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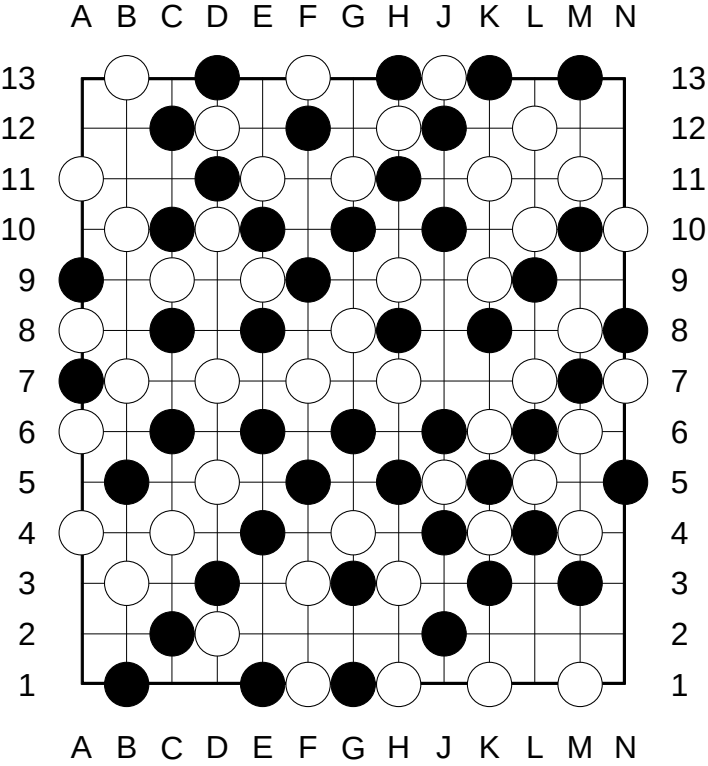
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COLgo and SNORTgo

September 26, 2005

Een COLgo positie.



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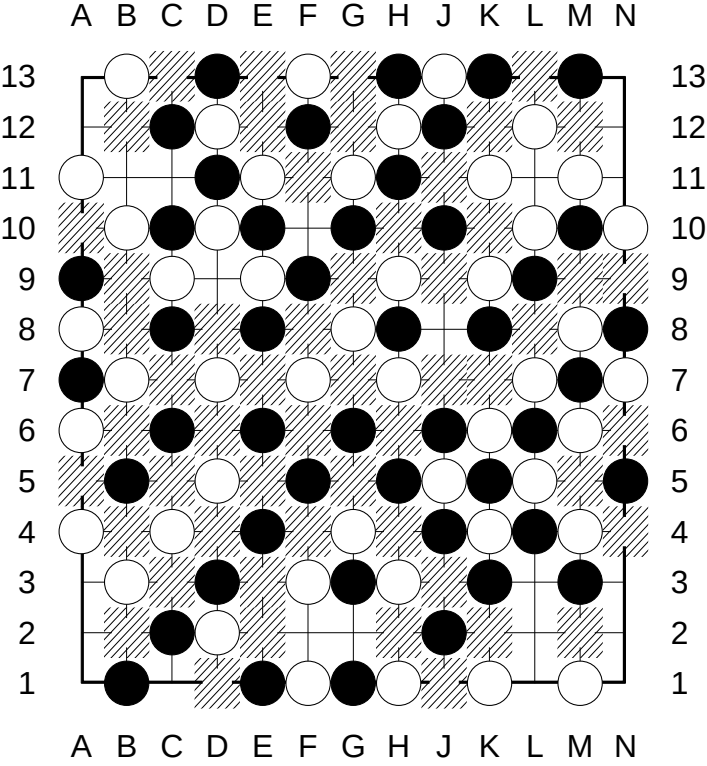
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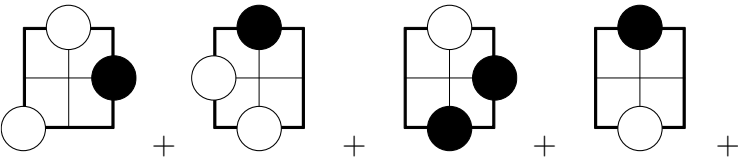
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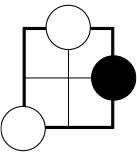
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$\bigcirc + \bigcirc + \bigcirc + \bullet + \bullet$



