

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

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→ n:8$
f:p_random(n);
f1:cycles2perm(f);
f2:perm2matrix(f);
en:p_size(f);
punkty_stale:p_fixed_points(f);
znak:p_sign(f);
typ:p_type(f);
rzad:p_order(f);
kanoniczna_postac:p_canonical_form(f);
przesuniecie_o_trzy:p_rotate(f1,3);
ile_inwersji:p_inversions_count(f);
lista_inwersji:p_inversions(f);
wektor_inwersji:p_inv_vector(f);
ile_cykli:c(f);
list_transpozycji:p_all_transpositions(8);
wynacznik_macierzy:determinant(f2);

(f) [[2,8,3,7],[4,5]]
(f1) [1,8,7,5,4,6,2,3]
(f2)

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

(en) 8
(punkty_stale) [1,6]
(znak) 1
(typ) [[1,2],[2,1],[4,1]]
(rzad) 4
(kanoniczna_postac) [[2,8,3,7],[4,5]]
(przesuniecie_o_trzy) [6,2,3,1,8,7,5,4]
(ile_inwersji) 18
(lista_inwersji) [[8,7],[8,5],[8,4],[8,6],[8,2],[8,3],[7,5],[7,4],[7,6],[7,2],[7,3],[5,4],[5,2],[5,3],[4,2],[4,3],[6,2],[6,3]]
(wektor_inwersji) [0,6,5,3,2,2,0,0]
(ile_cykli) 4
(list_transpozycji) [[[1,2],[8]], [[1,3],[8]], [[1,4],[8]], [[1,5],[8]], [[1,6],[8]], [[1,7],[8]], [[1,8]], [[2,3],[8]], [[2,4],[8]], [[2,5],[8]], [[2,6],[8]], [[2,7],[8]], [[2,8]], [[3,4],[8]], [[3,5],[8]], [[3,6],[8]], [[3,7],[8]], [[3,8]], [[4,5],[8]], [[4,6],[8]], [[4,7],[8]], [[4,8]], [[5,6],[8]], [[5,7],[8]], [[5,8]], [[6,7],[8]], [[6,8]], [[7,8]]]
(wynacznik_macierzy) 1

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```
→ n2:5$;  
q:p_random(n2);  
wszystkie_postaci_cykliczne:p_all_cyclic_notations(q);  
lista:makelist( is_equal(q, perm), perm, wszystkie_postaci_cykliczne );  
ilosc_mozliwych_zapisow:p_number_of_cyclic_notations(q);  
  
(q) [[1,4,5,3,2]]  
  
(wszystkie_postaci_cykliczne) [[[1,4,5,3,2]], [[2,1,4,5,3]], [[3,2,1,4,5]], [[4,5,3,2,1]],  
[[5,3,2,1,4]]]  
  
(lista) [true, true, true, true, true]  
  
(ilosc_mozliwych_zapisow) 5
```

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→ m1:2$;
   m2:3$;
   m3:4$;
   m4:5$;
   m5:6$;
   per1:p_random(m1);
   per2:p_random(m2);
   per3:p_random(m3);
   per4:p_random(m4);
   per5:p_random(m5);
   per1o:p_inverse(per1);
   per2o:p_inverse(per2);
   per3o:p_inverse(per3);
   per4o:p_inverse(per4);
   per5o:p_inverse(per5);
   p_inversions_count(per1);
   p_inversions_count(per1o);
   p_inversions_count(per2);
   p_inversions_count(per2o);
   p_inversions_count(per3);
   p_inversions_count(per3o);
   p_inversions_count(per4);
   p_inversions_count(per4o);
   p_inversions_count(per5);
   p_inversions_count(per5o);
   p_sign(per1);
   p_sign(per1o);
   p_sign(per2);
   p_sign(per2o);
   p_sign(per3);
   p_sign(per3o);
   p_sign(per4);
   p_sign(per4o);
   p_sign(per5);
   p_sign(per5o);

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```

(per1) [[1,2]]
(per2) [[1,2],[3]]
(per3) [[3,4]]
(per4) [[2,3],[4,5]]
(per5) [[1,5,6,2,4,3]]
(per1o) [[1,2]]
(per2o) [[1,2],[3]]
(per3o) [[3,4]]
(per4o) [[2,3],[4,5]]
(per5o) [[1,3,4,2,6,5]]
(%o96) 1
(%o97) 1
(%o98) 1
(%o99) 1

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```

→   perdlas1:p_random(5); perdlas2:p_random(5);
      zlozenie:perdlas1##perdlas2;
      macierz1:transpose(perm2matrix(zlozenie));
      macierz2:transpose(perm2matrix(perdlas1));
      macierz2:transpose(perm2matrix(perdlas2));
      iloczyn:macierz1.macierz2;

