what worked (evaluation)?

in-class-only evaluation

- 6 in-class quizzes (60 marks)

(based on practice questions with answers)

- final exam (40 marks)

what worked (curriculum)?

adding a new topic

to my algorithms course

rectilinear steiner tree puzzle

hayward@ualberta.ca

with thanks to Stefan Hougardy (U Bonn)

and Zac Friggstad (U Alberta)

High School Teachers' Symposium June 2026

Stefan Hougardy works at

Bonn Institute for Discrete Math

shares building with

Arithmeum

https://www.arithmeum.uni-bonn.de

© Arithmeum

https://www.arithmeum.uni-bonn.de/en/visitor-information/shop/details

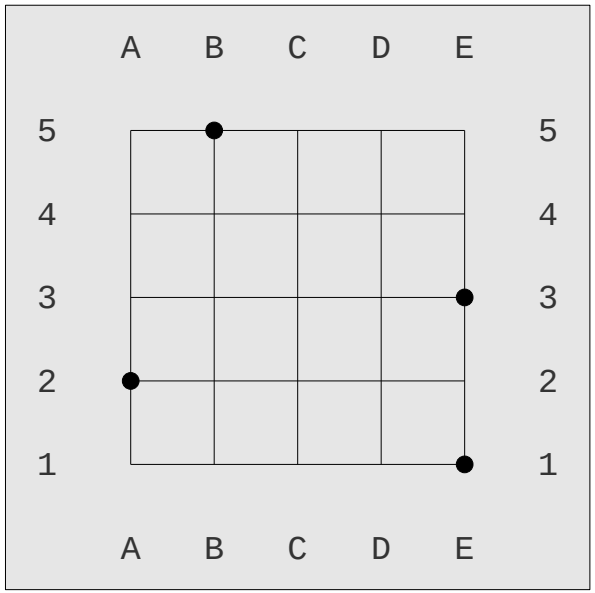
rectilinear steiner tree puzzle:

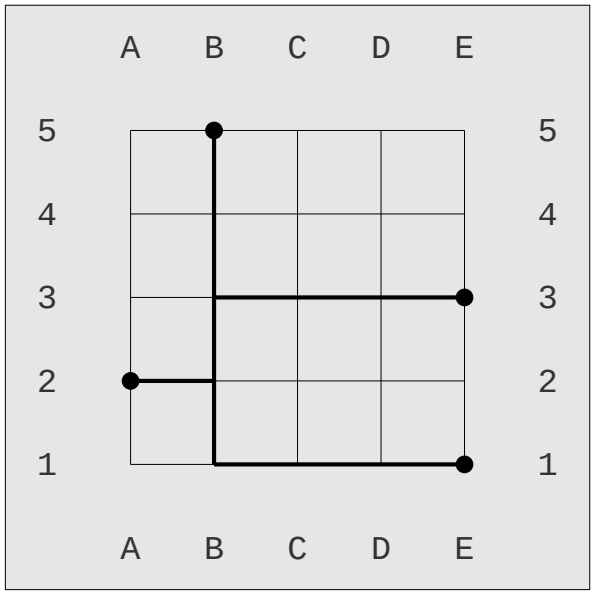
join all given pins with

horizontal/vertical wires,

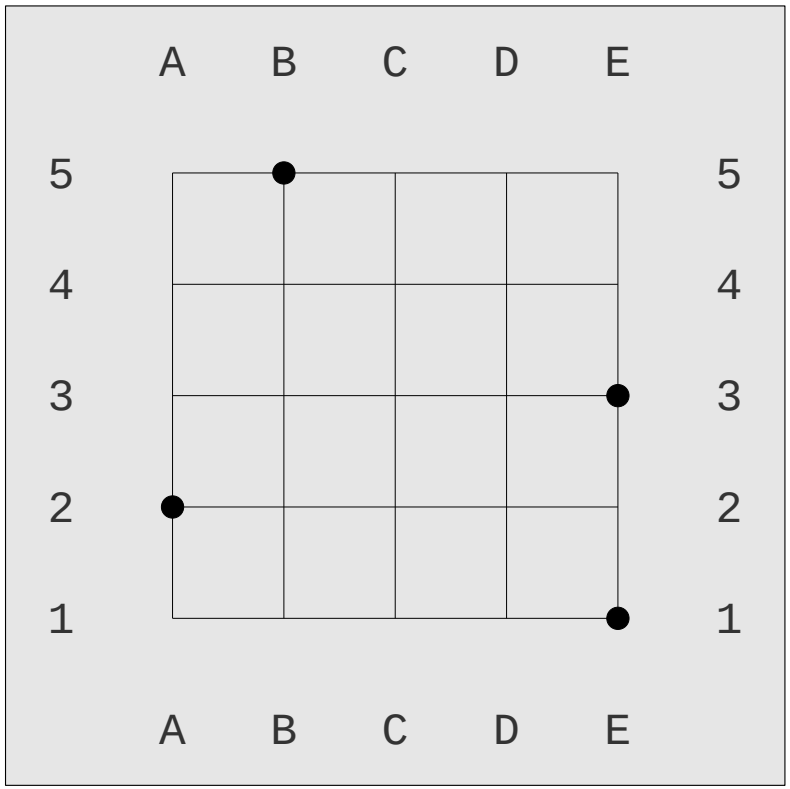
tree *cost* is sum of lengths of wires.

