ORCHARD WORDS

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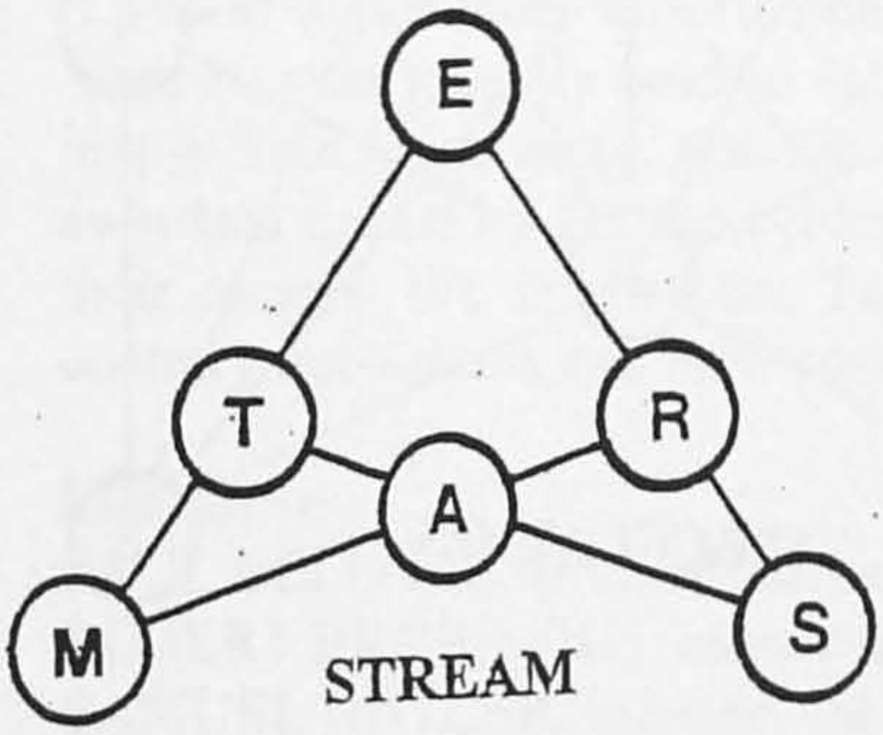
Your aid I want, nine trees to plant
In rows just half a score,
And let there be in each row three.
Solve this; I ask no more. *-John Jackson, 1821*

