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Step-1:-

The given problem is NP because we can verify its solution in polynomial time. We will check whether length of the solution $\geq k$ and then we will check if the vertices are adjacent and unique.

Step-2:-

Hamiltonian path problem can be reduced to the given problem. If we solve the given problem for $k = n-1$, we will actually solve the hamiltonian path problem.

Step 3:-

Reduction can be done in polynomial time. Because solution to the given problem with $k = n-1$ can be easily reduced. The solution will have $n-1$ edges and all the vertices will be distinct.

Step 4:-

If the given problem has solution with $k = n-1$, there must be one hamiltonian path.

If there in a hamiltonian path, there must be a solution to the problem A with $k = n-1$.

Same goes for vice-versa.

So, the given problem in NP-complete.