Assignment 9

18. Due 11/06/17.
Implement the follow ing search al gorithms as Grammars of Reduced Searches and show examples of searches:

a) Simple Hill-Climbing
b) Steepest Ascent Hill-Climbing
c) Alpha-Beta Minimax (extra credit)

In particular you have to construct MV and CUT for each case.

19. Due 11/06/17.
Construct functions MV and CUT for the Grammar of Reduced Searches to generate the search along the trajectories of Zones. You can make necessary assumptions.

20. Project IV. Due 11/15/17 (Wednesday - 2.5 weeks)

Implement Grammar of Reduced Searches G_{rs} (next handout) for the 2D/3A problem (page 3 – this handout).

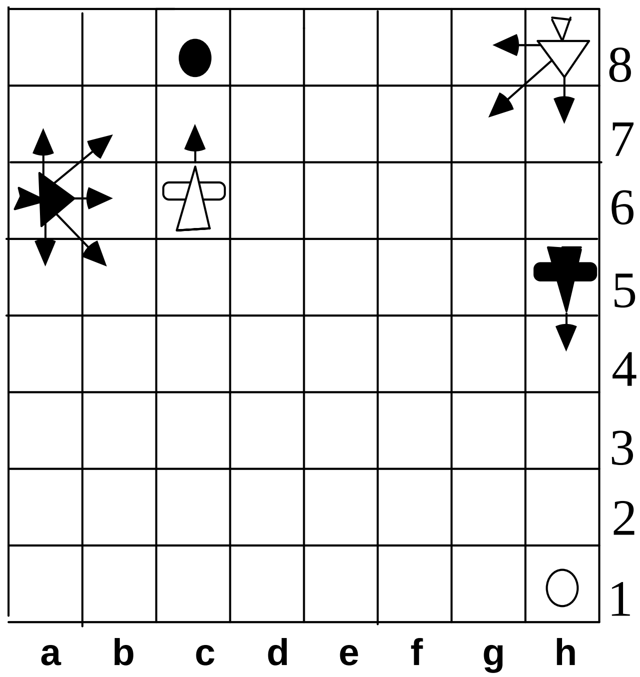
Implement CUT employing your full scale grammar of Zones G_Z (or a simplified version of this grammar), the notion of gateways and board distances.

At this time you do not have to implement MV . Instead you can simulate MV by storing the tree shown in page 10 (this handout) and running the grammar using this simulation of M V. However, your program should do everything else what G_{rs} is supposed to do, including tree generation, minimax, termination of branches using your real CUT. Zones must be either translated or regenerated in every state. Your printout should demonstrate a number of intermediate snapshots of the tree (and the final one) as w ell as terminal states of the tree with graphical networks (showing the basis for termination).

Representation of *search*: Languages of Searches

Optimization problem for autonomous aerospace robotic vehicles with serial alternating motions

2D/4A Problem



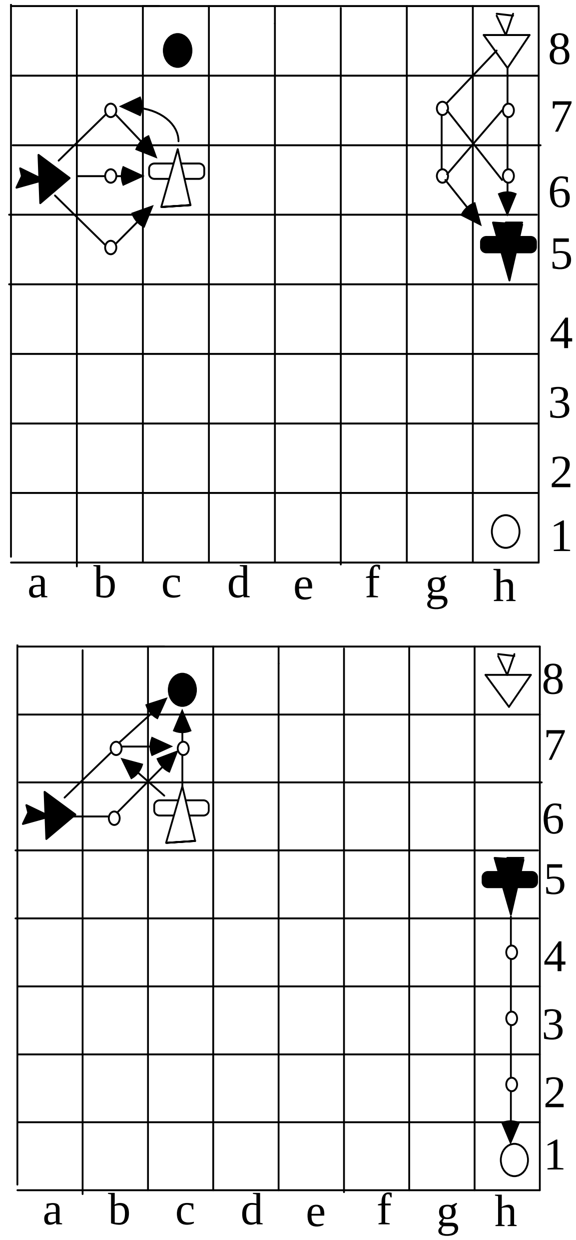
Is there a strategy for the White to make a draw?

