



Prof. Daniele D'Angeli

May-June 2025 *PhD course*

Teoria di Grafi e Applicazioni

Il corso intende fornire la base matematica della teoria dei grafi e mostrarne alcune importanti applicazioni in differenti campi. In matematica la teoria dei grafi si propone di utilizzare oggetti discreti (chiamati per l'appunto grafi) che permettono di modellare e descrivere una grande varietà di processi in termini quantitativi e algoritmici.

In particolare, durante il corso, ci proponiamo di definire alcuni concetti fondamentali della teoria dei grafi come la matrice di adiacenza di un grafo, la sua analisi spettrale, indici topologici che catturano la struttura geometrica del grafo, grafi pesati e orientati. Questo ci permetterà di vedere alcune applicazioni di questa teoria in differenti ambiti: reti elettriche e di flusso, catene di Markov, problemi di ottimizzazione (traffico, trasporti, etc.), problema dei 4 colori.

Graph Theory and Applications

The course intends to provide the mathematical basis of graph theory and show some important applications in different fields. In mathematics, graph theory aims to use discrete objects (called graphs) that allow to model and describe a large variety of processes in quantitative and algorithmic terms.

In particular, during the course, we aim to define some fundamental concepts of graph theory such as the adjacency matrix of a graph, its spectral analysis, topological indices that capture the geometric structure of the graph, weighted and oriented graphs. This will allow us to see some applications of this theory in different fields: electrical and flow networks, Markov chains, optimization problems (traffic, transport, etc.), the four-color problem .

Schedule

The course totals 10 hours :

26-5 time 13-16

29-5 time 14,30-17,30

4-6 time 11,15-12,15

5-6 time 14,30-17,30

Instructor

Daniele D'Angeli, Associate Prof. Niccolò Cusano University.

Language

English or Italian.

Requisites

Basic calculus.

Registration

Please send an email to confirm participation to daniele.dangeli@unicusano.it. In presence participation is strongly recommended. A link for those who will be participating remotely will be provided.

Exam

The final exam will consist of a work proposed by the professor to be done individually or in a group. More information will be communicated during the course.

ECTS

Participants who will be positively evaluated in the final examination will be awarded 2 ECTS. This will be recorded in the 'diploma supplement', together with the other education activities attended during the PhD programme.