Beam Algorithm - Software Version (v0.0.3-1)

1. Initialize a groupoid G of minimum size 3x3. Initialize a beam of width w and the set of male terms M equal the set of term variables $\overrightarrow{x}$. Initialize T, the target array of length g^k where g is the size of the groupoid G and k is the number of term variables in $\overrightarrow{x}$.

2. At beam level 0, initialize a set F containing w empty female terms $f_0(\Diamond)$. Let variable H be the current level of a female term in the beam, initialized to 0.

START LOOPING STARTING AT LEVEL H=0 UNTIL A SOLUTION IS FOUND

3. Mate each female term $f_H(\overrightarrow{x}, \Diamond)$ at some level H with each male term $m(\overrightarrow{x})$ in M and check if the resulting offspring $f_H(\overrightarrow{x}, m(\overrightarrow{x}))$ is a solution to the validity array of $f_H(\overrightarrow{x}, \Diamond)$. If $f_H(\overrightarrow{x}, m(\overrightarrow{x}))$ is a solution, break from the loop and proceed to step 6.

4. Start a process p_H for each female term $f_H(\overrightarrow{x}, \Diamond)$ in F for a total of w processes. Let each process p_H search for a female term at level $H{+}1$ called $f_{H+1}(\overrightarrow{x}, \Diamond)$ that is valid with respect to the validity array of $f_H(\overrightarrow{x}, \Diamond)$.

START LOOPING UNTIL LEVEL H+1 IS FULL

5. Let $f_{H+1}(\overrightarrow{x}, \Diamond)$ be a valid female term returned by a process p_H started in step 4. Assume $f_{H+1}(\overrightarrow{x}, \Diamond)$ was found using female term candidates chosen at random inside of a process p_H using the Gamblers Ruin Algorithm (GRA). Add $f_{H+1}(\overrightarrow{x}, \Diamond)$ to beam level $H + 1$. If level $H + 1$ contains w valid female terms, i.e. level $H + 1$ is full, then break from the loop, set H equal to H+1, and return to step 4.

CONTINUE LOOPING

SET H EQUAL TO H + 1 AND CONTINUE LOOPING

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6. Some solution term $f_H(\overrightarrow{x}, m(\overrightarrow{x}))$ was found at step 3. Recursively mate $f(\overrightarrow{x}, m(\overrightarrow{x}))$ with each of parent term at $f_{H-1}(\overrightarrow{x}, \Diamond)$, until reaching the term that has no parent. The result is a term which has an array that is a solution to the target array.