201500025

Web Science

Course info

Course module	201500025	**Starting block**	1B
Credits (ECTS)	15	**Application procedure**	You apply via OSIRIS Student
Course type	Module	**Registration using OSIRIS**	Yes
Language of instruction	English		
Contact person	prof.dr. R.J. Wieringa		
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Lecturer(s)

Previous 1-5 of 9 Next 4

Lecturer	dr. R.B.N. Aly
Lecturer	dr. L. Ferreira Pires
Lecturer	dr.ir. D. Hiemstra
Lecturer	dr. W. Kern
Lecturer	C.M. Laan

Learning goals

Learning goal is to be able to recognize and explain network phenomena. Social networks such as Facebook, information networks such as the Web, institutions such as voting are all IT-enabled. The student will learn

- how to recognize and explain structural and dynamic phenomena in these networks, such as cascading behavior and power laws, and
- how to model and analyze using graph theory and game theory.

After following this module, the student is able to

- Recognize these phenomena in practice;
- Apply mathematical models from graph theory, probability, and game theory to describe and analyze them;
- Explain and predict network phenomena in terms of network structure and behavior;
- Operationalize and apply these models to existing network data.

Content

- Graphs and Social Networks

We study basic graph theory concepts such as components, triadic closure, strong and weak ties, homophily (similarity between 'friends') and positive and negative relationships. These concepts are put to work on modeling network data such as collaborations, information linkage, citation, interactions, etc. Students will be able to understand and model network data as graphs, and develop algorithms for analyzing basic graph properties of large volumes of network data (big data).

- Information Networks

Our goal is to understand the structure of information networks on the internet that emerges from citation, liking, commenting, co-authoring, connection with 'friends', hypertext linking, etc. We study properties such as reputation, authority and relevance of web pages and persons. Students will learn to model, understand, and analyze such informational properties in terms of graph theory concepts.

- Game Theory and Network Traffic

We study basic game theoretic models and concepts, such as modeling strategic behavior in normal or extensive form games, best responses, pure and mixed strategies, Nash and dominant strategy equilibria. These concepts are put to work in a network context, modeling network traffic in terms of normal form games. We specifically analyze best response dynamics, user equilibria in networks, and the effects of lack of central coordination on the social cost, also known as the price of anarchy. Students will be able to understand, model, and formally analyze the effects of strategic behavior in general, and in the context of network traffic in particular.

- Auctions and Matching Markets

Our goal is to understand how business models in the web, such as Google's ad auctions, actually work. In order to understand that, we study the basics of auction theory, including in particular first and second price auctions, and the role of game theory in order to understand strategic behavior in such contexts. As a second step, we study matching markets, the computation of market clearing prices, generalized second price auctions, and the celebrated VCG mechanism for sponsored search markets. Students will thereby learn to model and understand the rationale behind various types of auctions and mechanisms, as a basis for understanding and designing business models for the web.

- Network Dynamics – Population Models and Structural Models

We study how people connected in a network influence each other's behaviour and decisions. First we consider

Required materials

Course material

• David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World. http://www.cs.cornell.edu/home/kleinber/networks-book/

Recommended materials

Course material

Supplementary ,material made available during the module

Instructional modes

Design

Fieldwork

Final thesis (Required)

Lecture (Required)

Practical (Required)

Presentation(s) (Required)

Self study with assistance (Required)

Self study without assistance

Tests

Social network structure and dynamics

Games, auctions and voting

Projects

Exam requirements

population models which help us to understand informational (or herding) effects and direct-benefit (or network) effects in social processes, and apply this knowledge to analyze the notion of popularity. Then we consider structural models to understand diffusion of information through groups of people, as opposed to a homogeneous population, and explain the small world phenomenon. Students will learn how to model and analyze the processes by which new ideas and innovations are adopted by a population in which groups of people are connected by very short paths.

- Institutions and Aggregate Behavior

Our goal is to understand institutions such as markets and voting systems where rules and characteristics and expectations of actors affect their behavior and consequently determine aggregate behavior of the set of actors as a whole. In particular, we study prediction markets such as horse races or stock trading, markets with asymmetric information or reputation systems, as well as voting systems such as elections or televised talent shows. Students will learn to model and understand the rationale and design behind various types of institutions in terms of the aggregate behavior they produce.

Assumed previous knowledge
Mandatory:
Some experience with programming

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