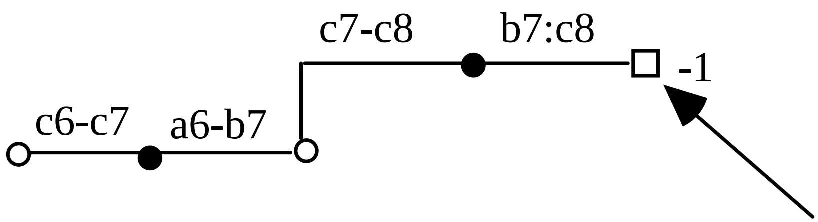
The specific question is as follows.
Is there an optimal strategy that provides one of the following?

1. **Both BOMBERs hit their targets on subsequent time increments and stay safe for at least one time increment.**

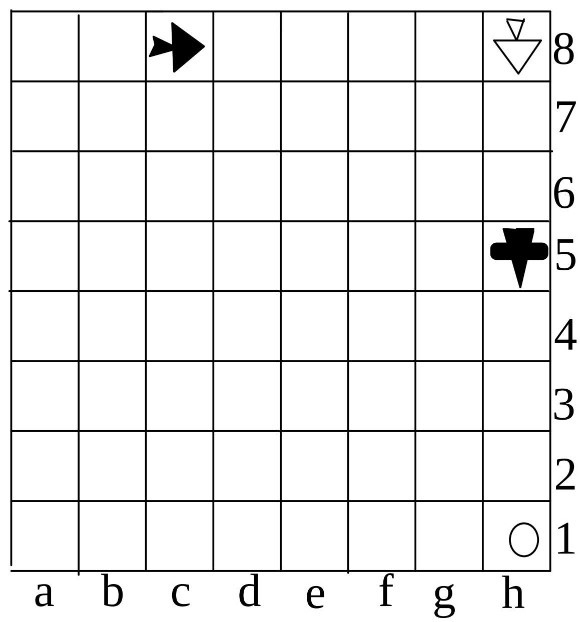
2. **Both BOMBERs are destroyed before they hit their targets or immediately after that.**

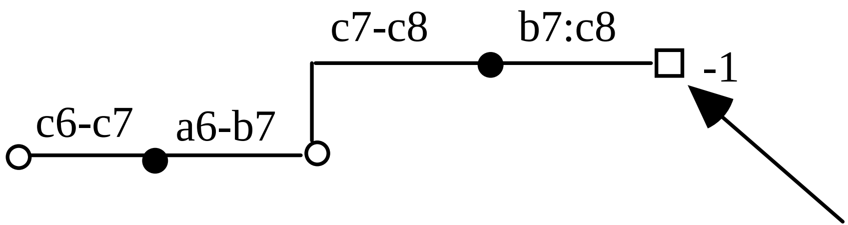
Zones in the Start State of the Robot Control Model.



