Activity 3:
The Tower of Hanoi
Solutions

1. Answers will vary with the individual or team.

2.

<table>
<thead>
<tr>
<th>Number of Discs</th>
<th>Minimum Moves</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>31</td>
</tr>
<tr>
<td>6</td>
<td>63</td>
</tr>
<tr>
<td>7</td>
<td>127</td>
</tr>
<tr>
<td>8</td>
<td>255</td>
</tr>
</tbody>
</table>

The rules will vary with the ability of students. Some students will explain that the next term is one more than double the last term (i.e. 31 is one more than 2x15).

Others may see the rule as: The minimum number of moves = \(2^n - 1\).

Some will generalize \(a_n = a_{n-1} + 2^{n-1}\).

Some will see the differences as powers of two (see below).

\[
15 - 7 = 8 = 2^3 \\
31 - 15 = 16 = 2^4 \\
63 - 31 = 32 = 2^5 \\
127 - 63 = 64 = 2^6
\]

3a. 31 minutes.

b. 32,767 minutes ÷ 60 = 546.12 hours ÷ 24 = 22.75 days

4.

seconds per minute = 60
seconds per hour = 60 x 60 = 3,600
seconds per day = 3,600 x 24 = 86,400
seconds per year = 86,400 x 365 = 31,536,000
18,446,744,073,709,551,615 ÷ 31,536,000 = 584,942,417,400 years
approximately 585 billion years