

The Octadecayotton (12 Dimensions)

who'll be there when i'm gone?

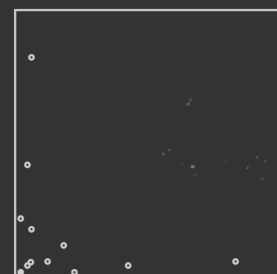
By default 9 dimensions is used, but multiple Octadecayottons or mod settings can change it.

The 4096 spheres will start moving, resembling the rotations of a 12-dimensional cube. 3 rotations are shown, followed by a brief pause before starting over.



Identifying Dimensions

- There are 12 dimensions: X, Y, Z, W, V, U, R, S, T, O, P, and Q. Each axis can either be positive, or negative.
- Any positive axis points to the right (+X), up (+Z), and/or towards (+Y) the viewer when viewed from the front.
- Any negative axis points to the left (-X), down (-Z), and/or away (-Y) the viewer when viewed from the front.
- Any given sphere has 12 neighbours, which are all 1 of each of the 12 axes, either positively or negatively.
- To the diagram to the right shows an example of a sphere's 12 neighbours as seen from the front. The unfilled spheres are neighbours of the filled sphere.
- In reading order (left-to-right then top-to-bottom), the spheres are O, S, Z, V, W, P, U, Q, T, R, Y (stacked on top of the filled sphere), and X.
- In this example, going from the filled sphere to any unfilled is a positive axis, while going from an unfilled sphere to the filled sphere is a negative axis.



Identifying Rotations

- Look at 2 spheres that are neighbours (note down their initial axis that connects them together) and watch them transform.
- If these 2 spheres are now neighboured from a different axis, that implies a rotation. Record the new axis that they transformed into, and repeat this process starting with the new axis until the first initial axis is reached.
- For any negative initial axis, invert both the initial and new axis. (positive -> negative, negative -> positive)

Identifying Rotations (...continued)

- When the first initial axis has been reached, start from the bottom of the list, and working your way up; append all the new axes to a separate list.
- The resulting list is called a subrotation. In a given rotation there can be multiple simultaneous subrotations happening at the same time.

Primary Values

- All rotations and subrotations have a primary value. Within each subrotation, create a list of every possible pair of axes from itself and the next axis. (including the last and first axis as a pair*)
- If the subrotation contains exactly 1 axis, ignore the above rule and make only 1 pair, consisting of the axis repeated twice.
- For each pair, get the value from the table, using the first letter as the row and the second letter as the column.
- If 1 of the 2 axes are negative, multiply the pair's result with -1.

* Even with 2 axes, this rule still applies. For example, subrotation +R-T gives +R-T and -T+R.

	X	Y	Z	W	V	U	R	S	T	O	P	Q	
X	1	2	5	1	8	8	1	5	2	1	2	5	X
Y	2	3	6	2	9	9	2	6	3	2	3	6	Y
Z	9	1	4	9	7	7	9	4	1	9	1	4	Z
W	1	2	5	1	8	8	1	5	2	1	2	5	W
V	2	3	6	2	9	9	2	6	3	2	3	6	V
U	9	1	4	9	7	7	9	4	1	9	1	4	U
R	1	2	5	1	8	8	1	5	2	1	2	5	R
S	2	3	6	2	9	9	2	6	3	2	3	6	S
T	9	1	4	9	7	7	9	4	1	9	1	4	T
O	1	2	5	1	8	8	1	5	2	1	2	5	O
P	2	3	6	2	9	9	2	6	3	2	3	6	P
Q	9	1	4	9	7	7	9	4	1	9	1	4	Q
	X	Y	Z	W	V	U	R	S	T	O	P	Q	

Primary Values (...continued)

- The absolute sum of all pairs on all subrotations is the primary value of that rotation. Later in this manual, whenever p_1 , p_2 , or p_3 is mentioned, it refers to the primary value of the 1st, 2nd, and 3rd rotation respectively.

The Anchor Sphere

- Create 4 codes, named a_0 , a_1 , a_2 , and a_3 , each starting with the value "000000000000". a_{1-3} represent rotations 1-3.
- Subtract the largest number equal or less than p_1 found in "Decimal \leftrightarrow Binary" from it, then set a_1 's Xth digit from the left to 1, where X is the position obtained from that same number that was subtracted with. Keep subtracting and setting digits to 1 until p_1 is 0.
- Repeat the above step using p_2 and a_2 , as well as p_3 and a_3 .

Decimal \leftrightarrow Binary												
Subtract	2048	1024	512	256	128	64	32	16	8	4	2	1
Position	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th

- Look at a_1 and its rotation, for each axis, invert the number's position (0 \rightarrow 1, 1 \rightarrow 0) according to this the table below.
- Repeat this for a_2 and a_3 , then set a_0 based on these 3 conditions:
- If the 7th digit of a_1 is 1, set the 1st, 2nd, 3rd, and 4th digits of a_0 to 1.
- If the 7th digit of a_2 is 1, set the 5th, 6th, 7th, and 8th digits of a_0 to 1.
- If the 7th digit of a_3 is 1, set the 9th, 10th, 11th, and 12th digits of a_0 to 1.

Axis \leftrightarrow Position												
+Axis	+X	+Y	+Z	+W	+V	+U	+R	+S	+T	+O	+P	+Q
-Axis	-Q	-P	-O	-T	-S	-R	-U	-V	-W	-Z	-Y	-X
Position	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th

The Anchor Sphere (...continued)

a_{1-3} is now gray code, convert each one to binary:

1. The first binary digit will match the first digit of the gray code.
 2. The next digit is a 1 if the sum of the previous digit of the binary code and the current position's gray code is exactly 1. Otherwise it's 0.
 3. Repeat step 2 until 12 digits are obtained. This is the binary code.
- Starting from a_1 , add the current a with the previous a , and then refer to the next a . Don't carry ($1+1 \neq 10$) and replace 2's with 0's on each step.
 - Replace every 0 with - and every 1 with +. This is now the anchor sequence. Whenever the anchor sphere is mentioned, it refers to the only 1 sphere that matches all positive/negative attributes of the anchor sequence's axes. The position of each character represents what axis they belong to, with the order being "XYZWVURSTOPQ".

Pausing

- Interact anywhere on the module to pause it. The rotations will stop, and a sound cue is played to indicate that it is ready to be interacted with.
- Each time the module is paused, a random sphere is chosen. This is called the starting sphere. The starting sphere is white.
- The goal is to get the starting sphere to be on the same location as the anchor sphere.

Navigation

- When the module is interacted with during the seconds digits (modulo 20) being 0-11, an axis is queued. Each submission from 0-11 represents an axis, though order is random.
- 3 axes need to be queued for a valid input. When the timer's seconds digits are 19, 39 or 59, it will try submitting the 3 axes. The queue is cleared if any other number of axes are queued.
- The starting sphere goes to the other side of all 3 axes that were submitted.
- During this submission, all axes can only be submitted up to 2 times.
- This rule can be violated up to four times. The 5th time causes a strike.
- When the starting sphere is in the same position as the anchor sphere, submit all 12 axes. The module will strike or solve accordingly.
- Striking the module will unpause the module.