Pair Making

The brute-force solution will include iterating through all pairs of numbers $\leq n$. This makes the solution $O(n^2)$ and will result in a TLE. Here is a faster solution:

For all positive integers i such that $i < p$, calculate $j = inverse(i^2) \times k$.

Now, we have 2 integers i, j such that $0 < i, j < p$ and $i^2 j \equiv k(mod\ p)$.

For all such i, j, find the number of ordered pairs (a, b) such that $a \equiv i(mod\ p)$ and $b \equiv j(mod\ p)$, $1 \leq a, b \leq n$ as $(\frac{n+p-i}{p}) \times (\frac{n+p-j}{p})$.

Final answer:

$\sum_{i=1}^{p-1} (\frac{n+p-i}{p}) \times (\frac{n+p-j}{p})$ where $j = inverse(i^2) \times k$

Time Complexity : $O(p \log p)$ (There are p iterations of i and each $inverse$ function is $O(\log p)$)

Space Complexity: $O(1)$

Note : $inverse(x)$ stands for "modular inverse"of x with respect to p.