$\{ \begin{array}{|c|c|c|} \hline \times & \circ & \\ \hline \times & & \bullet \\ \hline \circ & \times & \\ \hline \end{array} \mid \begin{array}{|c|c|c|} \hline & \circ & \\ \hline & & \bullet \\ \hline \circ & & \times \\ \hline \end{array} \} = 1 + 1 - 1 = 1$

$$G = \{ G^L \mid G^R \}$$

- $G > 0$ asa Links heeft winnende strategie
- $G < 0$ asa Rechts heeft winnende strategie
- $G = 0$ asa 2de speler heeft winnende strategie
- $G||0$ asa 1ste speler heeft winnende strategie

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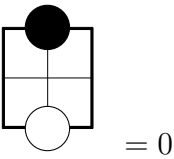
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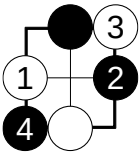
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want 2de speler heeft winnende 'spiegel-strategie', bvb.

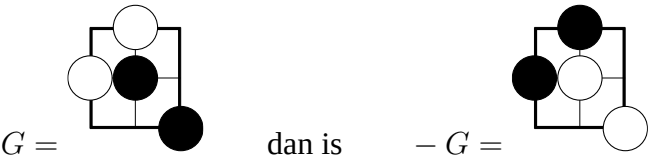


Tweedledee-Tweedledum strategie

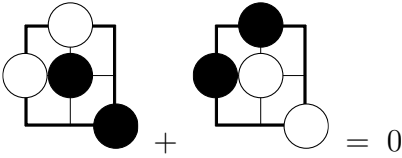
Ieder spel G heeft een 'negatief' $-G$ zodat

$$G + (-G) = 0$$

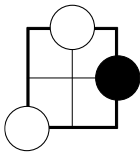
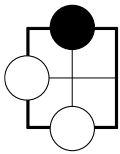
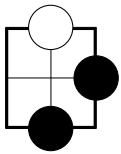
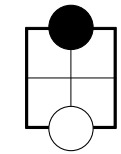
Verwissel alle kleuren in $-G$. Bvb.



want



(kopie-strategie).

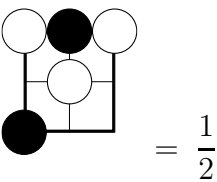
 +  +  +  +

+1 (tweedledee-tweedledum) 0 0

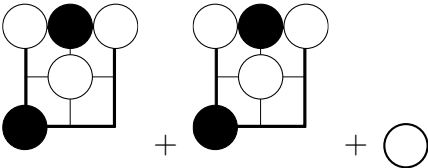
 +  +  +  + 

-3 +2

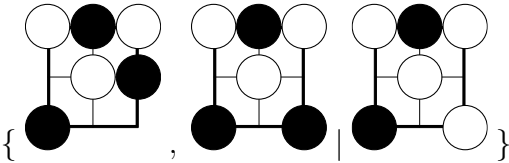
Niet-gehele voordelen bestaan

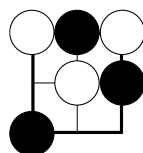


bewijs 1 (strategie)

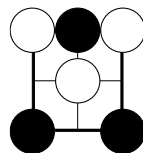


bewijs 2 (recursie)