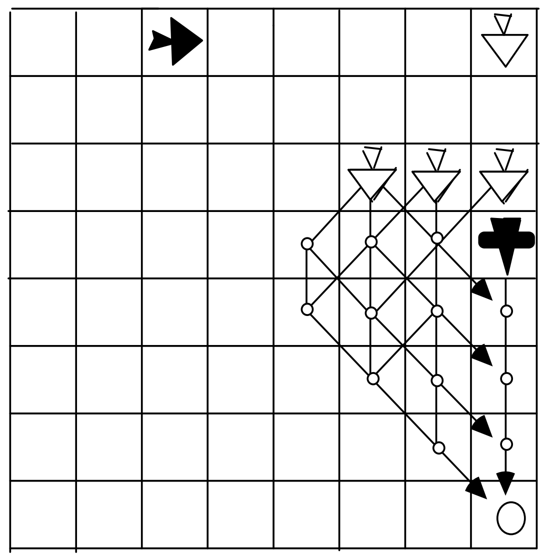


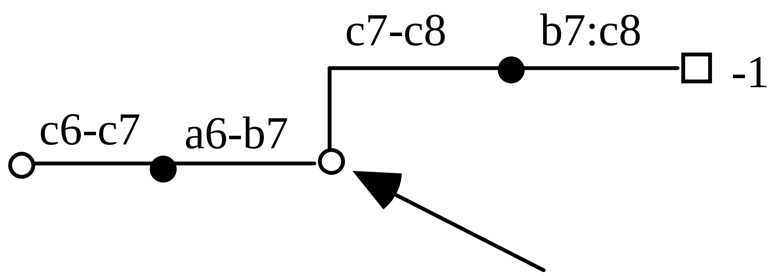
State where the branch was terminated and the control Zone from h8 to c8 was detected.



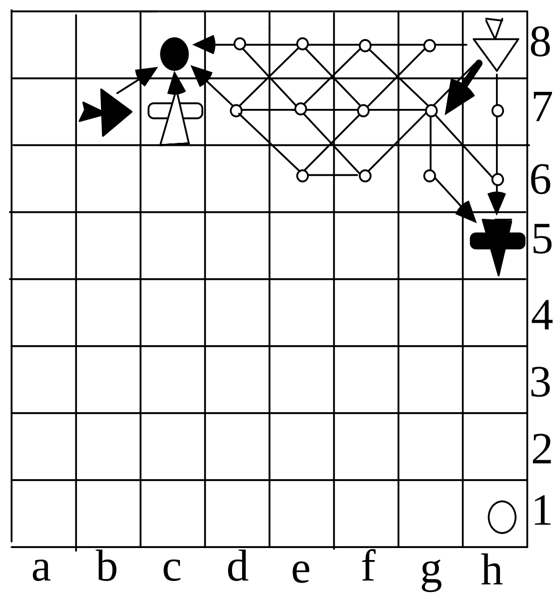


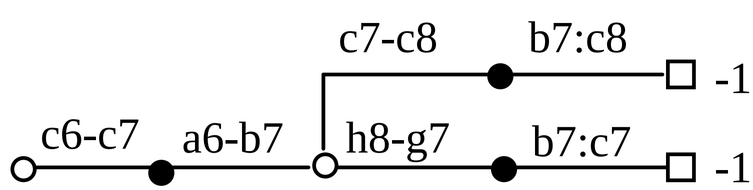
State where the branch was terminated. Zone gateways.

