

NETWORK ALGORITHMS WELCOME!!

A.A. 2014/15

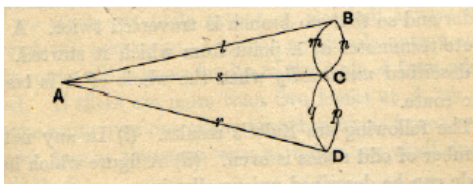
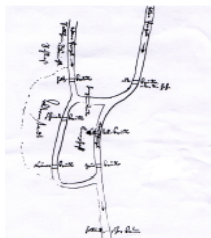
1

INTRODUCTION

Prof. Tiziana Calamoneri
Network Algorithms
A.A. 2014/15

THE STARTING POINT(1)

- It is usual to position the birthdate of the modern *graph theory* in 1736, when Euler formulated his Königsberg bridge problem.
- Euler solved this problem proving, in a constructive fashion, a characterization of Eulerian graphs. This is considered the first graph algorithm solving a “real life” problem.

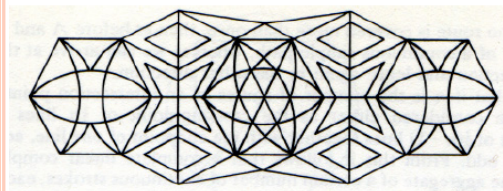
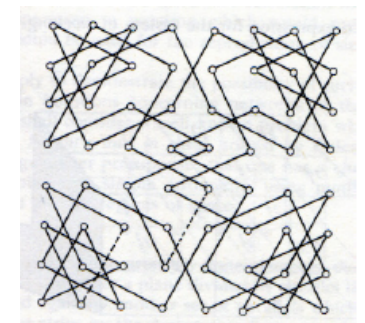


3

THE STARTING POINT (2)

Since then, graph algorithms have been used to solve many problems in several applicative fields:

- games and puzzles:
- topology



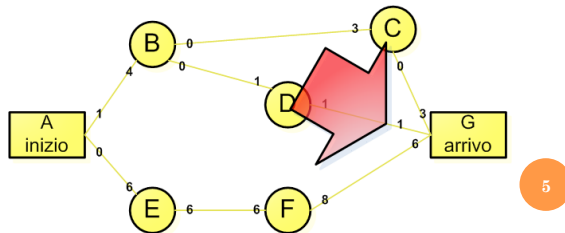
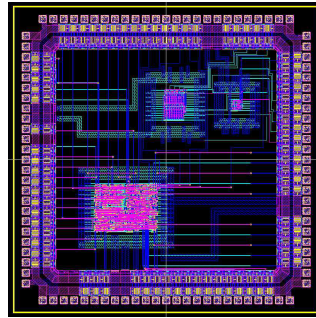
- biology



THE STARTING POINT (3)

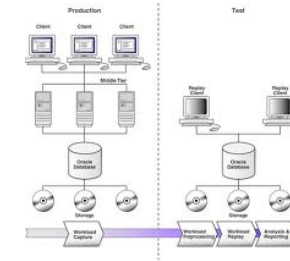
Specifically, in computer science:

- Electronic engineering:
- Operative research:



THE STARTING POINT (4)

- Artificial intelligence:
- Data bases:
- communication:



THE STARTING POINT (5)

- networks:

This course will be focused on:

- Cable networks
- Wireless networks
 - Fixed
 - Mobile



THE STARTING POINT (6)

- All over the world, courses of Graph Algorithms are thought.
- Almost all of them have a theoretical approach:
 - Princeton Univ. (Tarjan)
<http://www.cs.princeton.edu/courses/archive/spr11/cos423/>
 - Cornell Univ. (Eva Tardos)
<http://www.cs.cornell.edu/courses/cs684/2001fa/>
 - Universiteit Utrecht (Hans Bodlaender)
<http://www.cs.uu.nl/docs/vakken/na/>
 - Tel Aviv Univ.(Guy Even) <http://hyde.eng.tau.ac.il/CO/>
 - Uni Freiburg
http://ac.informatik.uni-freiburg.de/teaching/ss_12/network-algorithms.php
 - Purdue University www.cs.purdue.edu/
 - Univ. of Athens (Fotakis) ...