this tree has cost 11, can you do better?

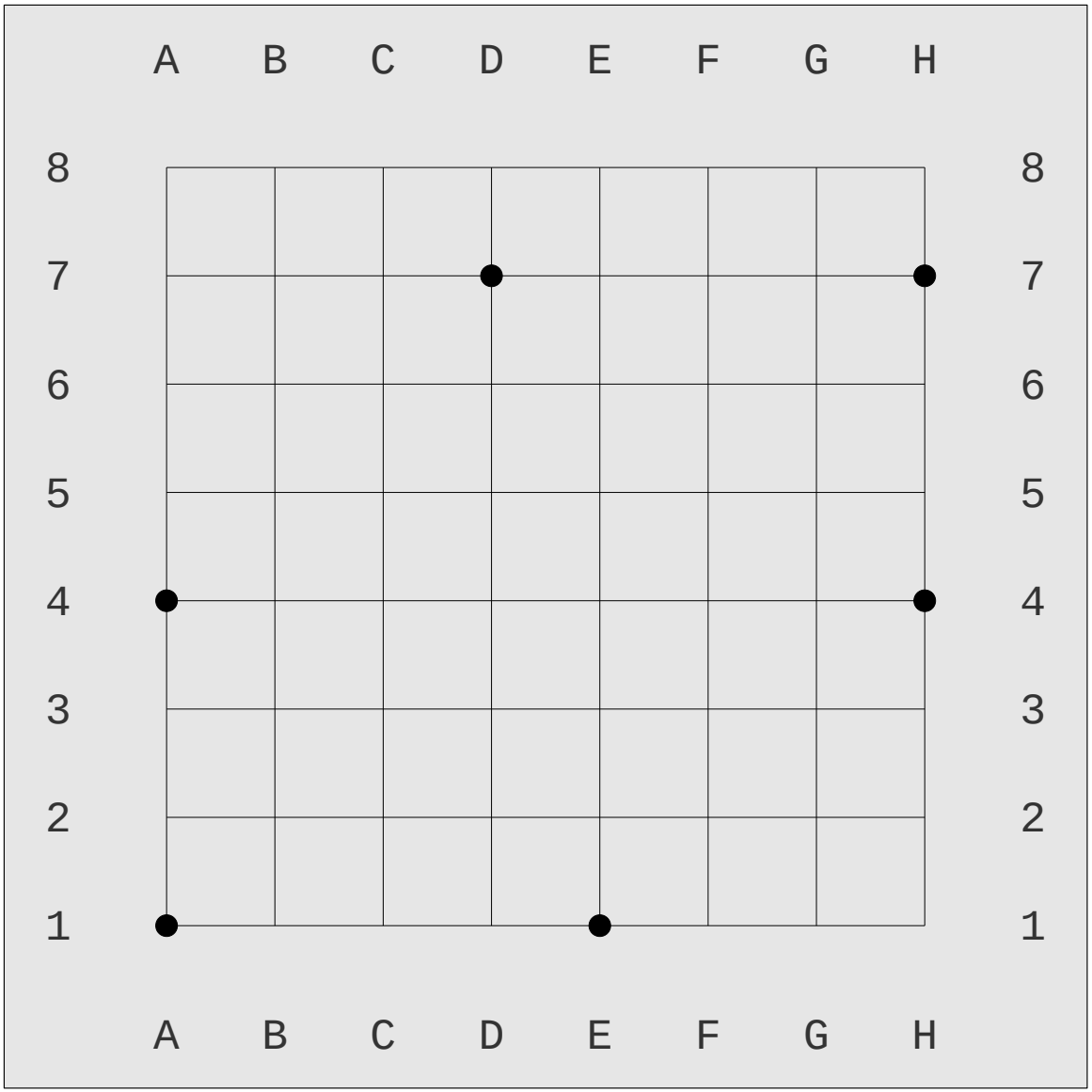




