```
(%i1) load("E:/instalki studia/permutacje.fasl")$
```

Biblioteka kombinatoryczno–grafowa, ver. 2.8, 1 marca 2020 r.
Autor: Antoni Szczepański, aszczep@prz.edu.pl PRz–WEiI–KEiPI–Rzeszów–Poland

```
(%i2) g:[5,4,6,2,3,1]##([[3,5,2],[1,4]]##([4,3,1,6,2,5]@-119)##((([[4,1,2],[3]]##[[5,6,2],[1],[3],[4]])@91))
(g)   [[1,5,3,6]]

(%i4) cycles2perm(g);

(%o3) [5,2,6,4,3,1]

(%i5) kill(f)$
      lewa(f):=([[4,2,1],[5,3]]##f@-1##[[4,1,3,5,2]])@-1##[[2,5,4],[1],[3]];
      prawa(f):=(([3,5,1,4,2]@-1)##((([[4,3],[1],[2],[5]]##[[1,2,4,5],[3]])@-1))@2017;
      rownanie(f):= (lewa(f)==prawa(f));
      f1:p_solve2(rownanie,5);
(%o5) lewa(f):=
      ([[4,2,1],[5,3]] ## (f @ (-1) ## [[4,1,3,5,2]])) @ (-1) ## [[2
      ,5,4],[1],[3]]
(%o6) prawa(f):=([3,5,1,4,2] @ (-1) ##
      ([[4,3],[1],[2],[5]] ## [[1,2,4,5],[3]]) @ (-1)) @ 2017
(%o7) rownanie(f):=lewa(f) == prawa(f)
(f1)  [[3,5,2,4,1]]

(%i8) perm2maxcycles(f1);

(%o9) [[3,5,2,4,1]]

(%i10) z4:p_random(6);
(z4)  [[1,3,5],[2,4,6]]

(%i11) is_derangement(z4);
       is_involution(z4);
       is_transposition(z4);
       is_onecyclic(z4);
       is_even(z4);
       is_odd(z4);
(%o17) true
(%o18) false
(%o19) false
(%o20) false
(%o21) true
(%o22) false
```

```
→ h:p_random(6);
(h) [[1,6,3,2],[4,5]]

→ h1:cycles2perm(h);
(h1) [6,1,2,5,4,3]

→ p_inversions(h1);
p_inv_vector(h1);
p_number(h1);
(%o32) [[6,1],[6,2],[6,5],[6,4],[6,3],[5,4],[5,3],[4,3]]
(%o33) [5,0,0,2,1,0]
(%o34) 605

→ h2:p_next(h1);
h3:p_next(h2);
h4:p_next(h3);
h5:p_next(h4);
h6:p_next(h5);
(h2) [6,1,3,2,4,5]
(h3) [6,1,3,2,5,4]
(h4) [6,1,3,4,2,5]
(h5) [6,1,3,4,5,2]
(h6) [6,1,3,5,2,4]

→ z4:[[4,1,5],[2,3]];
(z4) [[4,1,5],[2,3]]

→ z4l1:p_transpos_neighb_left(z4);
z4l2:p_transpos_neighb_right(z4);
(z4l1) [[[4,5]],[[3,4]],[[2,3]],[[3,4]],[[1,2]],[[2,3]],[[3,4]]]
(z4l2) [[[2,1]],[[3,2]],[[2,1]],[[5,4]],[[4,3]],[[3,2]],[[2,1]]]

→ p_inversions(z4);
(z4l3) [[5,3],[5,2],[5,1],[5,4],[3,2],[3,1],[2,1]]

→ z4l3:[[[5,3]],[[5,2]],[[5,1]],[[5,4]],[[3,2]],[[3,1]],[[2,1]]];
(z4l3) [[[5,3]],[[5,2]],[[5,1]],[[5,4]],[[3,2]],[[3,1]],[[2,1]]]
```

```
(%i78) p_list_composition(z4l1);
       p_list_composition(z4l2);
       p_list_composition(z4l3);
(%o78) [[1,5,4],[2,3]]
(%o79) [[1,5,4],[2,3]]
(%o80) [[1,5,4],[2,3]]

(%i81) z42:cycles2perm(p_random(4));
       cycles2perm(z42##[1,3,2,4]);
       cycles2perm([1,3,2,4]##z42);
(z42)  [2,3,1,4]
(%o117) [2,1,3,4]
(%o118) [3,2,1,4]
```

```
lltrsa:p_to_transpositions_neighb_comp(z4)$
llista:makelist(makelist(cycles2string(perm2mincycles(z4)),z4,llista),llista,lltrsa)$
length(lltrsa);
print_list(llista);
```

