Approximation Algorithms 14.7.2021
Exercise Sheet 6

$\boxed{\text{Ex 1}}$ I. Approximation Algorithms
(Definition, ...)
Vertex Cover vs. Matching
2-Approx. für VC / Hardness VC

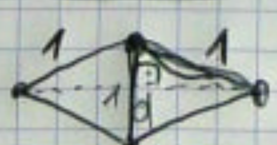
II. Set Cover / Greedy H_n Approximation
$\Theta(\log n)$
Shortest Superstring $2H_n$
Max Cover $1-\frac{1}{e}$

III. Packing (Covering)
(Grid) Shifting Technique
$k \times k$-Quadrate in Polyominos PTAS $(1+\varepsilon)$
Strip Cover $(1+\varepsilon)$-Approx.
LP-Relaxation / Duality -Alg.-Fami

IV. Tours
Metric TSP : $\begin{cases} 2 \text{ MST} \\ 3/2 \text{ Christofides} \end{cases}$
(Δ-Inequality)
Euklidisches TSP: Guillotine Subdivisions
PTAS
...
Max TSP

V Angular (Scan Cover / Freeze Tag) / Freeze Tag

$\boxed{\text{Ex 2}}$



$1^2 - \left(\frac{1}{2}\right)^2 = \frac{d^2}{4} \rightsquigarrow d = \sqrt{3} \approx 1.73...$

~~Exactly~~ tour

Embed the hexagonal grid graph in the plane with edge length 1.
The distance between any pair of non-adjacent points is at least $\sqrt{3}$.
If we had an approximation algorithm with factor $c < \sqrt{3}$, we could solve HC on hexagonal grid graphs in polynomial time ($\lightning$ $P \neq NP$):

Our approximation algorithm cannot give a solution with bottleneck $\geq \sqrt{3}$ if the graph is Hamiltonian ($c < \sqrt{3}$); thus, if our approximation algorithm is given points corresponding to a Hamiltonian GG, it will find a solution with bottleneck 1. $\square$