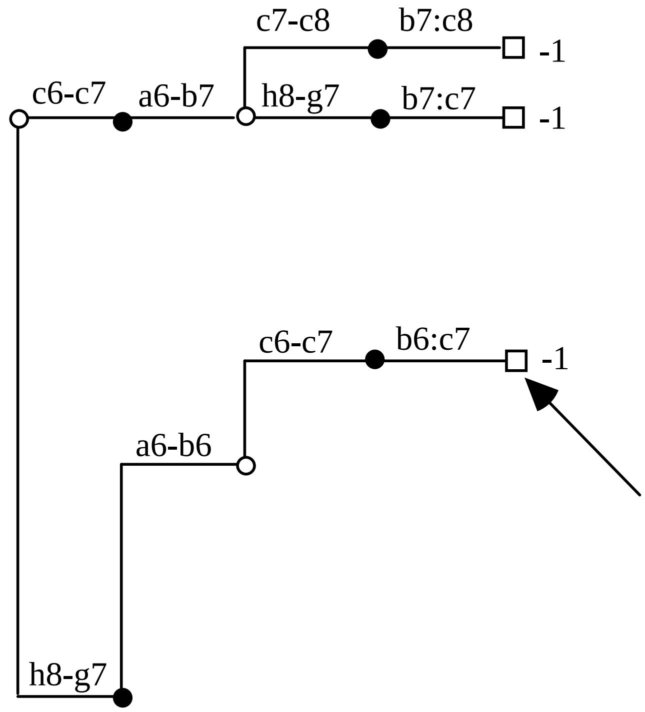




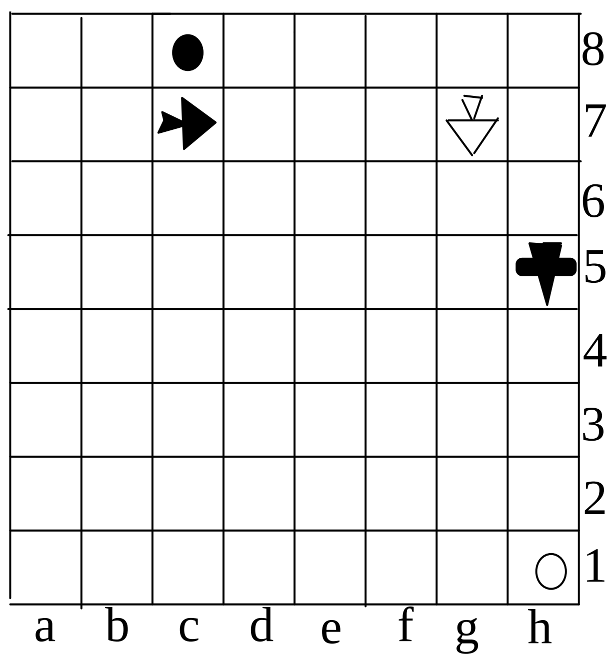
State where the control Zone from h8 to c8 was included into the search