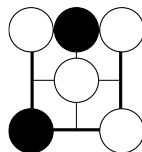




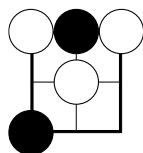
$$= \{\emptyset | 0\} = -1$$



$$= 0$$



$$= \{0 | \emptyset\} = 1$$



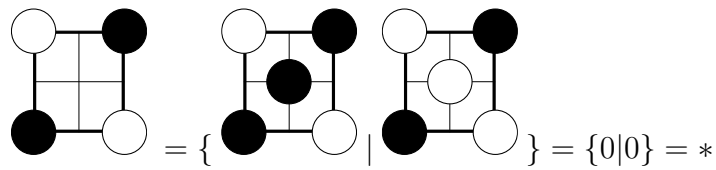
$$= \{-1, 0 | 1\} = \frac{1}{2}$$

Berlekamp's simplicity rule

$G = \{G^L | G^R\}$ is *getal* asa alle opties in G^L en in G^R getallen zijn en voor alle opties geldt $G^L < G^R$.

Dan is de waarde van G het eenvoudigste dyadische getal $> G^L$ en $< G^R$.

Niet-getal posities bestaan.



*||0

Hoofdstelling voor COLgo posities : De waarde van iedere COLgo positie is van de vorm

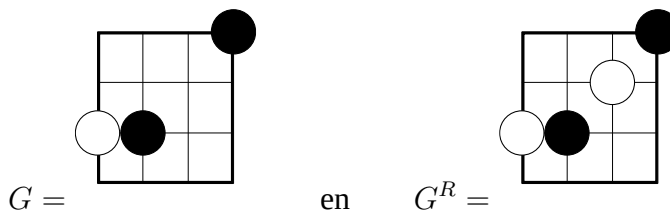
$$g \quad \text{of} \quad g + *$$

met g een (dyadisch) getal is. Links (bLack) wint als $g > 0$, Rechts (white) als $g < 0$. Als $g = 0$ dan wint de tweede speler tenzij $g + *$ dan wint de eerste speler.

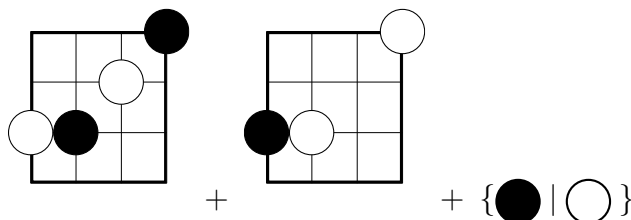
bewijs : Neem een COLgo positie $G = \{G^L \mid G^R\}$. We beweren :

$$G^L + * \leq G \leq G^R + *$$

Bvb.



Dan wint Links als tweede speler $G^R - G + *$, d.i. $G^R + * - G \geq 0$



Analoog bewijs je $G^L + * - G \leq 0$ (Rechts wint als tweede speler).

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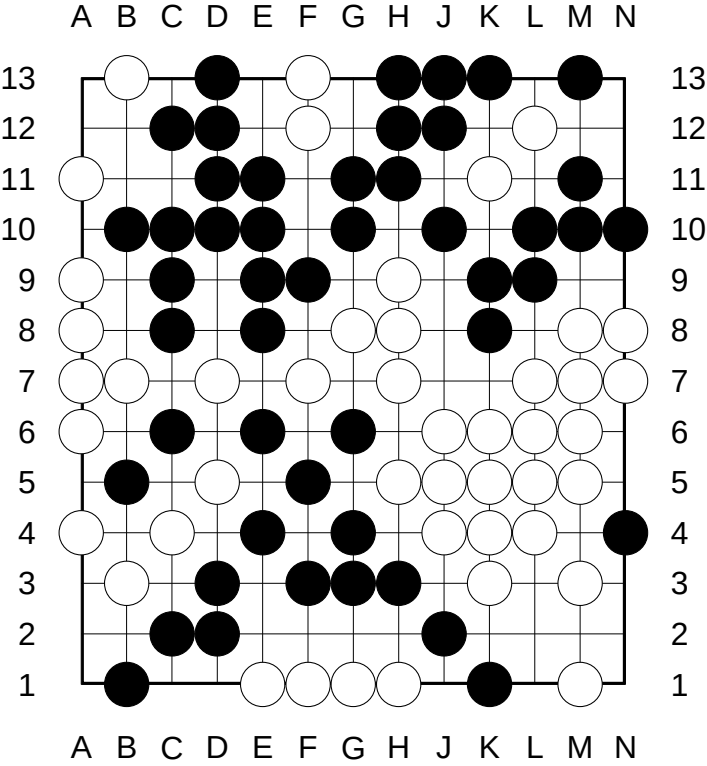
Rekursief is iedere $G^L = g_L$ of $g_L + *$ (analoog voor G^R). Neem :

