

1 Performance problems

At the present stage of the development of the DigiHive environment the main problem is its rather poor performance which mostly is the result of the implemented backtracking algorithm. The following example explains the problem. Let us assume that the program (listed in Fig. 1) searches the structure shown in Fig. 2a but in its surrounding there exists only the structure presented in Fig. 2b. Because the structure presented in Fig. 2b does not contain the structure presented in the Fig. 2a the program fails after many backtracking operations. Taking into account the number of particles encoding the program which is 32, the number of particles in Fig. 2b, and the order of predicates in the program, the number of calls of the predicate exists is 1604. The details of calculations are shown in the Tables 1,2, and 3.

In the tables the first column shows the cumulated number of calls of the predicate exists, the second column (Direction) presents the active direction of the program, the third column shows the line number of the program executed, and the last column gives the returned number of particle if the predicate succeeds or letter F means that the predicate fails.

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(1) program():-
(2)     search(), action().
(3) search():-
(4)     structure(0).
(5) structure(0):-
(6)     exists([x,x,x,x,x,x,x], mark V1),
(7)     exists([x,x,x,x,x,x,x] bound to V1 in S, mark V2),
(8)     exists([x,x,x,x,x,x,x] mark V3),
(9)     exists([x,x,x,x,x,x,x] bound to V3 in S, mark V4),
(10)    exists([x,x,x,x,x,x,x] bound to V4 in SW).
(11) action():-
(12)    bind(V2 to V3 in N).
  
```

Figure 1: Example program recognizing the structure shown in Fig. 2a

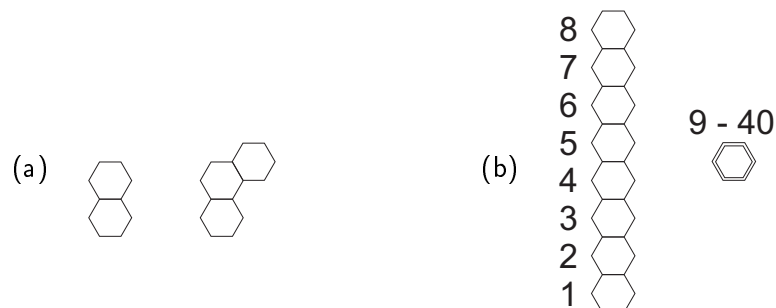


Figure 2: A structure searched by the program presented in Fig. 1 (a), and the structure seen by the program (particles 9 – 32 form the program itself) (b)

Cumulated number of calls	Direction of the program	Program line executed	Returned particle number
1	N	6	1
2	N	7	2
3	N	8	3
4	N	9	4
5	N	10	F
6	N	8	4
7	N	9	5
8	N	10	F
9	N	8	5
10	N	9	6
11	N	10	F
12	N	8	6
13	N	9	7
14	N	10	F
15	N	8	7
16	N	9	8
17	N	10	F
18	N	8	8
19	N	9	F
20	N	8	9
21	N	9	F
22	N	8	10
23	N	9	F
	⋮	⋮	
82	N	8	40
83	N	9	F
84	N	6	2
85	N	7	3
86	N	8	4
87	N	9	5
88	N	10	F
89	N	8	5
	⋮	⋮	
95	N	8	7
96	N	9	8
97	N	10	F
98	N	8	8
99	N	9	F
100	N	8	1
101	N	9	F
102	N	8	9
103	N	9	F
	⋮	⋮	
164	N	8	40
165	N	9	F

Table 1: The calling sequence of the predicate exists

Cumulated number of calls	Direction of the program	Program line executed	Returned particle number
166	N	6	3
167	N	7	4
168	N	8	5
169	N	9	6
170	N	10	F
171	N	8	6
	⋮	⋮	
246	N	8	40
247	N	9	F
248	N	6	4
	⋮	⋮	
328	N	8	40
329	N	9	F
330	N	6	5
	⋮	⋮	
410	N	8	40
411	N	9	F
412	N	6	6
	⋮	⋮	
492	N	8	40
493	N	9	F
494	N	6	7
	⋮	⋮	
575	N	8	40
576	N	9	F
577	N	6	8
578	N	7	F
579	N	6	9
580	N	7	F
	⋮	⋮	
641	N	6	40
642	N	7	F
643	S	6	8
644	S	7	7
645	S	8	6
646	S	9	5
647	S	10	F
	⋮	⋮	
1283	S	6	40
1284	S	7	F
1285	NE	6	1
1286	NE	7	F
	⋮	⋮	
1363	NE	6	40
1364	NE	7	F

Table 2: The calling sequence of the predicate exists (cont'd)

Cumulated number of calls	Direction of the program	Program line executed	Returned particle number
1365	SE	6	13
1366	SE	7	F
	⋮	⋮	
1443	SE	6	40
1444	SE	7	F
1445	SW	6	13
1446	SW	7	F
	⋮	⋮	
1523	SW	6	40
1524	SW	7	F
1525	NW	6	13
1286	NW	7	F
	⋮	⋮	
1603	NW	6	40
1604	NW	7	F

Table 3: The calling sequence of the predicate exists (cont'd)