Workshop for Randomised Algorithms

S_n recognition

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1. Implement a GAP function which tests whether a given permutation on n points has a cycle of prime length p with $n/2 < p < n - 2$.
2. Use this GAP function to implement a 1-sided Monte Carlo algorithm to test whether a permutation group on $\Omega = \{1, \ldots, n\}$ is S_n.
3. Run the 1-sided Monte Carlo algorithm several times for S_n for $n = 10, 50, 100, 1000$ and record the average number of random selections needed to prove that the group is S_n. Does this number match the theory?
4. Implement a GAP function which looks for an element of order dividing n.
5. How frequently are the elements this function returns n-cycles if the input group is S_n. Does this number match the theory?