exam schedule Mid second term	x		x			Synthesis	x		45

Working competences and assessment of learning outcomes:

	CB1	CB3	CB4	CB5	CE7	CE8	CE9
Delivery of abstracts	x	x	x	x	x	x	x
Participation in lectures	x	x	x	x	x	x	x
Evaluation I	x	x	x	x	x	x	x
Evaluation II	x	x	x	x	x	x	x

6. Bibliography and teaching resources

- Basic bibliography
  - Biomedical informatics: computer applications in health care and biomedicine. New York, NY : Springer, cop. 2006
  - M.L. Samuel, J.A. Witmer, A. Shaffner. Statistics for the life Sciences.

- Teaching resources
  - Lecture notes: Slides will be made available before the classes.
  - Exercise lists (part 3).
  - Tutorials for practical sessions (part 3)
    - https://www.otexts.org/book/biostat
    - http://onlinestatbook.com/
    - http://www.biostathandbook.com/
    -

7. Methodology

The workload of the course amounts to 300 hours. It is recommended that students follow the work plan outlaid in section 8 of this document. Work is divided into 3 types of activities: those developed in class (plenary, seminar and practical sessions), directed work (assignments) and autonomous work.

a) Plenary lessons: sessions where the teacher introduces and explains the course contents defined in the previous section. Plenary sessions of part I consist of talks given by expert of the field. Plenary lessons of part II and III include definitions, introduction to the most relevant methodologies.
b) Seminar sessions: In the seminar sessions will take place control tests on the exercise lists. Correction of lists of exercises. Discussion of results and explanation.
c) Part II will combine the explanation of some contents followed by practical sessions

8. Scheduling activities

Week	Activity in the classroom Grouping/type of activity	Activity outside the classroom Grouping/type of activity
Week 1 18/9	Introduction session: Objectives of the course. Syllabus presentation. Grading policy. Class dynamics. Introduction to Bioinformatics. First Talk 1. Students discussion and questions	abstract
Week 1 19/9 or 21/9	Hands on session 1.	
Week 2 27/9	Talk 2. Students discussion and questions	abstract
Week 3 4/10 or 5/10	Hands on session 2	
Week 3 2/10	Risk prevention laboratory	
Week 3 2/10	Talk 3. Students discussion and questions	abstract
Week 4 11/10	Hands on session 3.	
Week 4 9/10,10/10,11/10	Talk 4, 5 and 6. Students discussion and questions	abstract
Week 6 24/10	Hands on session 4.	
Week 6 26/10	Talk 7. Students discussion and questions	abstract
	Library?	
Week 7 30 and 31/10	Hands on session 5 and 6.	
Week 8 9/11 and 10/11	Talk 7 and 8. Students discussion and questions	abstract
Week 9 13/11	Talk 9. Students discussion and questions	abstract
Week 9 14/11	Hands on session 7	
Week 10 22/11	Talk 10. Students discussion and questions	abstract
Week 10 20/11	Hands on session 8	
Week final exams		Exam (Part 2)

La còpia i/o plagi total o parcial als treballs i/o exàmens comportarà suspendre l'assignatura amb una qualificació de zero sense dret a recuperació, sense perjudici de l'aplicació de les altres sancions previstes al Reglament de Règim disciplinari dels estudiants de la Universitat Pompeu Fabra en funció de la gravetat de la infracció.

La copia y/o plagio total o parcial en los Trabajos y/o exámenes comportará suspender la asignatura con una calificación de cero sin derecho a recuperación, sin perjuicio de la aplicación de las otras sanciones previstas en el Reglamento de Régimen disciplinario de los estudiantes de la Universitat Pompeu Fabra en función de la gravedad de la infracción.

Total or partial copy and/or plagiarism will imply a failure in the subject with a final grade of zero points and no access to the make-up exam. According to the academic regulations specified in the Disciplinary rules for students of Universitat Pompeu Fabra, other additional sanctions may apply depending on the seriousness of the offence.