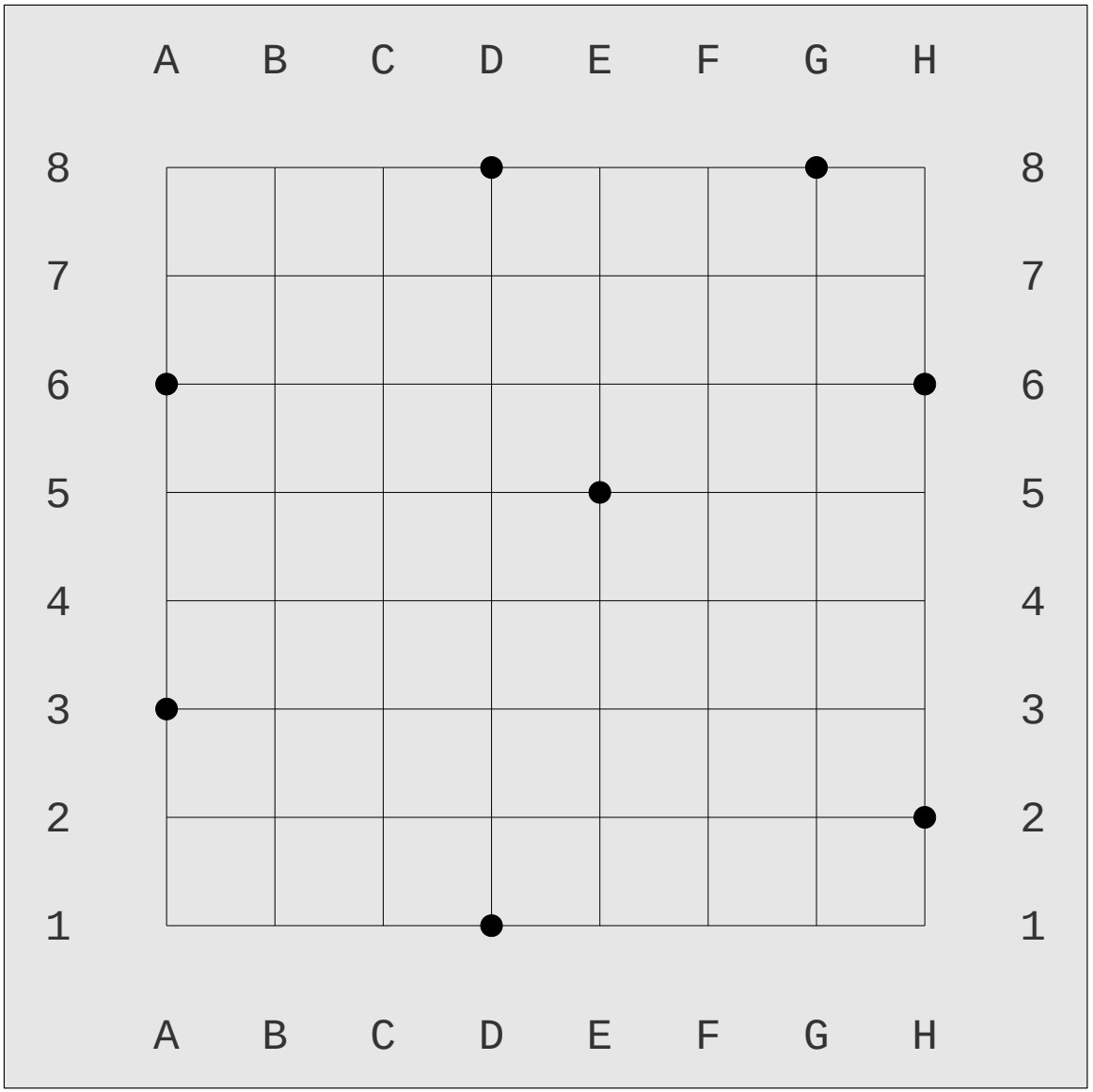
for each puzzle, find a min-cost rectilinear steiner tree



