

```

entropy[ps_List] := -N[Total[ (# * Log[2, #]) & /@ ps]]

entropy[{0.5, 0.25, 0.25}]

1.5

l = Length[perms = Permutations[Range[0, 9], {4}]]

5040

Mark[p1_List, p2_List] := Module[
  {b = Count[MapThread[Equal, {p1, p2}], True]},
  10 * b + Length[Intersection[p1, p2]] - b
];

Mark[i_Integer, j_Integer] := Mark[i, j] = Mark[perms[[i]], perms[[j]]]

p1 = {1, 3, 4, 5}; p2 = {1, 4, 3, 7}

{1, 4, 3, 7}

Mark[p1, p2]

12

Mark[20, 200]

11

perms[{{20, 200}}]

{{0, 1, 4, 8}, {0, 4, 6, 5}}

entropy[i_, s_List] := entropy[(Last /@ Tally[Mark[i, #] & /@ s]) / Length[s]]

i = 100; s = Range[1];

n = Length[s]

5040

Log[2, Last[#]] & /@ Tally[Mark[i, #] & /@ s]

{
   $\frac{\text{Log}[72]}{\text{Log}[2]}$ ,  $\frac{\text{Log}[720]}{\text{Log}[2]}$ ,  $\frac{\text{Log}[216]}{\text{Log}[2]}$ ,  $\frac{\text{Log}[180]}{\text{Log}[2]}$ ,  $\frac{\text{Log}[480]}{\text{Log}[2]}$ ,  $\frac{\text{Log}[24]}{\text{Log}[2]}$ ,
   $\frac{\text{Log}[6]}{\text{Log}[2]}$ , 0, 3,  $\frac{\text{Log}[1260]}{\text{Log}[2]}$ ,  $\frac{\text{Log}[264]}{\text{Log}[2]}$ ,  $\frac{\text{Log}[1440]}{\text{Log}[2]}$ ,  $\frac{\text{Log}[360]}{\text{Log}[2]}$ ,  $\frac{\text{Log}[9]}{\text{Log}[2]}$ 
}

entropy[(Last /@ Tally[Mark[i, #] & /@ s]) / Length[s]]

2.77115

```

```

entropy[7, Range[1]]
2.77115

cons[s_List, m_Integer, g_Integer] := Select[s, Mark[g, #] == m &];
cons[s_List, m_Integer, g_List] := cons[s, m, Position[perms, g][[1, 1]]]

guess[s_List] := perms[[s[[Ordering[entropy[#, s] & /@ s, -1]]][[1]]]]

a0 = Range[1];

a1 = cons[a0, 1, {1, 2, 3, 4}];

guess[a1]
{9, 8, 7, 3}

perms[[5037]]
{9, 8, 7, 3}

perms[[569]]
{1, 2, 3, 4}

a2 = cons[a1, 11, {9, 8, 7, 3}];

guess[a2]
{6, 3, 7, 5}

a3 = cons[a2, 20, {6, 3, 7, 5}]
{1503, 2511, 3121, 3122, 3289, 3290, 3516, 3517, 4135, 4303, 4708}

guess[a3]
{6, 4, 7, 9}

a4 = cons[a3, 20, {6, 4, 7, 9}]
{3121, 4303}

guess[a4]
{8, 4, 7, 5}

a5 = cons[a4, 11, {8, 4, 7, 5}]
{3121}

First[b1 = cons[a0, 1, {1, 2, 3, 4}]]
25

First[b2 = cons[b1, 11, {0, 1, 5, 6}]]
145

First[b3 = cons[b2, 2, {0, 3, 6, 7}]]
1055

```

**First[b4 = cons[b3, 2, {2, 0, 8, 6}]]**

1826

**First[b5 = cons[b4, 11, {3, 6, 5, 8}]]**

3121

**b5**

{3121, 3398}

**b4**

{1826, 1933, 3121, 3398, 3455, 3590, 3902, 4131, 4407}

**a4**

{3121, 4303}

**a3**

{1503, 2511, 3121, 3122, 3289, 3290, 3516, 3517, 4135, 4303, 4708}

**b3**

{1055, 1062, 1272, 1373, 1405, 1461, 1539, 1540, 1783, 1790, 1826, 1827, 1933,  
1989, 2063, 2070, 2280, 2381, 2413, 2469, 2784, 2875, 2889, 3121, 3122, 3398,  
3455, 3511, 3558, 3590, 3591, 3627, 3634, 3781, 3827, 3841, 3902, 3933, 3989,  
4044, 4058, 4063, 4131, 4261, 4407, 4437, 4548, 4562, 4567, 4635, 4765, 4911, 4941}

