The ASTEROID Puzzle and Games

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The ASTEROID Puzzle

Cut out the sixteen tiles and arrange them on the 16-cycle so that abutting tiles have a letter in common.
Presented by Karen Farrell
in honor of Martin Gardner
At G4G8

The ASTEROID Puzzle and Games

By Jeremiah and Karen Farrell

Each of our two-person games is a word version variation from the tic-tac-toe or noughts and crosses family. It is well known that classic tic-tac-toe is a draw when expertly played. It is also clear that not all of its plays are equal – a strong move for the first player is to initially take the powerful center square. ASTEROID and ASTEROID II, on the other hand, are both completely symmetric (in the sense that all letters are used equally) and each have rather subtle forced wins for either the first or the second player.

Rules:

<table>
<thead>
<tr>
<th>ASTEROID</th>
<th>ASTEROID II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two players alternately choose letters from ASTEROID until one of them wins by being first to complete, using letters selected by either person, one of the eight words:</td>
<td>Two players alternately choose letters from ASTEROID until one of them wins by being first to complete, using only his selected letters, one of the eight words:</td>
</tr>
<tr>
<td>AID EOS ERS IRE</td>
<td>AID DOT EOS OAR</td>
</tr>
<tr>
<td>OAT RID SOT TAD</td>
<td>RED SAT SIR TIE</td>
</tr>
</tbody>
</table>

(n.b., One player has a forced win here!)

ASTEROID II is a first person win. To accomplish the force one must memorize the key pairs R-T, A-E, D-S and I-O. This is easily accomplished by noting each pair’s position in the scheme RADIO SET.

The Jeremiah Bullfrog algorithm can then be used when playing first. (The reader should play against Jeremiah a few times to learn the force.)

1. Jeremiah takes any letter, and Second responds as he likes.
2. Jeremiah notes Second’s play and, if available, plays Second’s mate. For example, if Second plays S, Jeremiah plays D. If the mate is already taken (on Jeremiah’s first play), Jeremiah takes any other letter.
3. After Second’s next play, Jeremiah will either win immediately, or if not possible, will block Second’s threat.
4. Jeremiah finds the win.

If the graph of ASTEROID II was as easy to draw in the sand as the grid of tic-tac-toe, it is likely it would have been discovered long ago.
The graph of ASTEROID is simpler (see the diagram at right). Notice that the eight allowed words are all transposals of sets of three consecutive letters around the octagon. Second wins this game by merely choosing the diametrically opposite letter chosen by First (shown dotted in the diagram). If First chooses S, Second responds with D, etc. At each successive turn Second either wins or plays the opposite of First. Once again, the opposites are the pairs from RADIO SET.

These games may be varied by playing the misere forms of each. Misere means that the first player to be forced to make an allowable word now loses. We leave to the reader to discover just how Second wins either misere form.

The ASTEROID puzzle uses the sixteen tiles consisting of the eight letters of ASTEROID and the eight three-letter words of ASTEROID II. These tiles are to be arranged around a 16-cycle so that abutting tiles have a letter in common. One of the six solutions (not counting rotations or reflections) is shown at left.

Another two-person game can be played with the sixteen tiles using the 16-cycle as a playing board. The two players alternately draw from a face-up bone pile a tile of their choice. It is placed on an empty node of the 16-cycle with the proviso that if it abuts a tile it must have a letter in common with it. This game is a forced second person win. A careful study of the solution graph will reveal a pairing strategy that secures the win for the second player.