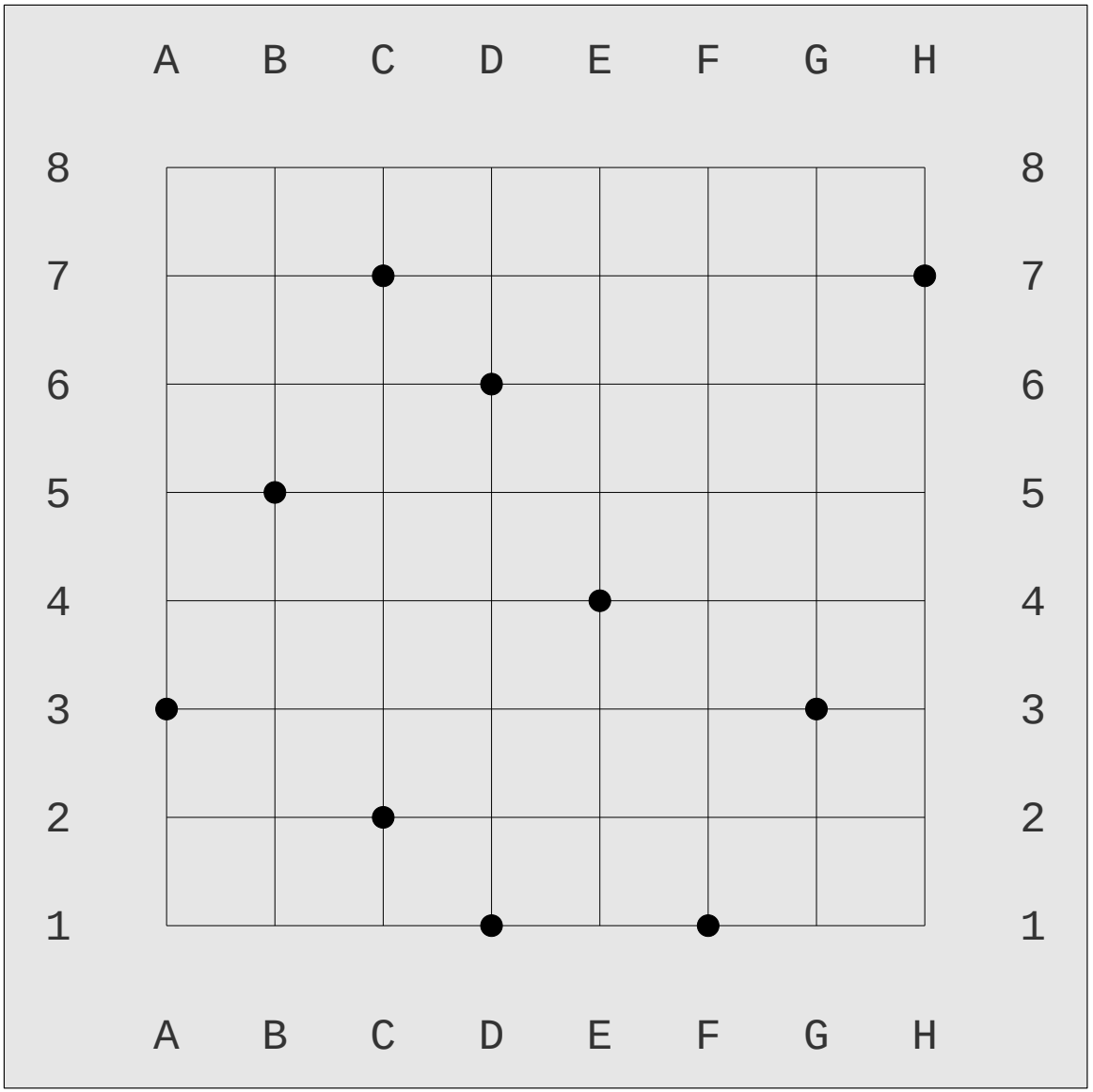
4 pins, cost 9



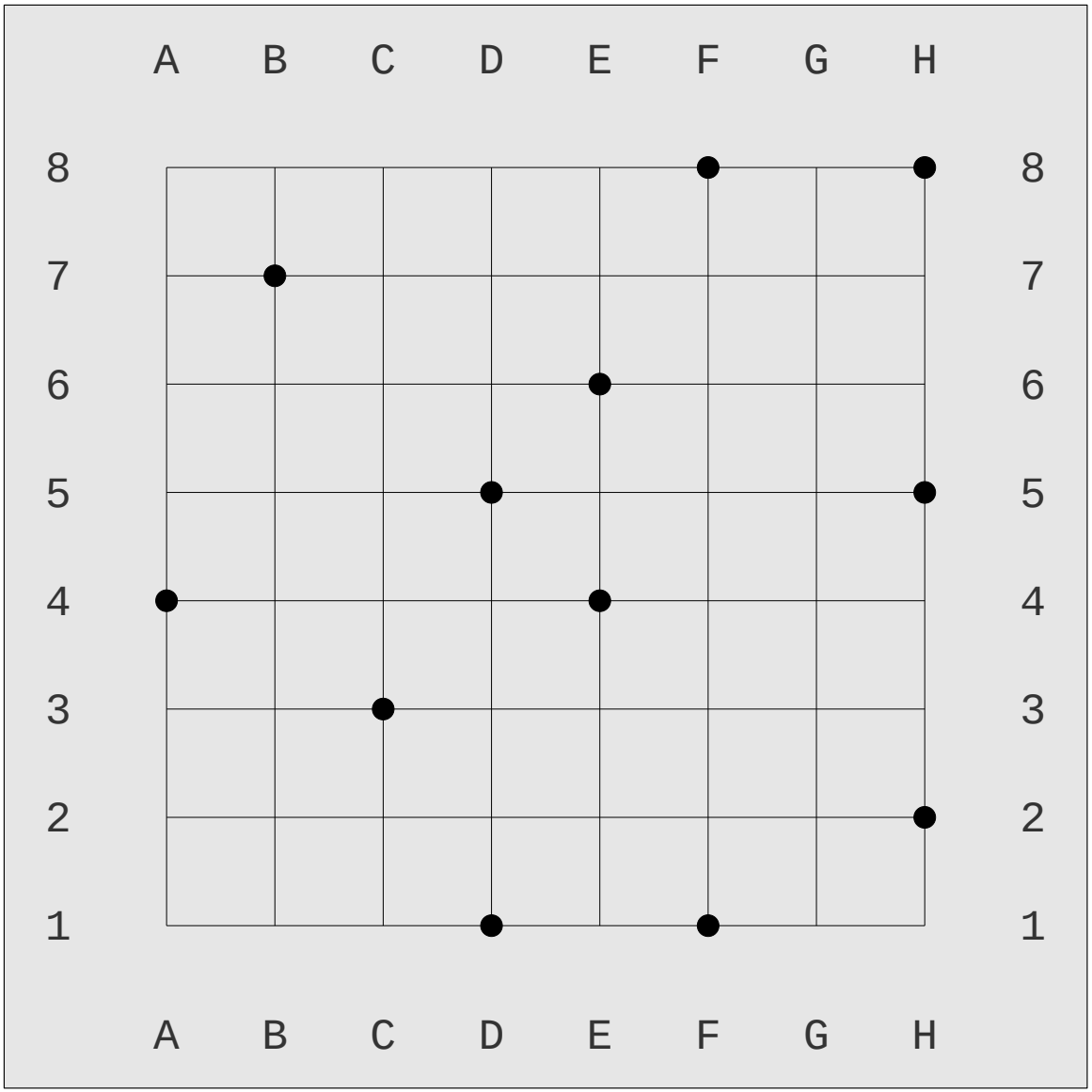
6 pins, cost 19



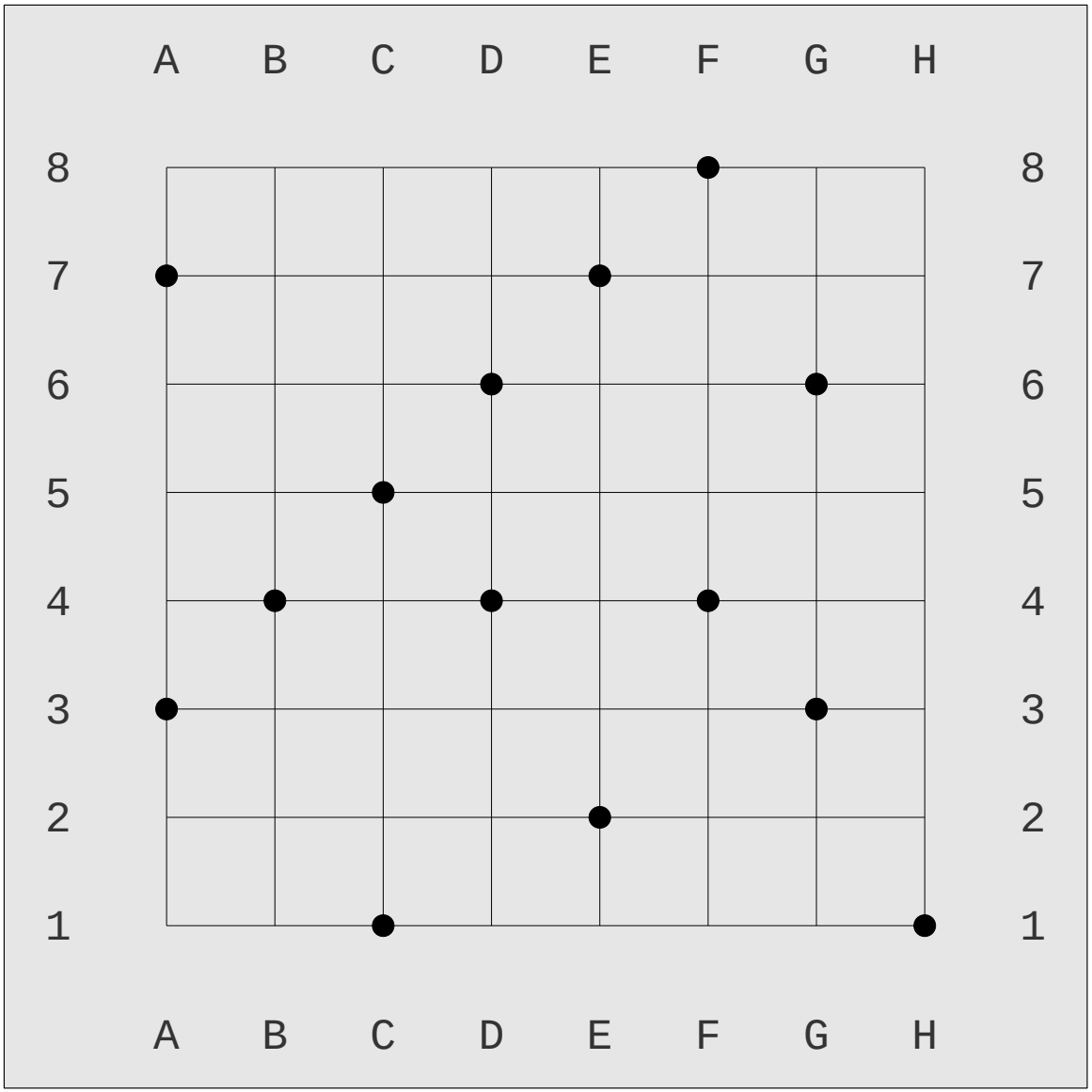
8 pins, cost 23



