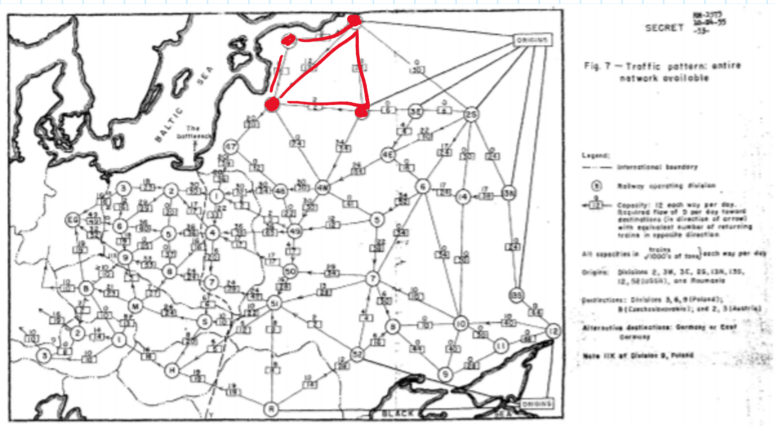
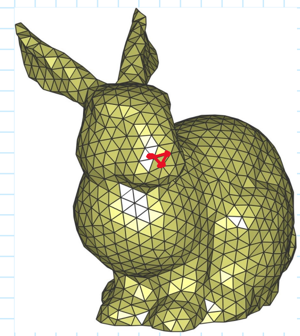
CS 173 Lecture 8a: Graphs



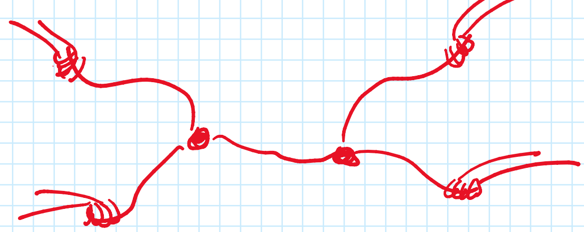
Warsaw Pact rail network, Harris and Ross



JIGSAW, Darren Engwirda

3d model mesh

- social network graph
  - connections between acquaintances
- tension ropes ("graphical statics")



A (undirected, simple) graph consists of a set V of "vertices" and a set E of "edges" where an edge is $\{u,v\}$ where $u,v \in V$. $u \neq v$

Given an edge $\{u,v\}$, u,v are its endpoints. $\{u,v\}$ is incident to u,v,

u,v are adjacent if $\{u,v\} \in E$

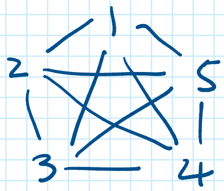
Notation: $G = (V,E)$

Special Graphs

- "Complete graph on n vertices" K_n

$V = \{1, 2, \ldots, n\}$

$E = \{\{u,v\} : 1 \le u, v \le n,\ u \ne v\}$.



K_5

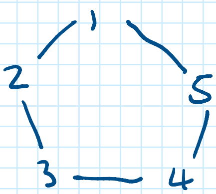
$|E| = \frac{n(n-1)}{2} = \binom{n}{2}$

(Handshake Lemma)

- "Cycle on n vertices" C_n

$V = \{1, 2, \ldots, n\}$

$E = \{\{u,v\} : v \equiv u+1 \bmod n\}$



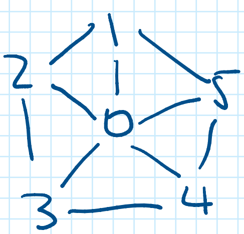
C_5

- "Wheel on $n+1$ vertices" W_n

$V = \{0, 1, 2, \ldots, n\}$

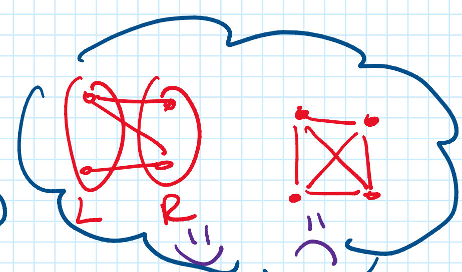
$E = \left\{\{u,v\} : \begin{array}{l} 1 \le u, v \le n, \\ v \equiv u+1 \bmod n \end{array}\right\}$

$\cup \{\{0, v\} : 1 \le v \le n\}$



W_5

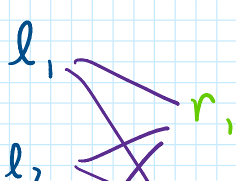
$V = L \cup R$, $L, R \ne \emptyset$, $L \cap R = \emptyset$
each edge connects a vertex in L & vertex in R

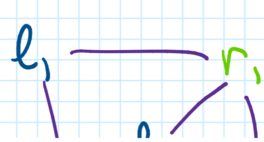


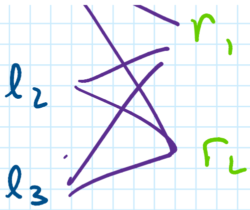
- "Complete bipartite graph on $m+n$ vertices" $K_{m,n}$

$V = \{\ell_1, \ldots \ell_m\} \cup \{r_1, \ldots, r_n\}$

$E = \{\{\ell_i, r_j\} : 1 \le i \le m,\ 1 \le j \le n\}$.







$K_{3,2}$