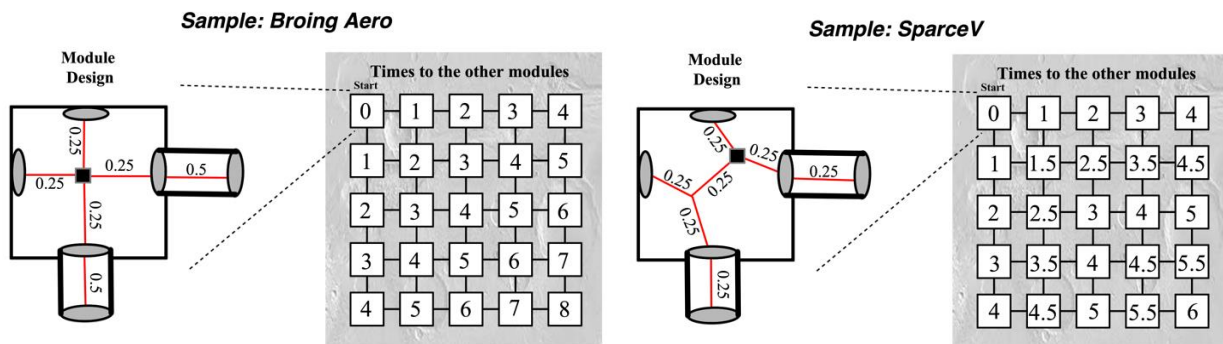


The Martian Mayor Problem

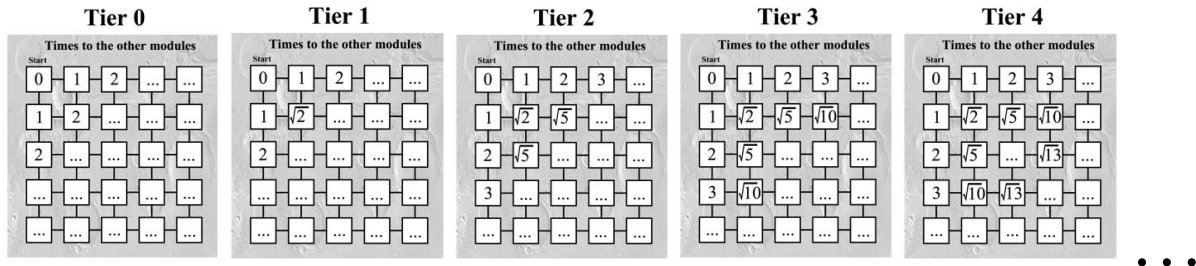
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Mayor Martin Martian oversees the contract bids for the design of the huge square module used in the large-scale colonization effort which will tile the Martian landscape. Contractors decide the layout and speed of bidirectional trolley paths and the location of the command center, which must all be constructed the same inside every module.

Assume that all trolley intersections are seamless interchanges. Two engineering firms have already submitted designs for the contract (for the sake of example). On the left of each sample is the module design with the travel time along each trolley segment. On the right is the Timing Table. These measure the minimum travel time in hours between the top left module and the other modules. All paths must start and stop on a command center, but do not need to visit intermediate command centers along the way. Each module has two connecting tunnels which permit ONLY a single trolley path. Paths may NOT bridge over each other.



Additionally, a recent Psychophysics research shows humans prefer more “Euclidean travel times” so there is a \$1 million bonus for each Tier above 0 achieved in the final design. Each Tier is shown in the Timing Tables below. There is no limit on the number or speed of trolley paths inside the module.



You work for a contracting company submitting a bid.

1. What is the module design for the best Tier you can achieve with a single tunnel between modules?

Unhappy with progress, the city council has intervened and allowed for two tunnels between adjoining modules.

2. What is the module design for the best Tier you can achieve with two parallel tunnels between adjoining modules? Three or more parallel tunnels?
3. What is the relationship between the number of tunnels and the highest achievable Tier?

A SparceV lobbyist campaigns to allow trolley paths inside the module to bridge over each other (Non-planar paths)

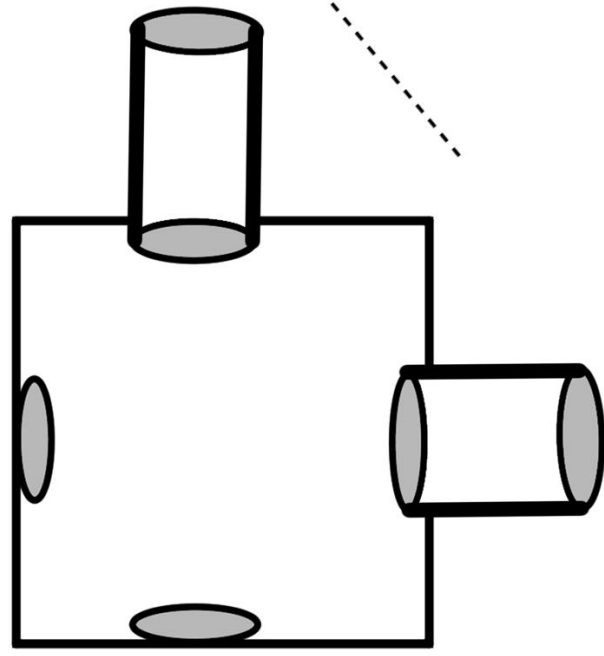
4. What has the lobbyist discovered? What is the module design of the best Tier for 1, 2, and 3 tunnels?

Big brain company Goobr has proposed some alternative shapes and the city council is changing the design again...

5. What do these modules look like for other tiling shapes (triangles, hexagons, and irregular tiles)?

Please send your solutions to Art Terlep, taterlep@gmail.com

**Module
Design**



Times to the other modules

Start