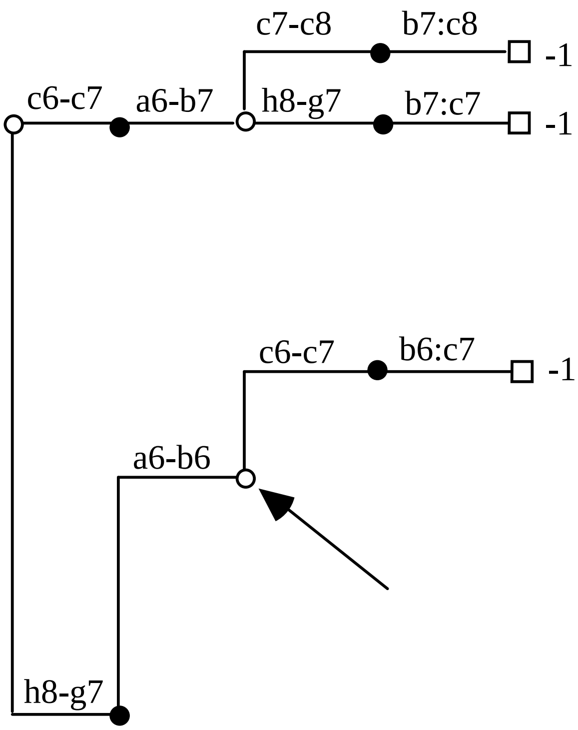




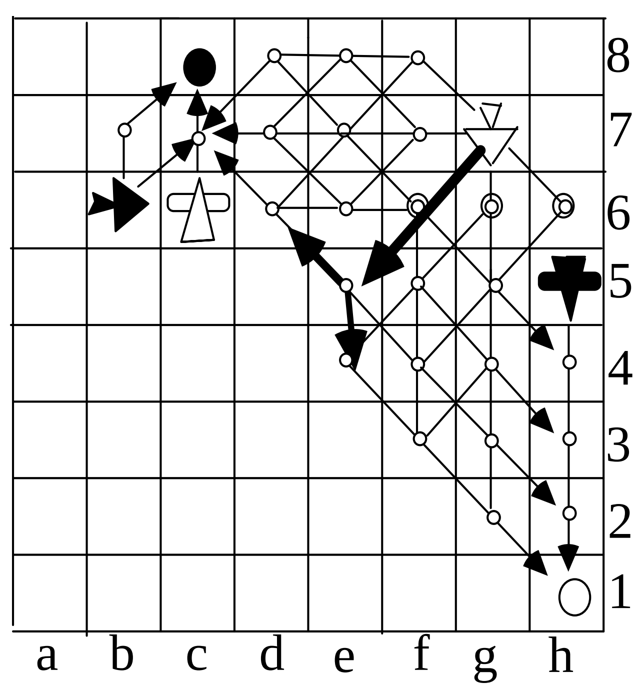


State where the control Zone from g7 to c7 was detected

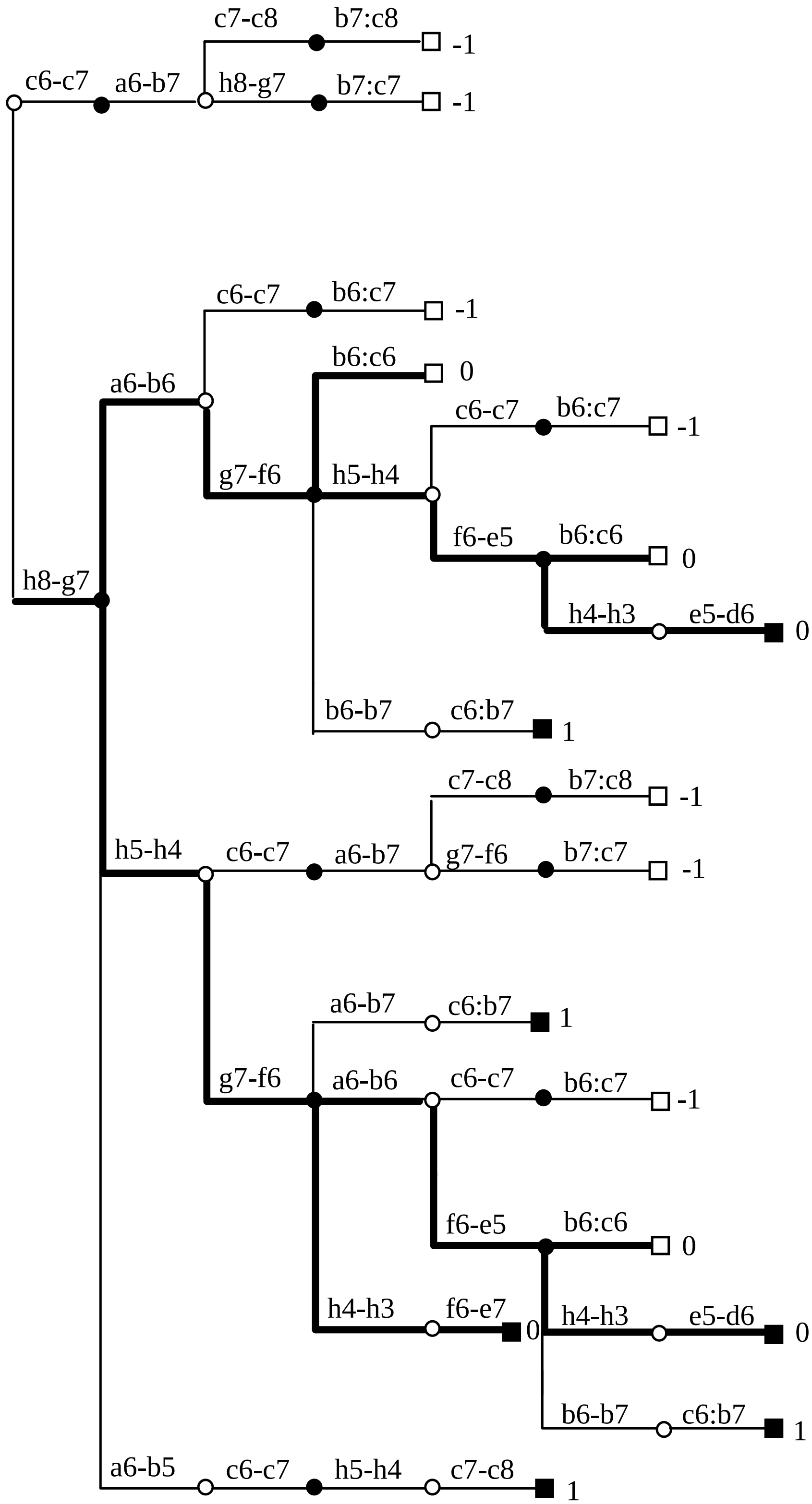




State where the control Zone from g7 to c7 was included into the search



Search tree for the robotic vehicles with alternating serial motions



Languages of Searches

A ***Family of Languages of Searches***
is the following five-tuple:

