This question is regarding the dining philosophers problem. In class we went over the algorithm where each hungry philosopher will pick up the fork on his left first:

```c
void lefty_philosopher (int i)
{
    while (true) {
        think();
        wait (fork[i]);
        wait (fork[(i+1) mod 5]);
        eat();
        signal (fork[(i+1) mod 5]);
        signal (fork[i]);
    }
}
```

In some way, you can think all these 5 philosophers are 'lefty'. Now, define this symmetrically such that a hungry philosopher would pick the fork on his right first:

```c
void righty_philosopher (int i)
{
    while (true) {
        think();
        wait (fork[(i+1) mod 5]);
        wait (fork[i]);
        eat();
        signal (fork[i]);
        signal (fork[(i+1) mod 5]);
    }
}
```
(1) If we have at least one lefty and one righty philosopher sitting on the dining table, would there ever be a deadlock? Why?

NO. We'll use a 'proof by contradiction'. Assume that there is a deadlock, i.e., there is a set D of philosophers such that each $P_i \in D$ holds one fork and waits for another fork held by his neighbor. WLOG, assume $P_j \in D$ is a lefty. As $P_i$ holds his left fork and cannot have his right fork, which must be held by his neighbor $P_k$ (who never completes his dinner) and is also a lefty. Therefore, $P_k \in D$. Continue this; we can show that all philosophers in D are lefty.

A Contradiction.

(2) If we have at least one lefty and one righty philosopher sitting on the dining table, would there ever be a starvation? Why?

NO. Assume that lefty $P_j$ starves, i.e., there is a pattern of dining in which $P_j$ never eats. ① Suppose $P_j$ holds no fork. Then, $P_j$'s left neighbor $P_i$ must continually hold his right fork and never finishes eating. Thus, $P_i$ is a righty and can never get his left fork, i.e., $P_i$ also starves. Proceed this leftward shows that all philosophers are (starving) righties. But $P_j$ is a lefty by assumption, a contradiction.

② If $P_j$ always holds one fork and waits for his right fork, $P_j$'s right neighbor $P_k$ never sets his left fork down and never completes a meal, i.e., $P_k$ is also a lefty who starves. (If $P_k$ did not continually hold his left fork, $P_j$ could eat; therefore $P_k$ must hold his left fork.) Carrying this argument rightward, then all the philosophers are (starving) lefties, a contradiction to the assumption that there is always a righty.