Preliminary problems. These problems should be completed before discussion.

(P1) Fix $n \geq 1$, and let $\phi(n)$ denote the number of integers $i \in [1, n-1]$ with $\gcd(i, n) = 1$ (this is known as the *Euler totient function*).

    (a) Find $\phi(10)$ and $\phi(12)$.

    (b) Let $s = \phi(n)$. A *reduced residue system* for n is a list of integers $r_1, \ldots, r_s$ such that

- $\gcd(r_i, n) = 1$ for each i,
- $r_i \not\equiv r_j \bmod n$ whenever $i \neq j$, and
- for any $r \in \mathbb{Z}$ with $\gcd(r, n) = 1$, we have $r \equiv r_i \bmod n$ for some i.

    Locate 2 distinct reduced residue systems for $n = 12$ that share at least one element.