M1235 Search Hints

(Greetings from The On-Line Encyclopedia of Integer Sequences!)

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A001250 Number of alternating permutations of order n. +10 17

(Formerly M1235 N0472)

1, 2, 4, 10, 32, 122, 544, 2770, 15872, 101042, 707584, 5405530, 44736512, 398721962, 3807514624, 38783024290, 419730685952, 4809759350882, 58177770225664, 740742376475050, 9902996106248192, 138697748786275802 (list; graph; refs; listen; history; text; internal format)

OFFSET 1,2

COMMENTS For n>1, a(n) is the number of permutations of order n with the length of longest run equal 2.

REFERENCES
L. Comtet, Advanced Combinatorics, Reidel, 1974, p. 261.
F. N. David, M. G. Kendall and D. E. Barton, Symmetric Function and Allied Tables, Cambridge, 1966, p. 262.
C. Davis, Problem 4755, Amer. Math. Monthly, 65 (1958), 533-534.
S. Kitaev, Multi-avoidance of generalized patterns, Discrete Math., 260 (2003), 89-100. (See p. 100.)
N. J. A. Sloane, A Handbook of Integer Sequences, Academic Press, 1973 (includes this sequence).
N. J. A. Sloane and Simon Plouffe, The Encyclopedia of Integer Sequences, Academic Press, 1995 (includes this sequence).

LINKS
Max Alekseyev, Table of n, a(n) for n = 1..100
Eric Weisstein's World of Mathematics, Alternating Permutation
Max A. Alekseyev, On the number of permutations with bounded runs length, arXiv, May 22, 2012.

FORMULA
a(n) = coefficient of x^(n-1)/(n-1)! in power series expansion of (tan(x) + sec(x))^2 = (tan(x)+1/cos(x))^2.
a(n) = coefficient of x^n/n! in power series expansion of 2*(tan(x) + sec(x)) - 2 - x. - Michael Somos, Feb 05 2011
For n>1, a(n) = 2 * A000111(n). - Michael Somos, Mar 19 2011
a(n) = 4*|Li_{-n}(i)|-[n=1] = sum_{m=0...n/2} (-1)^m*2^{1-k}*sum_{j=0...k} binomial(k,j)*(-1)^j*(k-2*j)^(n+1)/k - [n=1], where k = k(m) = n+1-2*m and [n=1] equals 1 if n=1 and zero else; Li denotes the polylogarithm (and i^2 = -1). - M. F. Hasler, May 20 2012
From Sergei N. Gladkovskii, Jun 18 2012: (Start)
Let E(x) = 2/(1-sin(x))-1 (essentially the e.g.f.), then
E(x) = -1 + 2*(-1/x + 1/(1-x)/x- x^3/((1-x)*((1-x)*G(0) + x^2))) where G(k)= (2*k+2)*(2*k+3)-x^2+(2*k+2)*(2*k+3)*x^2/G(k+1); (continued fraction, Euler's 1st kind, 1-step).
E(x) = -1 + 2*(-1/x + 1/(1-x)/x- x^3/((1-x)*((1-x)*G(0) + x^2))) where G(k)= 8*k+6-x^2/(1 + (2*k+2)*(2*k+3)/G(k+1)); (continued fraction, Euler's 2nd kind, 2-step).
E(x) = (tan(x) + sec(x))^2 = -1 + 2/(1-x*G(0)) where G(k)= 1 - x^2/(2*(2*k+1)*(4*k+3) - 2*x^2*(2*k+1)*(4*k+3)/(x^2 - 4*(k+1)*(4*k+5)/G(k+1))); (continued fraction, 3rd kind, 3-step).
(End).

MAPLE
```
# With Eulerian polynomials:
A := (n, x) -> `if`(n=1, 1/2, add(add((-1)^j*binomial(n+1, j)*(m+1-j)^n,
  j=0..m)*x^m, m=0..n-1)):
A001250 := n -> 2*(I-1)^(1-n)*exp(I*(n-1)*Pi/2)*A(n, I);
seq(A001250(i), i=1..22); # Peter Luschny, May 27 2012
```

PROG

```
(PARI) {a(n) = local(v=[1], t); if( n<0, 0, for( k=2, n+3, t=0; v = vector(
  k, i, if( i>1, t += v[k+1 - i]))); v[3])} /* Michael Somos, Feb 03 2004 */
(PARI) {a(n) = if( n<0, 0, n! * polcoeff( (tan(x + x * O(x^n)) + 1 / cos(x +
  x * O(x^n)))^2, n))} /* Michael Somos, Feb 05 2011 */
(PARI) A001250(n)=sum(m=0, n\2, my(k); (-1)^m*sum(j=0, k=n+1-2*m,
  binomial(k, j)*(-1)^j*(k-2*j)^(n+1))/k>>k)*2-(n==1)  \\ M. F. Hasler, May
  19 2012
(PARI) A001250(n)=4*abs(polylog(-n, I))-(n==1)  \\ M. F. Hasler, May 20 2012
(Sage) # Algorithm of L. Seidel (1877)
def A001250_list(n) :
    R = [1]; A = {-1:0, 0:2}; k = 0; e = 1
    for i in (0..n) :
        Am = 0; A[k + e] = 0; e = -e
        for j in (0..i) : Am += A[k]; A[k] = Am; k += e
        if i > 1 : R.append(A[-i//2] if i%2 == 0 else A[i//2])
    return R
A001250_list(22) # Peter Luschny, March 31 2012
(PARI)
x='x+O('x^66);
egf=2*(tan(x)+1/cos(x))-2-x;
Vec(serlaplace(egf))
/* Joerg Arndt, May 28 2012 */
```

CROSSREFS Cf. A000111. A diagonal of A010094.
Cf. A001251, A001252, A001253, A010026, A211318.

KEYWORD nonn

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EXTENSIONS Edited by Max Alekseyev, May 04 2012

STATUS approved

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