```

(perdlas1) $[[1, 2, 3, 4, 5]]$

(perdlas2) $[[2, 3, 5]]$

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

(macierz1) $\begin{pmatrix} 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{pmatrix}$

(macierz1) $\begin{pmatrix} 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{pmatrix}$

(macierz2) $\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{pmatrix}$

(iloczyn) $\begin{pmatrix} 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{pmatrix}$

$$p = \langle 632541 \rangle = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 6 & 3 & 2 & 5 & 4 & 1 \end{pmatrix} = (16)(23)(45) = (f_1=6 \ f_2=3 \ f_3=2 \ f_4=5 \ f_5=4 \ f_6=1) =$$

$$= \begin{vmatrix} & & & & 1 \\ & & & 1 & \\ & 1 & & & \\ & & 1 & & \\ & & & 1 & \\ 1 & & & & \end{vmatrix} = \begin{matrix} \text{1} & \text{2} & \text{4} \\ \text{6} & \text{3} & \text{5} \end{matrix} = \begin{matrix} \text{1} & \text{6} \\ \text{2} & \text{3} \\ \text{4} & \text{5} \end{matrix}$$

$$a/ p = \langle 7, 9, 8, 1, 3, 6, 4, 8, 2 \rangle = (174)(2938)(6)(8)$$

$$|S_n| = 9! = 362880 \quad n=9$$

b/ pwny state 6 i 8

$$c/ p^{-1} = \langle 495726183 \rangle$$

$$d/ pr = \langle 2, 8, 4, 6, 3, 1, 9, 5, 7 \rangle$$

$$e/ [1^3 3^1 4^1]$$

$$f/ \text{ord}(p) = \text{NWW}(4, 3) = 12$$

$$i/ \text{liczba cykli} = 4$$

$$j/ \text{liczba cykli nieparzystych} = 1$$

$$k/ \text{liczba cykli nieparzystych} = 3$$

$$l/ \text{inwersje} : (7, 9)(7, 1)(7, 3)(7, 6)(7, 4)(7, 2)(5, 1)(5, 3)(5, 6)(5, 2)(9, 1)(9, 3)(9, 6)(9, 4)(9, 8)(9, 2)(3, 2)(6, 4)(6, 2)(4, 2)(8, 2)$$

$$m/ \text{liczba inwersji} = 21$$

$$n/ w_i = [6, 4, 6, 0, 1, 2, 1, 1, 0]$$

$$o/ \text{Sign}(p) = (-1)^{21} = -1 \quad |c_p| = 21$$

$$\text{sign}(p) = (-1)^{7+4} = -1 \quad C(p) = 4$$

$$\text{sign}(p) = (-1)^5 = -1 \quad \Gamma(p) = 5$$

$$\text{Sign}(p) = (-1)^4 = -1 \quad C_p(p) = 1$$

$$\text{Sign}(p) = \det(A) = -1$$

$$A = \begin{matrix} & \begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \end{matrix} \\ \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{matrix} & \begin{bmatrix} & & & & & & 1 & & \\ & & & 1 & & & & & \\ & & & & & & & 1 & \\ 1 & & & & & & & & \\ & 1 & & & & & & & \\ & & 1 & & & & & & \\ & & & 1 & & 1 & & & \\ & & & & 1 & & & 1 & \\ 1 & & & & & & & & \end{bmatrix} \end{matrix}$$

$$= \begin{vmatrix} 0 & 1 \\ 1 & 0 \end{vmatrix} = -1$$