**a2**

{41, 42, 151, 152, 209, 210, 269, 276, 325, 332, 367, 374, 398, 399, 405, 406, 419, 420, 442,  
443, 479, 486, 491, 492, 1049, 1050, 1273, 1274, 1329, 1330, 1406, 1407, 1434, 1435,  
1441, 1442, 1450, 1454, 1455, 1499, 1503, 1504, 1551, 1552, 1772, 1776, 1828, 1832, 1908,  
1909, 1933, 1937, 1940, 1944, 2057, 2058, 2281, 2282, 2337, 2338, 2414, 2415, 2442, 2443,  
2449, 2450, 2458, 2462, 2463, 2507, 2511, 2512, 2565, 2572, 2617, 2618, 2724, 2728, 2785,  
2786, 2846, 2853, 2859, 2895, 2925, 2926, 2932, 2933, 2946, 2947, 2963, 2964, 2971, 3007,  
3012, 3013, 3069, 3076, 3121, 3122, 3228, 3232, 3289, 3290, 3350, 3357, 3363, 3399, 3429,  
3430, 3436, 3437, 3450, 3451, 3467, 3468, 3475, 3511, 3516, 3517, 3559, 3566, 3811, 3847,  
3867, 3903, 3921, 3922, 3928, 3932, 3933, 3935, 3939, 3940, 3949, 3953, 3954, 3957,  
3958, 3964, 3965, 4063, 4070, 4075, 4076, 4131, 4135, 4136, 4299, 4303, 4304, 4315,  
4351, 4356, 4357, 4371, 4407, 4412, 4413, 4542, 4543, 4549, 4550, 4563, 4564, 4586,  
4587, 4598, 4599, 4626, 4627, 4633, 4634, 4642, 4646, 4647, 4708, 4709, 4733, 4737,  
4740, 4744, 4766, 4767, 4794, 4795, 4801, 4802, 4810, 4814, 4815, 4829, 4830, 4836,  
4837, 4850, 4851, 4867, 4868, 4885, 4886, 4892, 4893, 4906, 4907, 4923, 4924, 4929,  
4930, 4936, 4940, 4941, 4943, 4947, 4948, 4957, 4961, 4962, 4965, 4966, 4972, 4973}

**b2**

{145, 146, 147, 151, 158, 165, 201, 202, 203, 207, 214, 221, 236, 237, 238, 250, 251, 252, 261, 262, 268, 269, 275, 276, 292, 293, 294, 306, 307, 308, 317, 318, 324, 325, 331, 332, 342, 343, 347, 361, 373, 374, 379, 386, 398, 399, 403, 417, 429, 430, 435, 442, 454, 455, 459, 473, 485, 486, 491, 498, 1034, 1035, 1036, 1048, 1055, 1062, 1272, 1279, 1286, 1321, 1322, 1323, 1349, 1373, 1405, 1429, 1461, 1485, 1538, 1539, 1540, 1552, 1559, 1566, 1776, 1783, 1790, 1825, 1826, 1827, 1853, 1877, 1909, 1933, 1965, 1989, 2042, 2043, 2044, 2056, 2063, 2070, 2280, 2287, 2294, 2329, 2330, 2331, 2357, 2381, 2413, 2437, 2469, 2493, 2617, 2618, 2624, 2625, 2631, 2632, 2728, 2735, 2742, 2784, 2791, 2798, 2875, 2889, 2931, 2945, 2987, 3001, 3121, 3122, 3128, 3129, 3135, 3136, 3225, 3226, 3227, 3281, 3282, 3283, 3398, 3399, 3454, 3455, 3510, 3511, 3540, 3554, 3558, 3559, 3590, 3591, 3625, 3626, 3627, 3631, 3634, 3638, 3701, 3725, 3757, 3781, 3827, 3841, 3902, 3903, 3933, 3957, 3989, 4013, 4044, 4058, 4062, 4063, 4094, 4095, 4129, 4130, 4131, 4135, 4138, 4142, 4205, 4229, 4261, 4285, 4331, 4345, 4406, 4407, 4437, 4461, 4493, 4517, 4548, 4562, 4566, 4567, 4598, 4599, 4633, 4634, 4635, 4639, 4642, 4646, 4709, 4733, 4765, 4789, 4835, 4849, 4910, 4911, 4941, 4965, 4997, 5021}

**Length[a2]**

222

**Length[b2]**

222

**Last[a1]**

5037