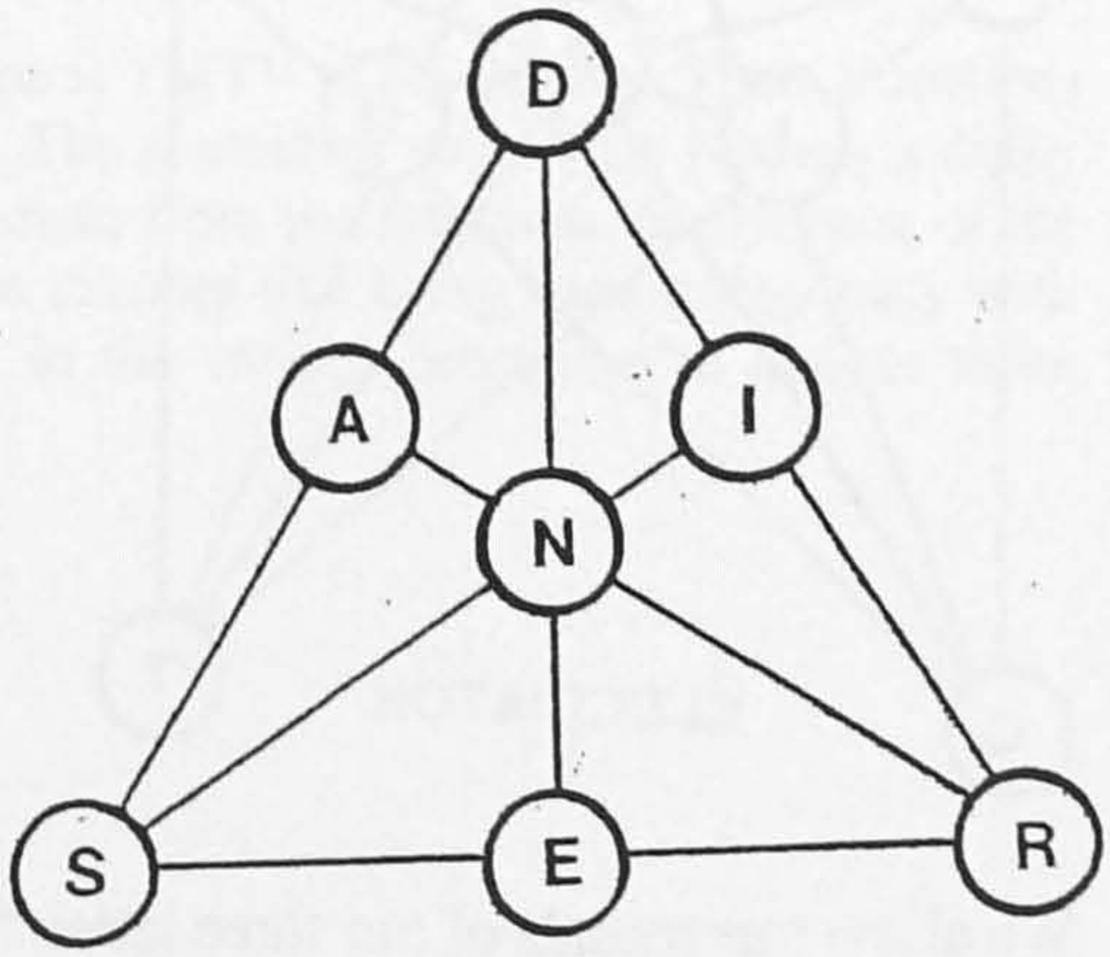
The orchard problem, also known as the tree-planting problem in the literature, is to plant n trees so that there will be r straight rows with k trees in each row. The maximum r for various k is unknown except for certain small cases of n and k. We have constructed examples of known maximums using words which we call Orchard Words.

In his essay "Tree-Plant Problems" in the collection *Time Travel and Other Mathematical Bewilderments* (New York: W.H. Freeman, 1988), Martin Gardner finds the first non-trivial orchard problem in John Jackson's *Rational Amusements for Winter Evenings,* published in London in 1821. The quatrain above is from that book. We use Gardner's results in our constructions; he collects the works of many mathematician-puzzlists including Sir Isaac Newton, J.J. Sylvester, Stefan A. Burr, Branko Grünbaum, N.J.A. Sloane, Henry Ernest Dudeney and Sam Loyd. A very impressive list indeed!

