GHENT UNIVERSITY

Course Specifications

From the academic year 2021-2022 up to and including the academic year

Networks in Socio-Economic Systems (F000920)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0	**Study time 180 h**	**Contact hrs**	45.0h

Course offerings and teaching methods in academic year 2022-2023

A (semester 2)	English	Gent	online lecture	0.0h
			lecture	15.0h
			online seminar: practical PC room classes	0.0h
			seminar: practical PC room classes	30.0h

Lecturers in academic year 2022-2023

Correa da Rocha, Luis Enrique	EB21	lecturer-in-charge

Offered in the following programmes in 2022-2023	**crdts**	**offering**
Master of Science in Business Economics (main subject Accountancy)	6	A
Master of Science in Business Economics (main subject Corporate Finance)	6	A
Master of Science in Business Engineering(main subject Data Analytics)	6	A
Master of Science in Business Engineering(main subject Finance)	6	A
Master of Science in Business Economics (main subject Marketing)	6	A
Master of Science in Business Engineering(main subject Operations Management)	6	A
Master of Science in Economics	6	A
Exchange programme in Economics and Business Administration	6	A

Teaching languages

English

Keywords

complex systems; complexity; complex networks; social networks; human behaviour; socio-economic systems; data science; data analytics; modelling; agent-based.

Position of the course

This course introduces fundamental and state-of-the-art network science tools, and aims to guide students in the application of network modelling and analytics to real-world data to study socio-economic problems from a system's perspective, e.g. social and communication networks, interbank lending, trade and transportation networks, innovation, collaboration, opinions, migration, mobility, among others.

Contents

The course covers a spectrum of network data modelling and analytic quantitative techniques relevant to study socio-economic systems. The course is divided in three parts.

Part 1. Fundamentals of Network Science.
This part introduces elementary mathematical and computational network methods and concepts such as network modelling, data representation, and network visualisation. It also introduces elementary algorithms to extract information from network data, e.g. node degree, clustering, motifs, paths, centrality, core-periphery, assortativeness.

Part 2. Processes on Networks.
This part introduces techniques to model dynamic processes on networks, as for example diffusion of information (e.g. opinions, rumours), network attacks, failures and cascades, and search on networks.

Part 3. Advanced Network Analytics.
This part introduces advanced analytic methods, e.g. page-rank, community detection, network sampling, recommendation systems.

Initial competences

Basic mathematical knowledge, computer literacy and programming skills.

Final competences

1 To identify and critically analyse socio-economic problems from a system's perspective.
2 To examine and select network methods for a particular network data analytics task.
3 To design and implement a network data analysis project using network tools in Python.
4 To organise and manage collaborative data analysis projects
5 Professionele en overtuigende data analytics rapporten, mondelinge presentaties en collegiale beoordelingen maken.

Conditions for credit contract

Access to this course unit via a credit contract is unrestricted: the student takes into consideration the conditions mentioned in 'Starting Competences'

Conditions for exam contract

Access to this course unit via an exam contract is unrestricted

Teaching methods

Online lecture, Online seminar: practical pc room classes, Lecture, Seminar: practical pc room classes

Extra information on the teaching methods

Onderzoekend leren. Lesgeven en leren zijn studentgericht en gebaseerd op sociaal constructivisme. Hoorcolleges en workshops omvatten groepswerk, en workshops omvatten begeleide zelfstudie. Journalclub, discussies, collegiale toetsing.

Learning materials and price

- M Newman (2010). Networks: An Introduction. Oxford University Press, UK. ISBN 01992066.
Available at the Ugent libraries.
- DataCamp (2019). Python tutorial.
Freely available at: http://www.learnpython.org (Accessed 14.11.2019)
- NetworkX Developers. NetworkX Documentation & Tutorial (2019)
Freely available at http://networkx.github.io/documentation/stable/ (Accessed 14.11.2019)
- Slides will be available online (Ufora)

References

- A-L Barabasi (2016). Network Science. Cambridge University Press, UK. ISBN 1107076269
- MO Jackson (2010). Social and Economic Networks. Princeton University Press, USA. ISBN 0691148201
- D Easley and J Kleinberg (2010). Networks, Crowds, and Markets: Reasoning about a Highly Connected World. Cambridge University Press, UK. ISBN 0521195330
- B Hogan (2017). Online social networks: Concepts for data collection in: The SAGE Handbook of online research methods. Sage Thousand Oaks, CA, USA.
- Google Education (2019). Introduction to Python.
Freely available at: http://developers.google.com/edu/python/ (Accessed 14.11.2019)

Course content-related study coaching

Interactive online counselling (email), individual and group support via appointment.

Assessment moments

continuous assessment

Examination methods in case of periodic assessment during the first examination period

Examination methods in case of periodic assessment during the second examination period

Examination methods in case of permanent assessment

Oral examination, Peer assessment, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

a. 1st summative assessment after the 1st part of the course (around week 7)
b. 2nd summative assessment after the 3rd part of the course (around week 15)
c. 3rd summative assessment after the 3rd part of the course (around week 15)

Final mark = a*0.5 + b*0.3 + c*0.2

1st assignment
Method: Individual report
Word length: 2500 words (without counting bibliography, 10% tolerance, plus figures)
Brief description: Each student will develop a network data analysis starting from a real-world socio-economic data set. S/he will apply network methods and make a critical analysis to get socio-economic insights from data. S/he will write a professional report containing, at least: i. a description of the data; ii. justification of chosen methods; iii. data analysis; iv. evidence-based insights. S/he must provide a Jupyter notebook with codes as appendix.

2nd assignment
Method: Group presentation
Duration: approx. 15 min presentation + approx. 10 min Q&A per group
Brief description: Students will build up on the previous assessment and in a small group will develop an advanced network data analysis using a real-world socio-economic data set. They will apply network methods and make a critical analysis to get socio-economic insights from data. They will deliver a professional presentation containing, at least: i. a description of the data; ii. justification of chosen methods; iii. data analysis; iv. evidence-based insights. The group must provide a Jupyter notebook with codes.

3rd assignment
Method: Individual peer assessment
Word length: 700 words (without counting bibliography, 10% tolerance)
Brief description: Each student will make a critical professional assessment of the presentation and network analysis of one other group.

Calculation of the examination mark

- The pass mark is 50 for all assessments.
- Active participation in the group project and presentation is mandatory. If not, individual marks can be reduced.
- Deadlines must be respected. If not, marks can be reduced.

Facilities for Working Students

Lab attendance is not mandatory. Online feedback.