$$g' = \max(g_L) \quad \text{en} \quad g'' = \min(g_R)$$

dan hebben we volgende mogelijkheden :

$$\begin{cases} g' < g'' \Rightarrow G = g \text{ of } g + * \\ g = g' = g'' \Rightarrow G = \{g \mid g\} = g + * \text{ of } \{g + * \mid g + *\} = g \end{cases}$$

Een SNORTgo positie



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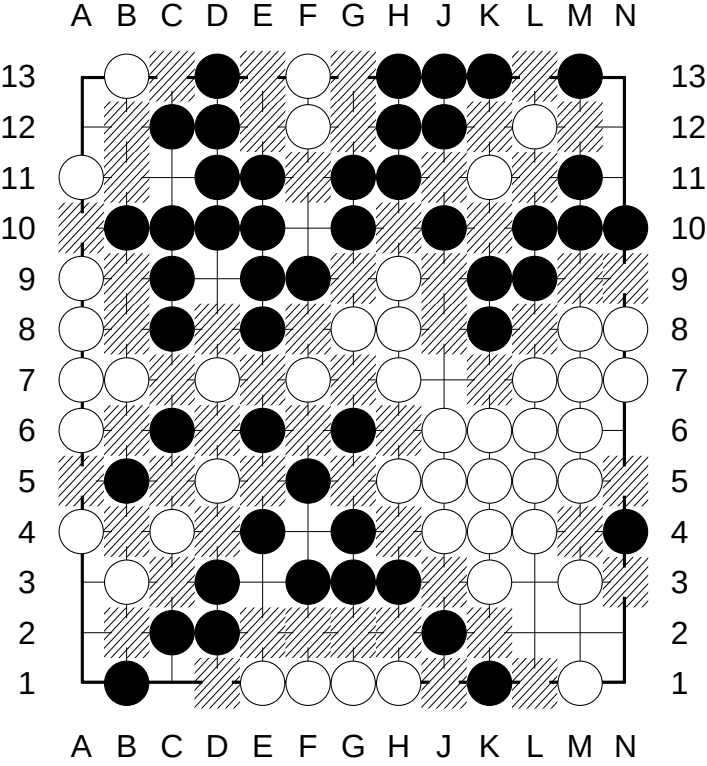
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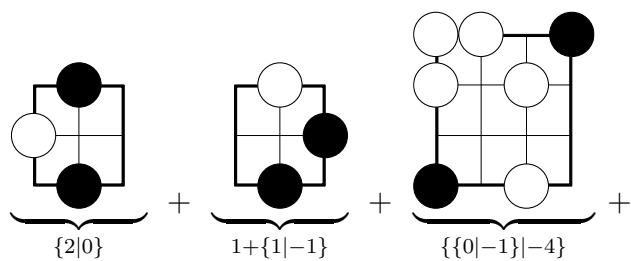
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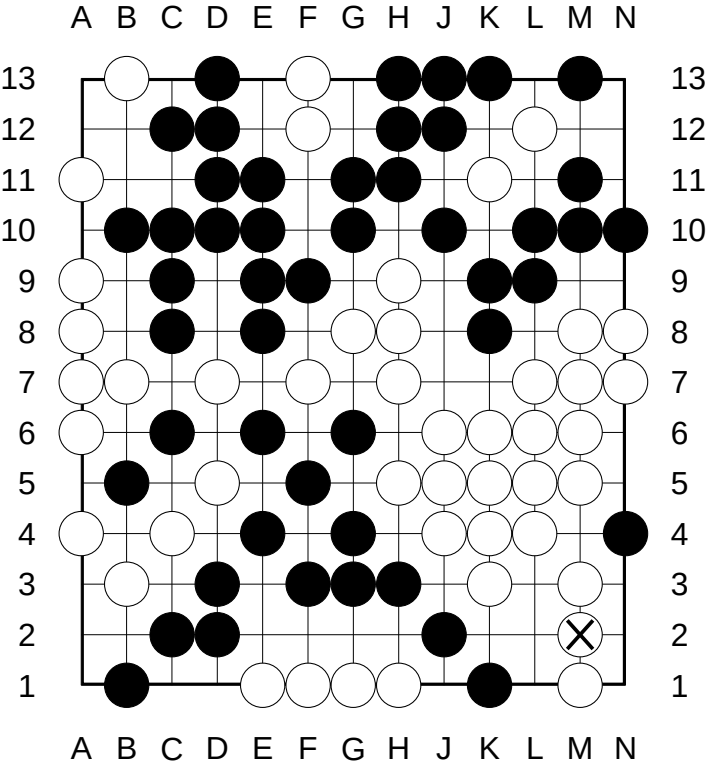