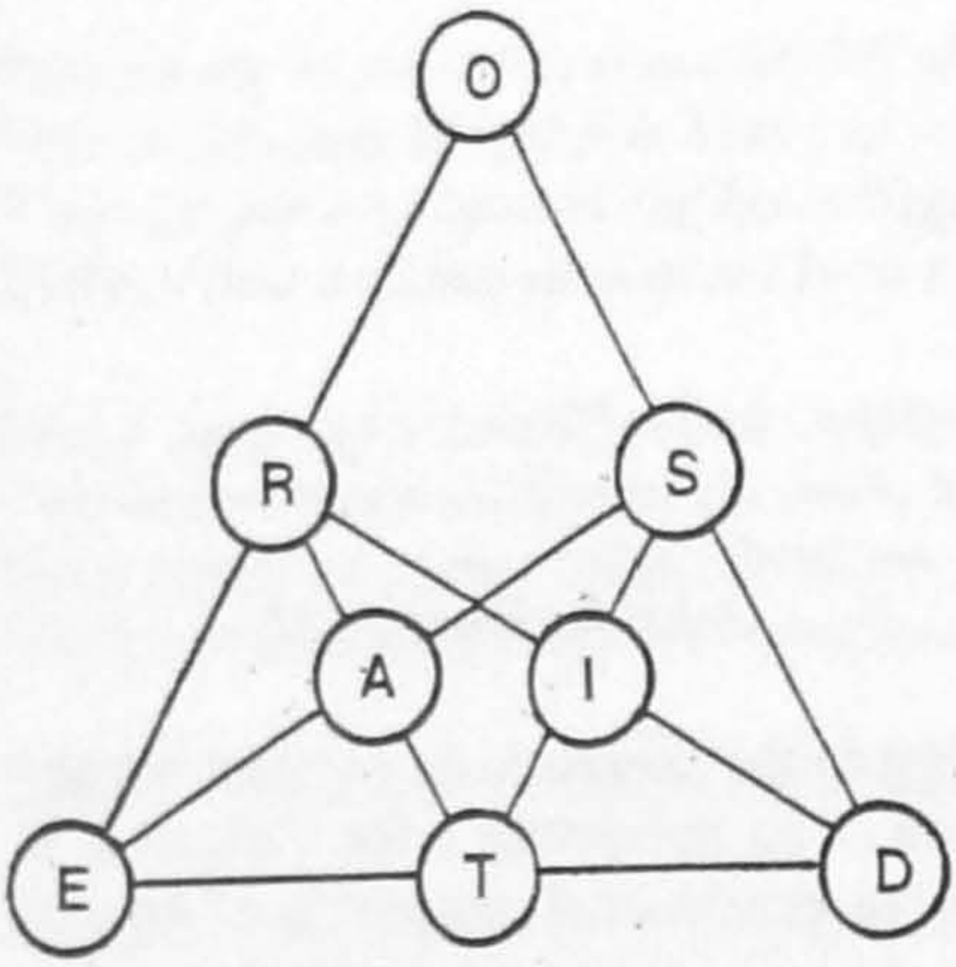
We restrict our Orchard Words to three letters, so k = 3. The maximum number of rows of three for n = 6, 7, 8, 9, 10 and 11 types is respectively 4, 6, 7, 10, 12 and 16. Our results follow.



