Announcement:

Midterm 2 tonight!

7:00pm - 8:30pm in 217 Noyes Lab. (ref. sheet allowed)

Be early!

Exam covers: Ch 1-3 (focus on Ch. 2, 3),
plus circuit application of matrix tree thm.

Most focus: topics that appeared in lecture or homework

Some focus: topics in relevant subsections of textbook

Low/no focus: topics in subsections we didn't cover at all

Types of graphs: (dis.)conn., bipartite, paths, cycles, trees, forests, complete (bipartite) graphs, digraphs, weighted graphs

Walks, trails, circuits

Things graphs have:

Eulerian circuits (Euler Thm.)

Perfect matching (Hall's Thm., Tutte's Thm.)

Trees:

- Equiv. defn's
- Prüfer code & Cayley's formula
- Spanning subgraphs & spanning trees
- Matrix tree thm.
- Kirchoff's Laws and Kirchoff's Thm.

Algorithms:

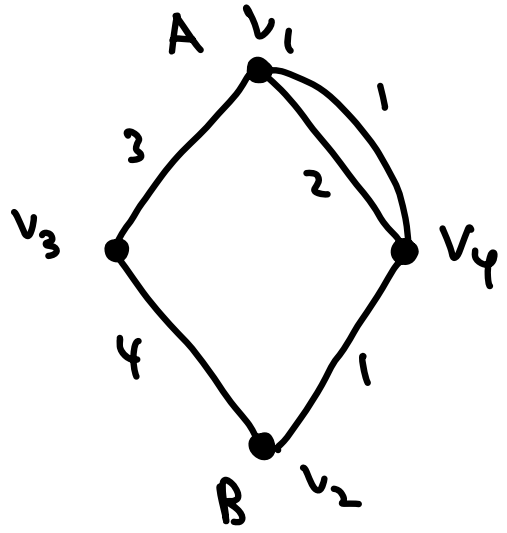
- Kruskal (min. wt. spanning tree)
- Dijkstra (distances)
- Gale-Shapley (stable matching)
- Algorithmic thinking

Matchings:

- Perfect vs. maximum vs. maximal (general concept)
- M-alt. paths & M-aug. paths
- Theorems: Berge, Hall, Tutte, Berge-Tutte, Petersen x2
- Relationships btwn. matchings, vertex/edge covers, and indep. sets
- k-factors

Examples:

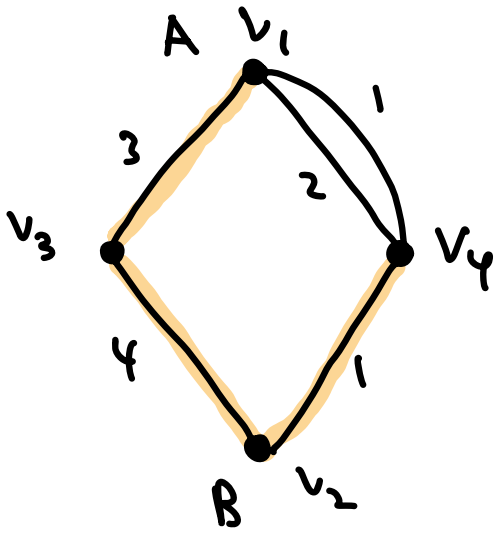
1) Consider the weighted graph G:



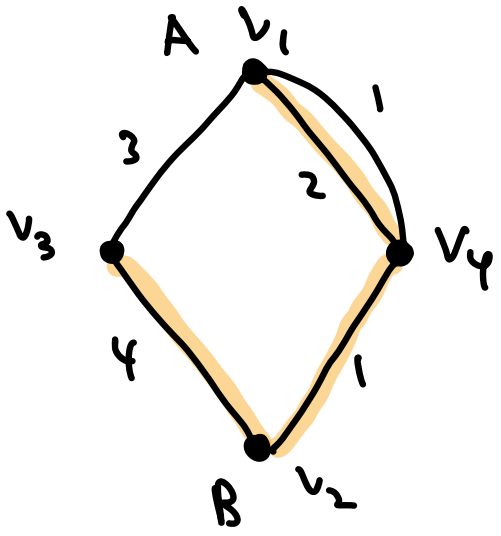
Find the effective resistance from A to B