(π(i$_1$)π(i$_2$)…π(i$_m$)), *Child*, *Sibling*, *Parent*, *other functions*),

where

π(i$_k$) denote branches of a tree and for each i_n:

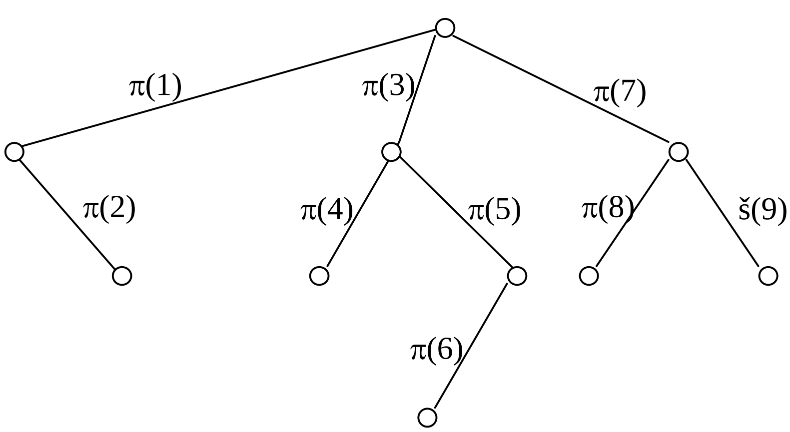
Child*(i$_n$)** = 0 if π(i_n) represents a leaf branch, ***Child(i_n) = **i_{n+1}** in the other cases; it means that π(i_{n+1}) is the left-most child branch for π(i_n);

Parent*(i$_n$)** = 0 if π(i_n) is a root branch (without parent), for the remaining n ***Parent(i_n) = i_r, where π(i_r) is parent branch for π(i_n);

Sibling*(i$_n$)** = 0 if branch π(i_n) is the right most child branch of a parent (or root); ***Sibling(i_n) = π(i_r), where π(i_r) is the next right child branch of the same parent π(***Parent***(i_n)).

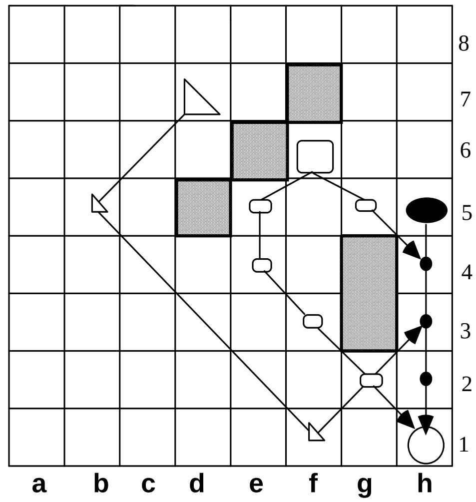
The list of certain ***other functions*** singles out a specific language of searches, a member of this family (or sub-family of languages).

Interpretation of the language of searches
(π(1)π(2)π(3)π(4)π(5)π(6)π(7)π(8)π(9), *Child*, *Parent*, *Sibling*)



Child(1)=2, ***Parent***(1)=0, ***Sibling***(1)=3;
Child(2)=0, ***Parent***(2)=1, ***Sibling***(2)=0,
and so on.

