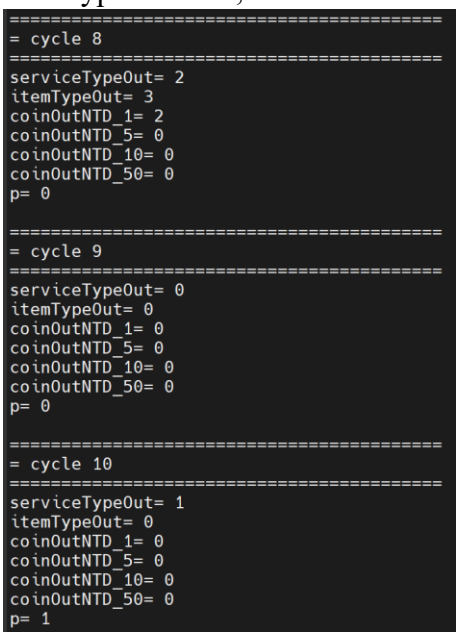
The bug occurs when the transaction fails (e.g. not enough changes), the output changes are not equal to the input changes. In other words, the vending machine “eat” customer’s changes.

To show the bug, I place “3 0 1 2 0” in row 2 in “./hw/hw1/debug/input-cex.pattern”. After several cycles, since I input 25 NTD into the vending machine and item C costs 22 dollars, ideally the vending machine should output three 1-NTD coins for changes. However, since the vending machine initially stores 2 coins for each type of NTD, it’s not capable of output three 1-NTD coins. For “vending-simple.v”, the vending machine neither output item C nor give my 25 dollars input back, which means the vending machine **eats money**.

The bug can be shown in the right figure, which is snapped from “./hw/hw1/debug/output-cex.pattern”. In cycle 9, the machine output nothing and no coin. In cycle 10, the monitor indicates “p= 1”.



To fix the bug, since it happens when the vending machine run out of changes, simply modify the FSM when machine detects the changes is not enough. Specifically, in “vending-simple.v”, change line 237 “serviceTypeOut_w = `SERVICE_OFF;” into “serviceTypeOut_w = `SERVICE_BUSY;” will fix the bug.