(%o146) 35

[(1,2),(2,3),(1,2),(4,5),(3,4),(2,3),(1,2)]
[(1,2),(2,3),(4,5),(1,2),(3,4),(2,3),(1,2)]
[(1,2),(2,3),(4,5),(3,4),(1,2),(2,3),(1,2)]
[(1,2),(2,3),(4,5),(3,4),(2,3),(1,2),(2,3)]
[(1,2),(4,5),(2,3),(1,2),(3,4),(2,3),(1,2)]
[(1,2),(4,5),(2,3),(3,4),(1,2),(2,3),(1,2)]
[(1,2),(4,5),(2,3),(3,4),(2,3),(1,2),(2,3)]
[(1,2),(4,5),(3,4),(2,3),(1,2),(3,4),(2,3)]
[(1,2),(4,5),(3,4),(2,3),(3,4),(1,2),(2,3)]
[(2,3),(1,2),(2,3),(4,5),(3,4),(2,3),(1,2)]
[(2,3),(1,2),(4,5),(2,3),(3,4),(2,3),(1,2)]
[(2,3),(1,2),(4,5),(3,4),(2,3),(1,2),(3,4)]
[(2,3),(1,2),(4,5),(3,4),(2,3),(3,4),(1,2)]
[(2,3),(4,5),(1,2),(2,3),(3,4),(2,3),(1,2)]
[(2,3),(4,5),(1,2),(3,4),(2,3),(1,2),(3,4)]
[(2,3),(4,5),(1,2),(3,4),(2,3),(3,4),(1,2)]
[(2,3),(4,5),(3,4),(1,2),(2,3),(1,2),(3,4)]
[(2,3),(4,5),(3,4),(1,2),(2,3),(3,4),(1,2)]
[(2,3),(4,5),(3,4),(2,3),(1,2),(2,3),(3,4)]
[(4,5),(1,2),(2,3),(1,2),(3,4),(2,3),(1,2)]
[(4,5),(1,2),(2,3),(3,4),(1,2),(2,3),(1,2)]
[(4,5),(1,2),(2,3),(3,4),(2,3),(1,2),(2,3)]
[(4,5),(1,2),(3,4),(2,3),(1,2),(3,4),(2,3)]
[(4,5),(1,2),(3,4),(2,3),(3,4),(1,2),(2,3)]
[(4,5),(2,3),(1,2),(2,3),(3,4),(2,3),(1,2)]
[(4,5),(2,3),(1,2),(3,4),(2,3),(1,2),(3,4)]
[(4,5),(2,3),(1,2),(3,4),(2,3),(3,4),(1,2)]
[(4,5),(2,3),(3,4),(1,2),(2,3),(1,2),(3,4)]
[(4,5),(2,3),(3,4),(1,2),(2,3),(3,4),(1,2)]
[(4,5),(2,3),(3,4),(2,3),(1,2),(2,3),(3,4)]
[(4,5),(3,4),(1,2),(2,3),(1,2),(3,4),(2,3)]
[(4,5),(3,4),(1,2),(2,3),(3,4),(1,2),(2,3)]
[(4,5),(3,4),(2,3),(1,2),(2,3),(3,4),(2,3)]
[(4,5),(3,4),(2,3),(1,2),(3,4),(2,3),(3,4)]
[(4,5),(3,4),(2,3),(3,4),(1,2),(2,3),(3,4)]

(%o147) done

ltrsa

(%o148) ltrsa

```
→ z43:["(4,5)","(1,2)","(3,4)","(2,3)","(3,4)","(1,2)","(2,3)"];
(z43) [(4,5),(1,2),(3,4),(2,3),(3,4),(1,2),(2,3)]

→ z433:[[2,3]]##[[1,2]]##[[3,4]]##[[2,3]]##[[3,4]]##[[1,2]]##[[4,5]];
(z433) [[1,4,5],[2,3]]

→ z44:cycles2perm(z433##[[4,5]]);
z44t:z44$
(z44) [4,3,2,1,5]

→ z44:cycles2perm(z44t##[[1,2]]);
z44t:z44$
(z44) [3,4,2,1,5]

→ z44:cycles2perm(z44t##[[3,4]]);
z44t:z44$
(z44) [3,4,1,2,5]

→ z44:cycles2perm(z44t##[[2,3]]);
z44t:z44$
(z44) [3,1,4,2,5]

→ z44:cycles2perm(z44t##[[3,4]]);
z44t:z44$
(z44) [3,1,2,4,5]

→ z44:cycles2perm(z44t##[[1,2]]);
z44t:z44$
(z44) [1,3,2,4,5]

→ z44:cycles2perm(z44t##[[2,3]]);
z44t:z44$
(z44) [1,2,3,4,5]
```

```
lltrsa1:p_to_transpositions_neighb_comp(z4, 7)$
llista1:makelist(makelist(cycles2string(perm2mincycles(z4)),z4,llista1),llista1,lltrsa1)$
length(lltrsa1);
print_list(llista1);
lltrsa2:p_to_transpositions_neighb_comp(z4, 5)$
llista2:makelist(makelist(cycles2string(perm2mincycles(z4)),z4,llista2),llista2,lltrsa2)$
length(lltrsa2);
print_list(llista2);
lltrsa3:p_to_transpositions_neighb_comp(z4, 9)$
llista3:makelist(makelist(cycles2string(perm2mincycles(z4)),z4,llista3),llista3,lltrsa3)$
length(lltrsa3);
print_list(llista3);
```