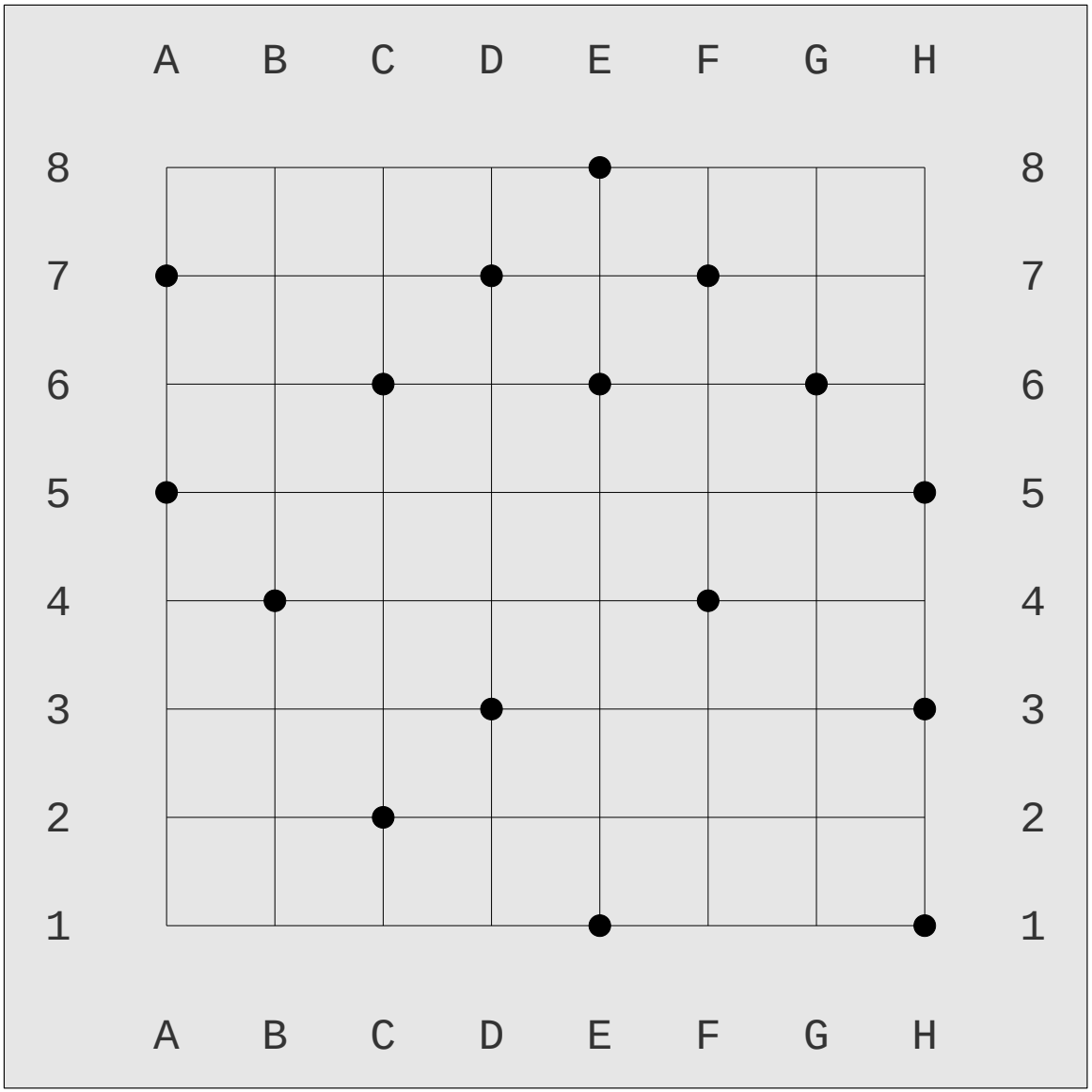
10 pins, cost 22



(harder) 12 pins, cost 26



(harder) 14 pins, cost 27

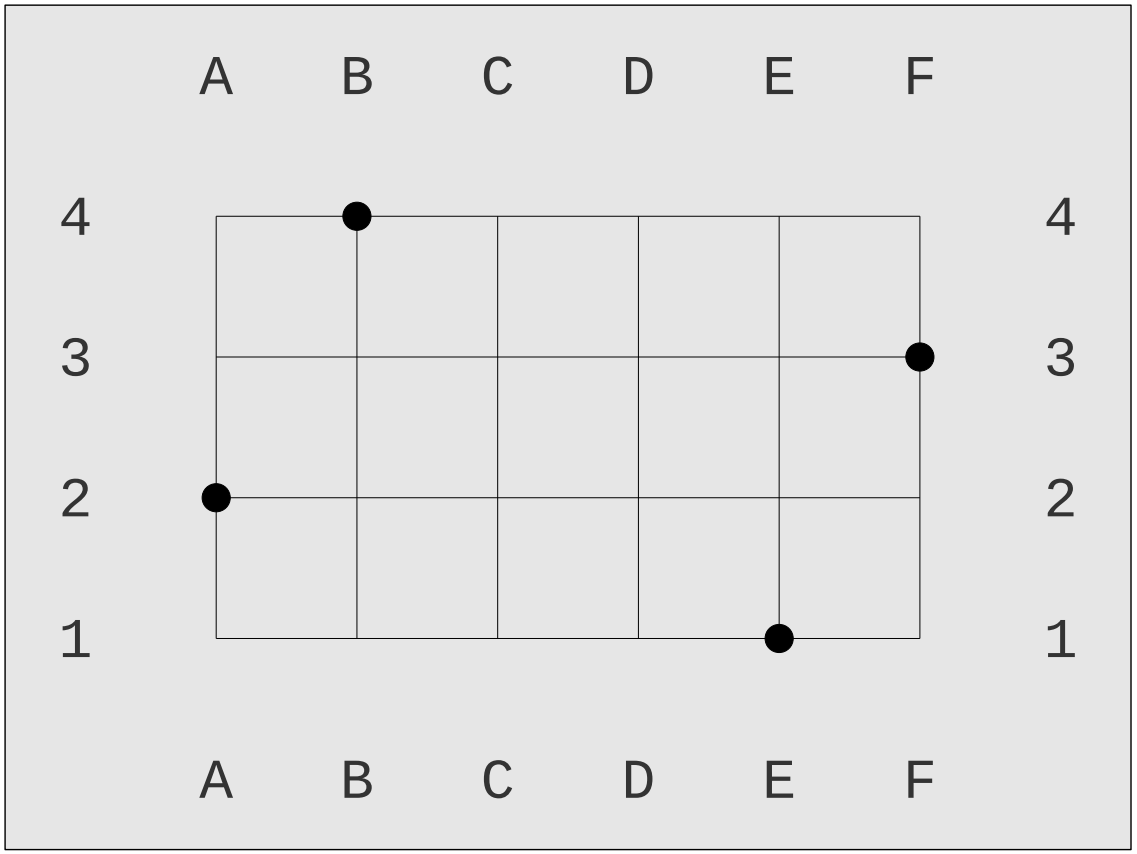


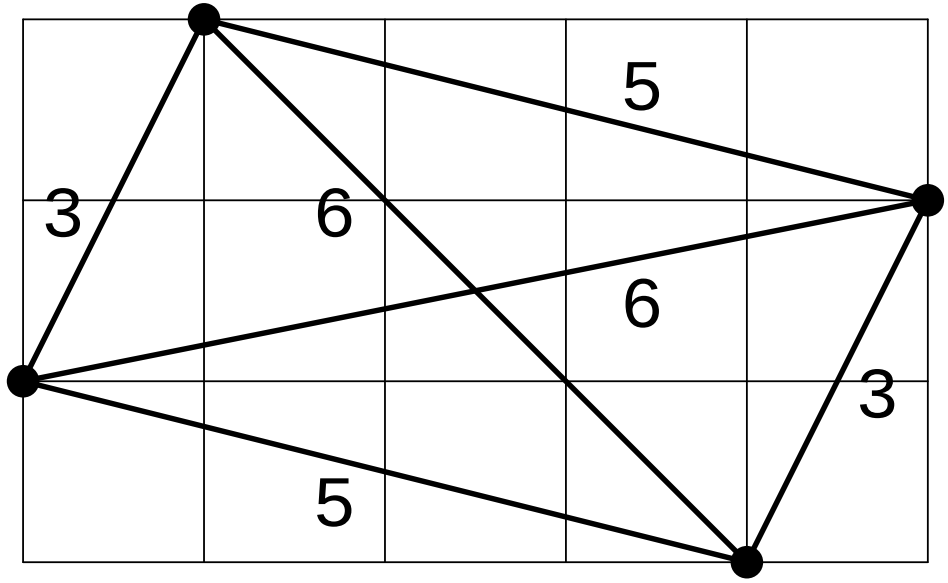
(harder) 16 pins, cost 28

thank you

steiner tree approx

- **from input G, create pins-graph $P(G)$**
- **$P(G)$ node set: pins of G**
- **$P(G)$ edge set: all pairs of pins of G**
- **for each edge of $P(G)$, cost is min-cost path in G**
- **find mst M of $P(G)$**
- **claim: G has steiner tree with cost $\leq$ cost(M)**
- **proof:**
- **for each edge (x, y) of M, add corresponding min-cost path in G (on the path, don't add any edge that would create a cycle)**


A B C D E F
4 3 2 1
4 3 2 1
A B C D E F


5
3
6
6
3
5