Problem 1. Prove that for any integers $a$, $b$ and $n$, if $n \nmid (a \cdot b)$, then $n \nmid a$ and $n \nmid b$ using an indirect proof.  
Note: $n \mid x$ means that $x$ is divisible by $n$, or there is some integer $p$ such that $x = n \cdot p$.

Problem 2. Eleven of Arthur’s knights are seated at least 2 meters apart around a table (a round one, of course). Prove that if the sum of their ages adds up to 333, then there must be a group of three knights sitting side by side whose average age is at least 30 years old. Hint: use a proof by contradiction.

Problem 3. Fill out the table below with the values held in registers A and B at the end of every clock cycle. Assume A and B both hold 0 initially.