13.09.11

# Lecture 1 handout



## Review course outline

MAT 332 Introduction to Graph Theory

Daniel Moskovich פרופ' דניאל מוסקוביץ

Office hours: T4-5 R2-3

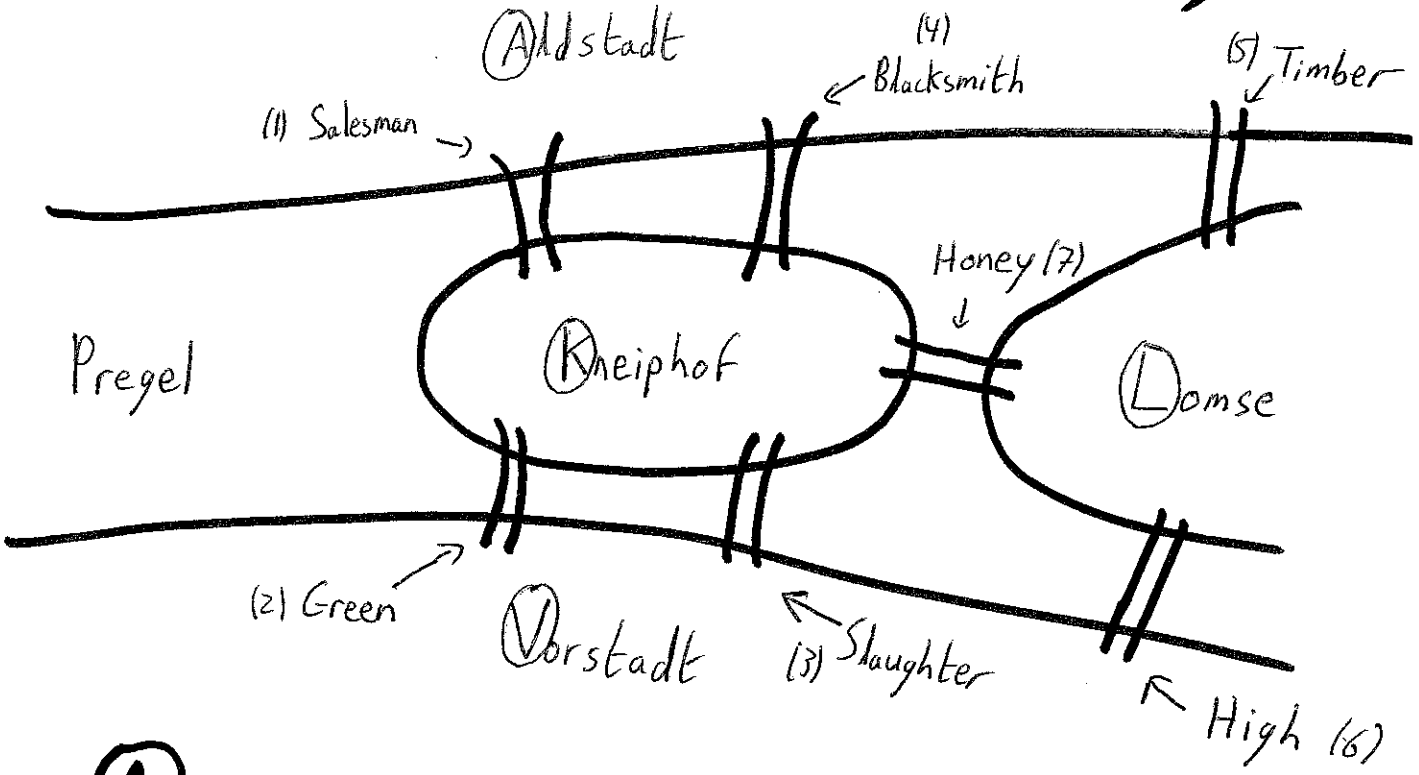
Office: BA 6189 Tel: 416-978-5001

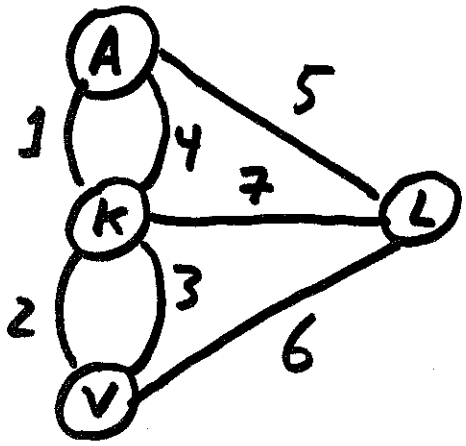
Homepage: www.math.toronto.edu/ddmoskov/mat332

Textbook: Graph Theory (3rd edition)
Bondy-Murty; Springer 2008.

Propaganda: Graph theory is fun and useful.

# The bridges of Königsberg



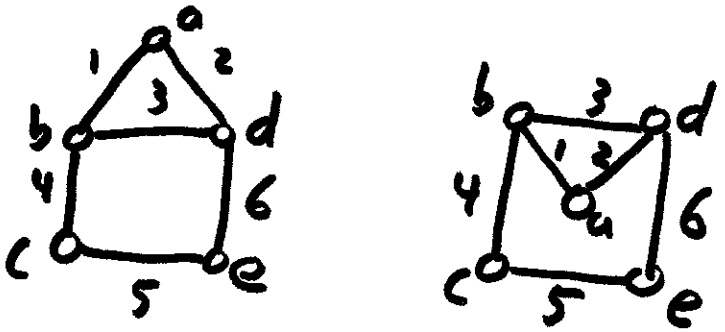

- $V = \{A, K, V, L\}$
- $E = \{1, 2, 3, 4, 5, 6, 7\}$

$\psi : E \to V^{(2)}$ incidence function

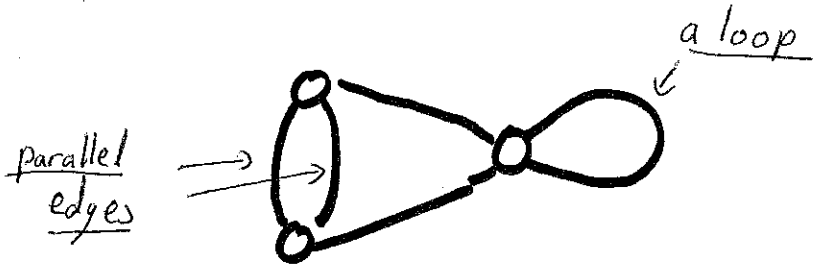
$\psi(1) = \psi(4) = AK$ ; $\psi(2) = \psi(3) = KV$ ;
$\psi(5) = AL$ ; $\psi(6) = VL$ ; $\psi(7) = KL$.

The <u>degree</u> of valence of vertex $v$ is the number of edges incident to $v$.

For Euler's graph, valences are $\{5, 3, 3, 3\}$.




Vertices connected by an edge are adjacent. Adjacent vertices are neighbours.




A simple graph is a graph with no loops or parallel edges.

A loopless graph is a graph with no loops.

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**Handshake Lemma**

If $G=(V,E)$ is a graph, then $\sum_{v \in V} \deg(v) = 2|E|$

**Proof**

Each edge $\psi(e) = v_1 v_2$ is counted twice towards the sum

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**Next time:** 1.2 Isomorphism and Automorphism