Soln: Step 1: compute $\tau(G)$

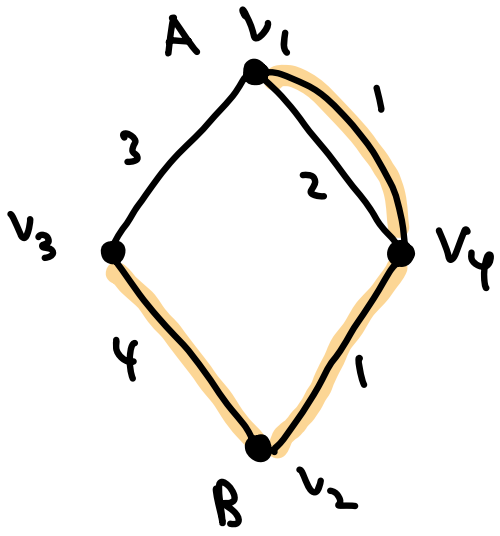
OR


A
v_1
1
3
2
v_3
v_4
4
1
B
v_2

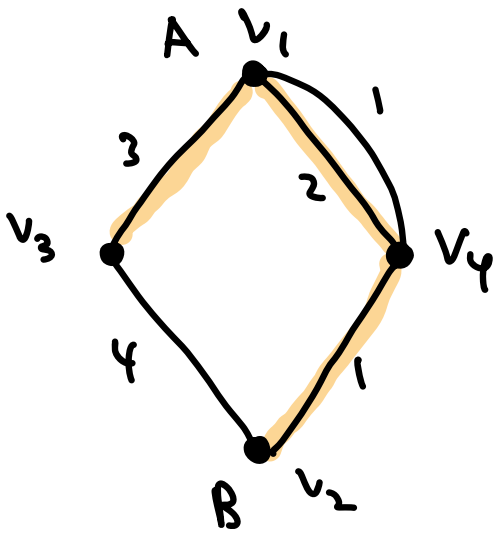
12


A
v_1
1
3
2
v_3
v_4
4
1
B
v_2

8


A
v_1
1
3
2
v_3
v_4
4
1
B
v_2

4


A
v_1
1
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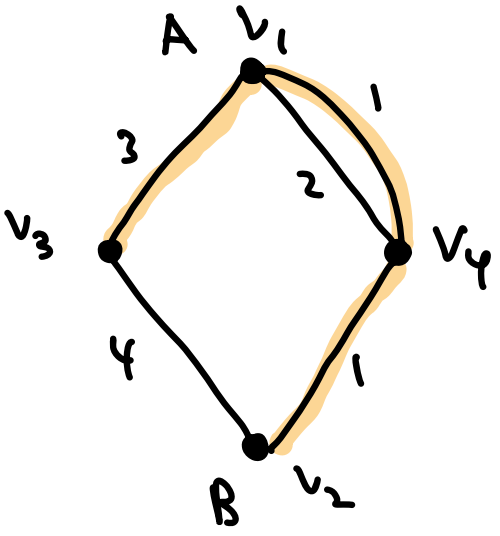
2
v_3
v_4
4
1
B
v_2

6



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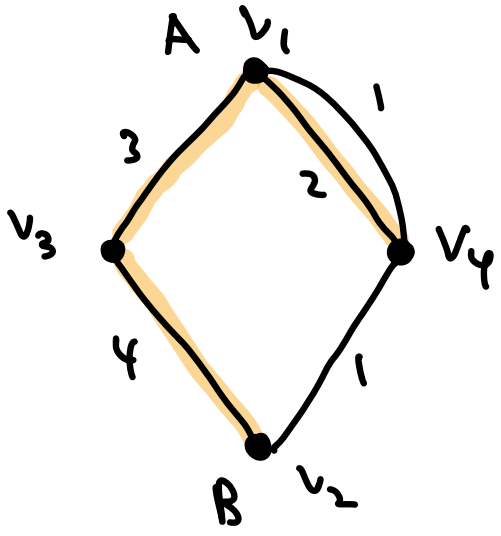

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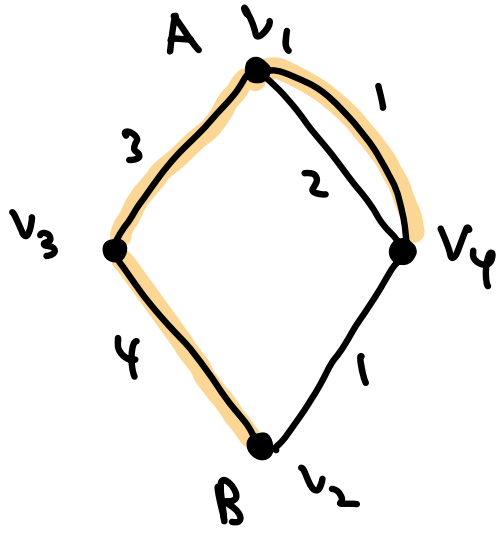
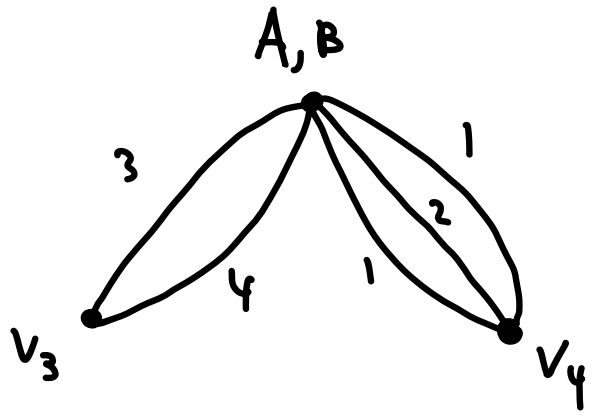


12

$T(G) = 12+8+4+6+3+24+12$

Step 2:

$(G \cup AB) \cdot AB$:



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2) Let G be a simple graph s.t. $\delta(G) \geq k$ and $n(G) \geq 2k$. Prove that G has a matching of size $\geq k$.

3) Compute $\tau(k_{2,m})$