(%o190) 35

[(1,2),(2,3),(1,2),(4,5),(3,4),(2,3),(1,2)]
[(1,2),(2,3),(4,5),(1,2),(3,4),(2,3),(1,2)]
[(1,2),(2,3),(4,5),(3,4),(1,2),(2,3),(1,2)]
[(1,2),(2,3),(4,5),(3,4),(2,3),(1,2),(2,3)]
[(1,2),(4,5),(2,3),(1,2),(3,4),(2,3),(1,2)]
[(1,2),(4,5),(2,3),(3,4),(1,2),(2,3),(1,2)]
[(1,2),(4,5),(2,3),(3,4),(2,3),(1,2),(2,3)]
[(1,2),(4,5),(3,4),(2,3),(1,2),(3,4),(2,3)]
[(1,2),(4,5),(3,4),(2,3),(3,4),(1,2),(2,3)]
[(2,3),(1,2),(2,3),(4,5),(3,4),(2,3),(1,2)]
[(2,3),(1,2),(4,5),(2,3),(3,4),(2,3),(1,2)]
[(2,3),(1,2),(4,5),(3,4),(2,3),(1,2),(3,4)]
[(2,3),(1,2),(4,5),(3,4),(2,3),(3,4),(1,2)]
[(2,3),(4,5),(1,2),(2,3),(3,4),(2,3),(1,2)]
[(2,3),(4,5),(1,2),(3,4),(2,3),(1,2),(3,4)]
[(2,3),(4,5),(1,2),(3,4),(2,3),(3,4),(1,2)]
[(2,3),(4,5),(3,4),(1,2),(2,3),(1,2),(3,4)]
[(2,3),(4,5),(3,4),(1,2),(2,3),(3,4),(1,2)]
[(2,3),(4,5),(3,4),(2,3),(1,2),(2,3),(3,4)]
[(4,5),(1,2),(2,3),(1,2),(3,4),(2,3),(1,2)]
[(4,5),(1,2),(2,3),(3,4),(1,2),(2,3),(1,2)]
[(4,5),(1,2),(2,3),(3,4),(2,3),(1,2),(2,3)]
[(4,5),(1,2),(3,4),(2,3),(1,2),(3,4),(2,3)]
[(4,5),(1,2),(3,4),(2,3),(3,4),(1,2),(2,3)]
[(4,5),(2,3),(1,2),(2,3),(3,4),(2,3),(1,2)]
[(4,5),(2,3),(1,2),(3,4),(2,3),(1,2),(3,4)]
[(4,5),(2,3),(1,2),(3,4),(2,3),(3,4),(1,2)]
[(4,5),(2,3),(3,4),(1,2),(2,3),(1,2),(3,4)]
[(4,5),(2,3),(3,4),(1,2),(2,3),(3,4),(1,2)]
[(4,5),(2,3),(3,4),(2,3),(1,2),(2,3),(3,4)]
[(4,5),(3,4),(1,2),(2,3),(1,2),(3,4),(2,3)]
[(4,5),(3,4),(1,2),(2,3),(3,4),(1,2),(2,3)]
[(4,5),(3,4),(2,3),(1,2),(2,3),(3,4),(2,3)]
[(4,5),(3,4),(2,3),(1,2),(3,4),(2,3),(3,4)]
[(4,5),(3,4),(2,3),(3,4),(1,2),(2,3),(3,4)]

```
lltrsa6:p_to_transpositions_comp(z4, 7)$
llista6:makelist(makelist(cycles2string(perm2mincycles(z4)),z4,llista6),llista6,lltrsa6)$
length(lltrsa6);
print_list(llista6);
```