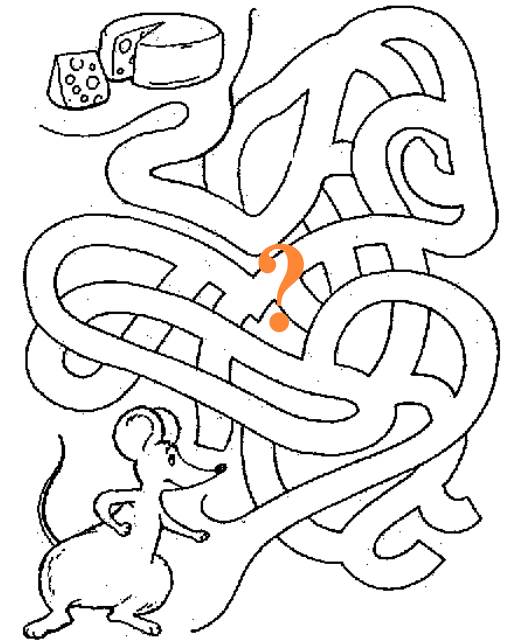
THE ARRIVAL POINT

◦ Aim:

to convince you that **graph algorithms** are not old-fashioned, though dated; instead, they are **useful instruments to solve important and living problems**.

9

ARRIVAL POINT



STARTING POINT

WHICH ROUTE? (1)

Several topics will be dealt with, all in the same way:

- Definition of the network problem
- Model as (classical) graph problem
- Known solutions for the graph problem
- Other possible approaches based on the properties of the considered networks

Some classical topics

Some research topics
(suitable for theses and new results)

11

WHICH ROUTE? (2)

- The first topics will be more classical, and they will exploit some things you studied in the past, in order to start in an “easy” way; then the topics will become less and less standard...
- **Why (my) research topics?** three reasons:
 - Passion for these topics
 - International context
 - Chance to approach research topics in the algorithm field and produce new and interesting results.

12

WHICH ROUTE? (3)

Topics surely dealt with in this course:

- Cable networks:
 - The routing problem
i.e.
The minimum cost path problem
 - The interconnection topology layout problem
i.e.
The orthogonal grid drawing
 - The problem of minimizing boolean circuits
i.e.
The minimum set cover problem
 - The problem of infecting a network with a worm
i.e.
The minimum vertex cover problem

13

WHICH ROUTE? (4)

Topics surely dealt with in this course (2):

- Wireless ad hoc networks:
 - The frequency assignment problem
i.e.
A vertex coloring problem
 - The minimum energy broadcast problem
i.e.
The minimum spanning tree problem

14

WHICH ROUTE? (5)

Topics surely dealt with in this course (3):

- Sensor networks:
 - The centralized deployment problem
i.e.
The minimum cost perfect matching problem on bipartite graphs
 - The self-deployment problem
i.e.
The Voronoi diagram construction problem

15

WHICH ROUTE? (6)

Books:

- Many topics deal with recent research, so:
few books and many papers
- In the web page of the course: list of papers I have used.
- Attending lessons is particularly important! Even because...

16

EXAM PROCEDURE

- Only oral exam
- A (small!) number of lessons will be held by students.
- These have a twofold aim: from the one hand they get close students to research; from the other hand they are a good exercise to learn to extract the main ideas from a paper.
- These lessons will exonerate students by a part of the oral exam.

17

RELATION WITH OTHER COURSES

- No previous exams are required to attend this course, nevertheless A DEEP FAMILIARITY WITH **ALGORITHMS AND DATA STRUCTURES** IS NECESSARY.

18

AT THE END OF THIS COURSE...

I would be happy to have your comments, especially about possible improvements.

Namely:

- What to deep in,
- What to skip,
- What to add,
- Any other suggestion...

19