$$\underbrace{\bigcirc + \bigcirc + \bigcirc + \bigcirc}_{-4} + \underbrace{\bullet + \bullet + \bullet + \bullet + \bullet}_{+5}$$

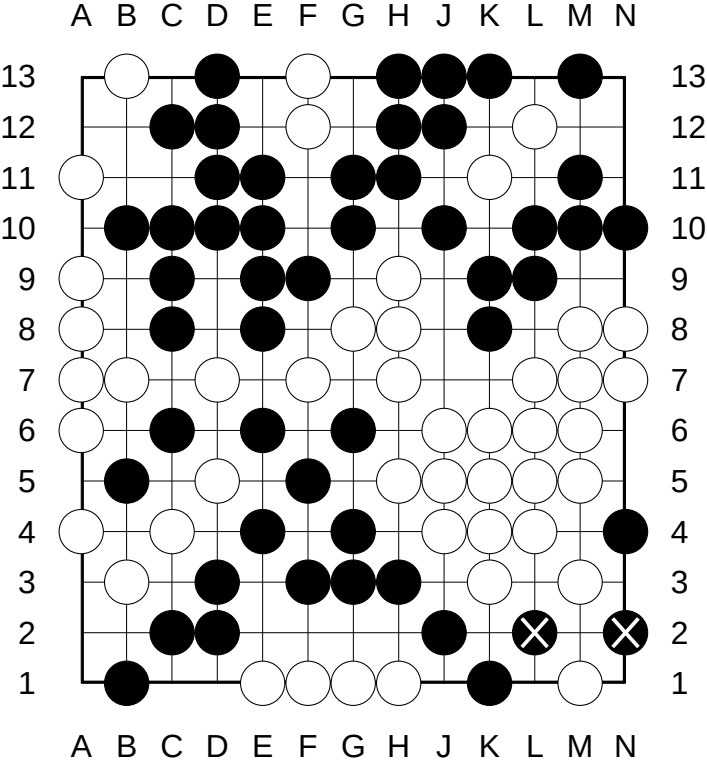
Combinatorial Game Suite : Java Applet
<http://cgsuite.sourceforge.net/download.php>

$$G = \{\{3|2\}|-1\}||0$$

dus eerste speler heeft een winnende strategie!



De unieke! winnende zet voor Rechts (white).



De winnende opties voor Links (bLack).