Language of Translations for Robot Control Model



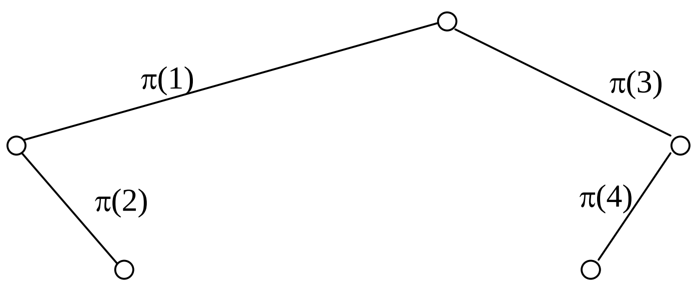
A simplified string of the Language of Translations is as follows:

$(\pi(2)\pi(1)\pi(4)\pi(3)$, ***Child***, ***Sibling***, ***Parent*****,** TRANSITIONS),

where

Child(1) = 2,	***Child***(2) = 0,	***Child***(3) = 4,	***Child***(4) = 0,
Parent(1)= 0,	***Parent***(2) =1,	***Parent***(3) = 0,	***Parent***(4) = 3,
Sibling(1) = 3,	***Sibling***(2) =0,	***Sibling***(3) = 0,	***Sibling***(4) = 0.

TRANSITIONS = $\{M_1, M_2, M_3, M_4\}$.



M_1 = TRANSITION(MISSILE, d7, b5)
M_2 = TRANSITION(BOMBER, h5, h4)
M_3 = TRANSITION(FIGHTER, f6, e5)
M_4 = TRANSITION(BOMBER, h5, h4)

Languages of Searches

A Family of Languages of Searches is the family of languages generated by the certain family of grammars {$\mathbf{G_S}$}:

Family of Grammars of Searches $\mathbf{G_S}$
(*draft*)

L	Q	Kernel, π_k	π_n	F_T	F_F
1	Q_1	***S***(i) –> ***A***(i)	formulas for **$\mathbf{G_s}$**	2	ø

2	$Q_2^{G_s}$	***A***(i) –> ***A***(End)***π***(End)***A***(i)	***Parent***(End) := i
			
			If ***Child***(i) ≠ 0
			then
			Sibling(***Child***(i)):=End
			else
			Sibling(i):= 0
			Endif
			Child(i):=End
			End:=End+1
			
			formulas for **$\mathbf{G_s}$**
				2	3

3	Q_3	***A***(i) –> ***e***	formulas for **$\mathbf{G_s}$**	2	ø

At the beginning of the derivation: i = 0, End = 1; Functions ***Child***(i), ***Sibling***(i) and ***Parent***(i) equal 0 for all integer i ≥ 0.

Among formulas for $\mathbf{G_S}$ there are formulas for TRANSITIONs of the Complex system of such a sort, that every branch of the tree generated by the grammar corresponds to some TRANSITION.

Derivation of the string of the Language of Translations

S(0) ^{1}=> A(0) ^{2}=> A(1)π(1)A(0)

> **i= 0**
> ***Parent*(1) :=0**
> ***Child*(0) = 0 —> *Sibling*(0) := 0**
> ***Child*(0) := End (=1)**
>
> **End := End+1 (= 2)**

^{2}=> A(2)π(2)A(1)π(1)A(0)

> **i= 1**
> ***Parent*(2) :=1**
> ***Child*(1) = 0 —> *Sibling*(1) := 0**
> ***Child*(1) := End (= 2)**
>
> **End := End+1 (= 3)**

^{2}=> failure ^{3}=> π(2)A(1)π(1)A(0)

^{2}=> failure ^{3}=> π(2)π(1)A(0)

^{2}=> π(2)π(1)A(3)π(3)A(0)

> **i= 0**
> **Parent(3) :=0**
> ***Child*(0) ≠ 0 (=1) —> *Sibling*(1) := End (=3)**
> ***Child*(0) := End (=3)**
> **End := End+1 (= 4)**

^{2}=> π(2)π(1)A(4)π(4)A(3)π(3)A(0)

> **i= 3**
> ***Parent*(4) :=3**
> ***Child*(3) = 0 —> *Sibling*(3) := 0**
> ***Child*(3) := End (=4)**
> **End := End + 1 (= 5)**

^{2}=> failure ^{3}=> π(2)π(1)π(4)A(3)π(3)A(0)
^{2}=> failure ^{3}=> π(2)π(1)π(4)π(3)A(0)
^{2}=> failure ^{3}=> π(2)π(1)π(4)π(3) ^{2}=> failure ^{3}=> stop