```c
#include <stdio.h>

int main(){
    int n, m, i, j, temp;
    scanf("%d %d\n", &n, &m);
    int a[n][m];
    for(i = 0; i < n; i++)
        for(j = 0; j < m; j++)
            scanf("%d", &a[i][j]);
    char c;
    scanf("\n");
    scanf("%c", &c);

    while(c != 'X'){
        switch(c){
            case 'H':
                printf("HORIZONTAL\n");
                // Exchange row across the horizontal middle
                for(i = 0; i < n; i++) {
                    for(j = 0; j < (m/2); j++) {
                        temp = a[i][j];
                        a[i][j] = a[i][m-1-j];
                        a[i][m-1-j] = temp;
                    }
                }
                break;
            case 'V':
                printf("VERTICAL\n");
                // Exchange columns across the vertical middle
                for (i = 0; i < (n/2); i++) {
                    for(j = 0; j < m; j++) {
                        temp = a[i][j];
                        a[i][j] = a[n-1-i][j];
                        a[n-1-i][j] = temp;
                    }
                }
                break;
            default:
                printf("ILLEGAL\n");
                break;
        }

        // Print the flipped matrix
        for(i = 0; i < n; i++) {
            for(j = 0; j < m; j++) {
                printf("%d", a[i][j]);
                if(j < m-1) printf(" ");
            }
            if(i < n-1) printf("\n");
        }
        scanf("%c", &c);
        if(c != 'X') printf("\n");
    }
    return 0;
}
```