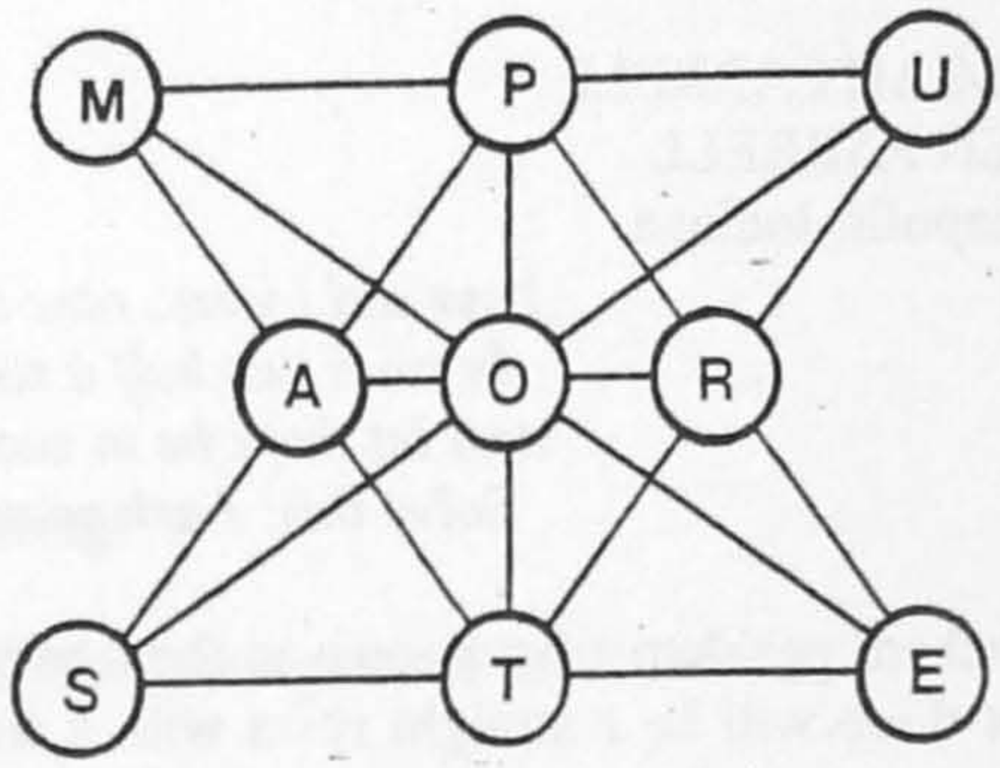
STREAM



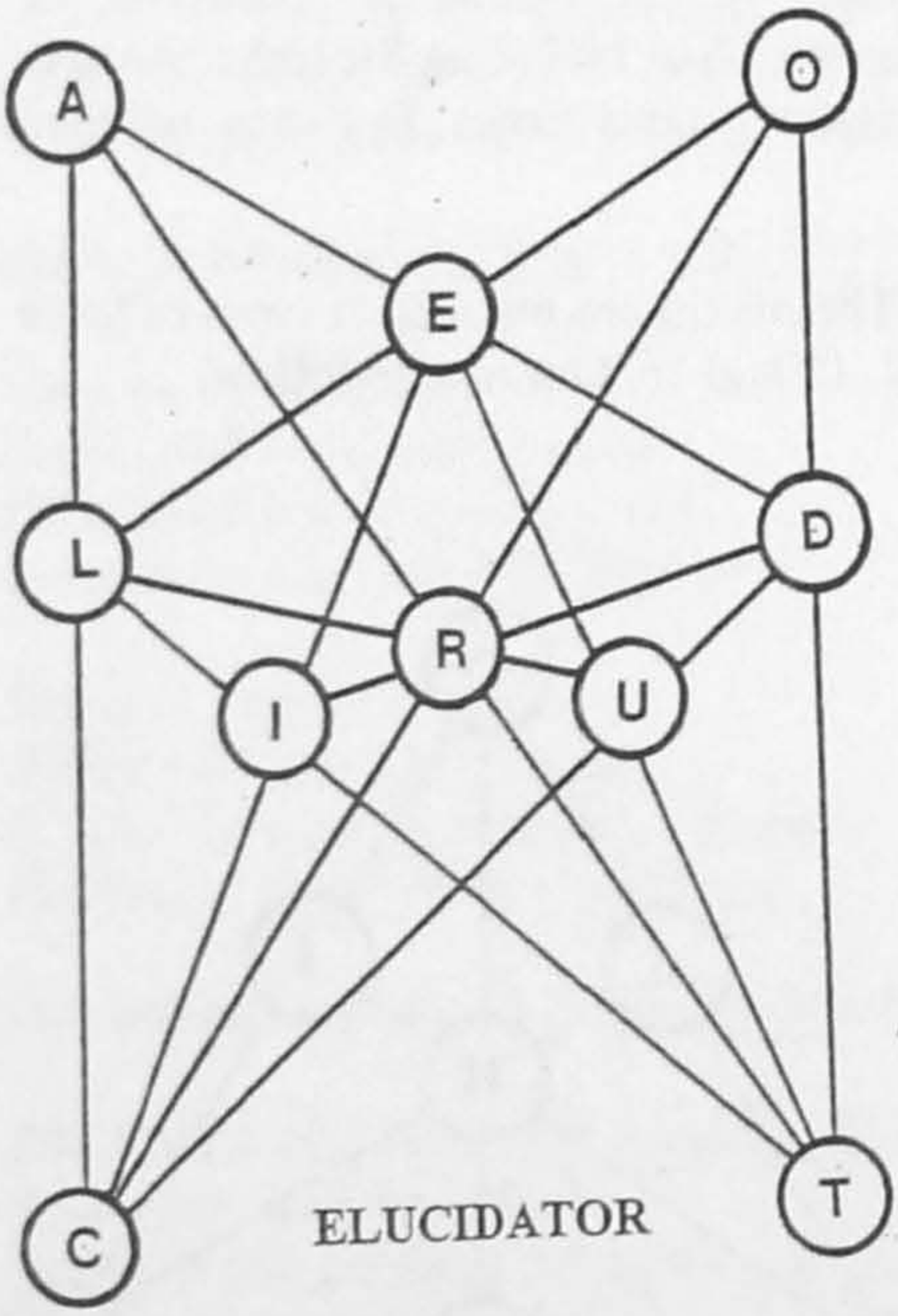
SARDINE



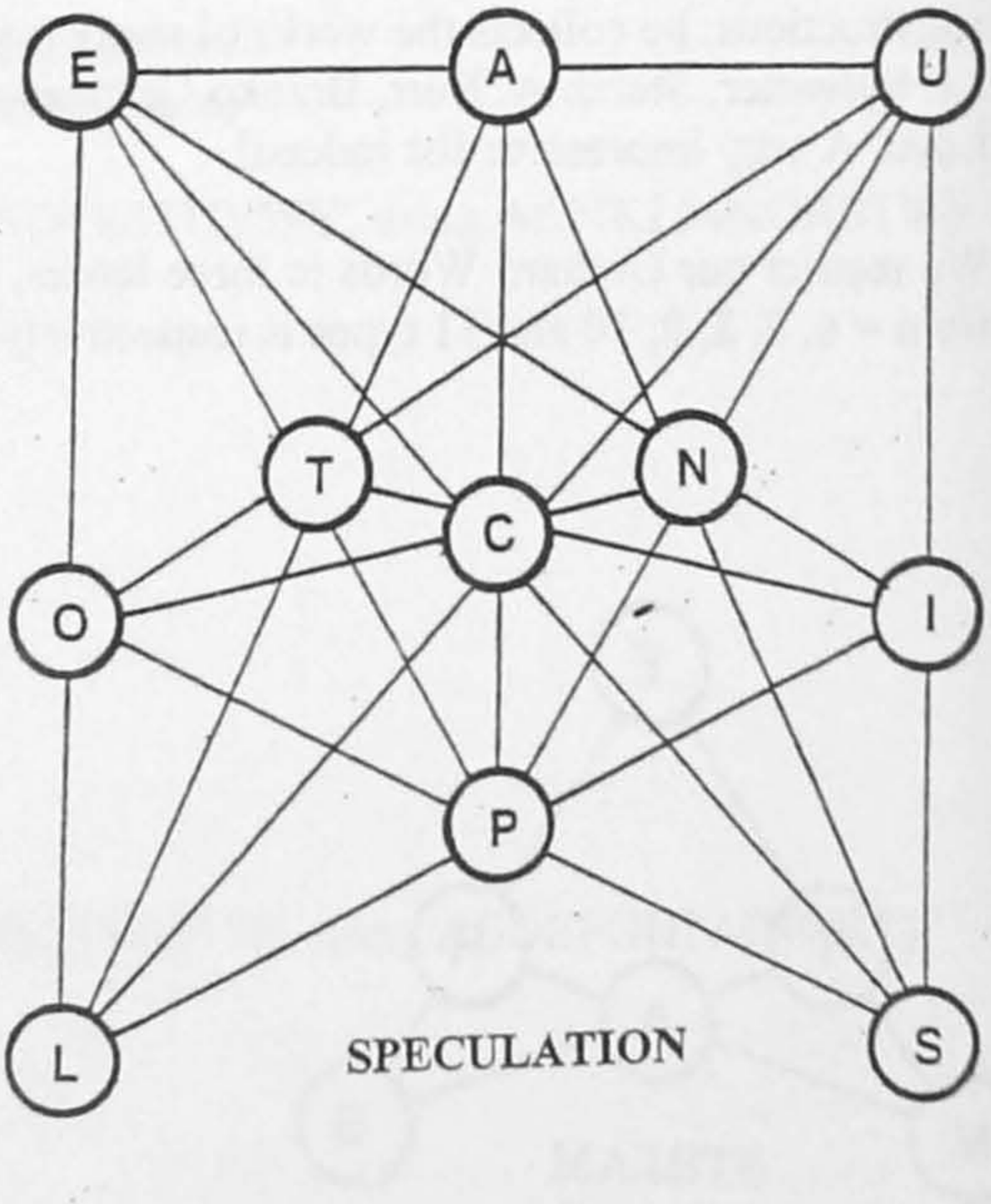
ASTEROID



MOUSETRAP



ELUCIDATOR



SPECULATION

We allow transposals of our three letter "rows" to generate the words that work in the diagram. It is also possible to play a two-person game using letter tiles on any given grid. The players alternately play a tile of their choice on the grid but must form words on any row incident to that node (transposals are okay). The last player to be able to play wins.

The answer to Johnson's quatrain poser is our MOUSETRAP orchard.