DS Assignment 7

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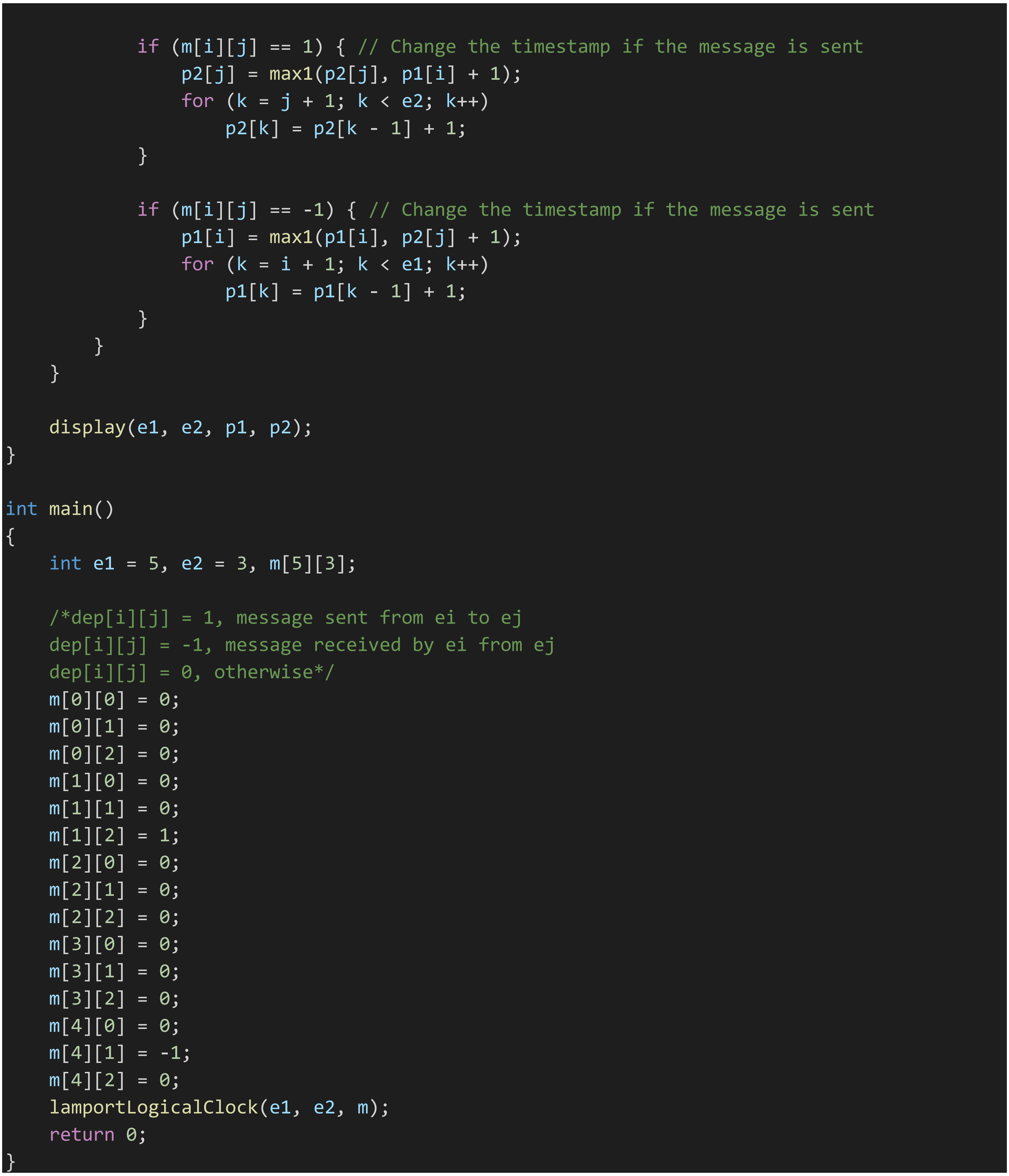
1. Implement Lamport's clock synchronization algorithm and discuss its time complexity.

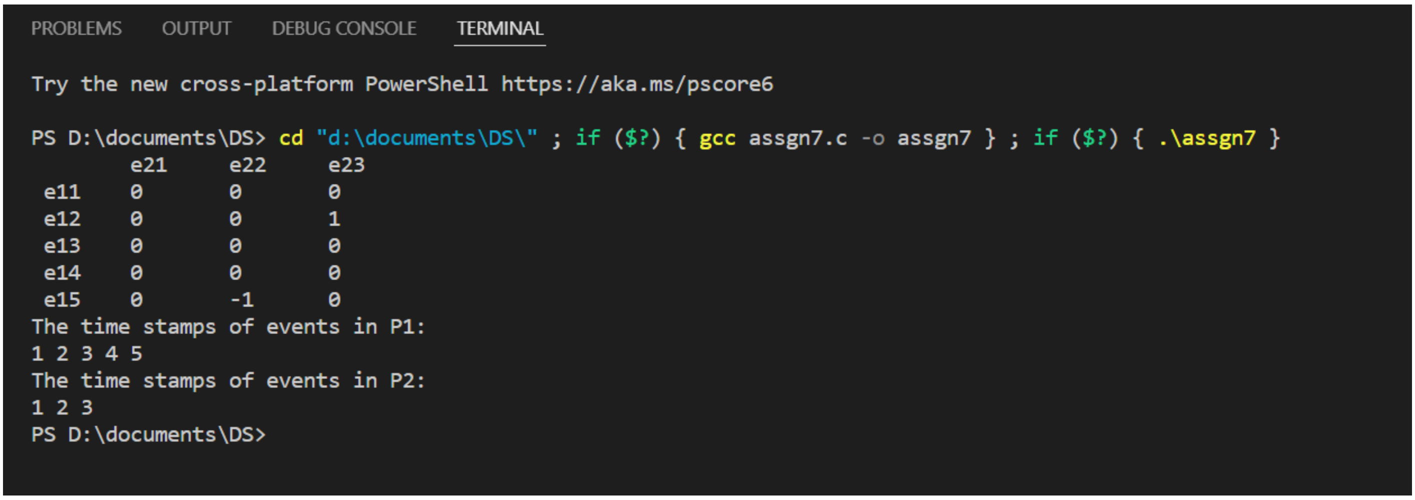
Source Code:

```
#include <stdio.h>

int max1(int a, int b){  //maximum timestamp between 2 events
    if (a > b)
        return a;
    else
        return b;
}

void display(int e1, int e2, int p1[5], int p2[3]){ //display the logical timestamp
    int i;

    printf("\nThe time stamps of events in P1:\n");
    for (i = 0; i < e1; i++) {
        printf("%d ", p1[i]);
    }
    printf("\nThe time stamps of events in P2:\n");

    for (i = 0; i < e2; i++) printf("%d ", p2[i]);
}


void lamportLogicalClock(int e1, int e2, int m[5][3]) //timestamp of events
{
    int i, j, k, p1[e1], p2[e2];
    for (i = 0; i < e1; i++)
        p1[i] = i + 1;

    for (i = 0; i < e2; i++)
        p2[i] = i + 1;

    for (i = 0; i < e2; i++)
        printf("\te2%d", i + 1);

    for (i = 0; i < e1; i++) {

        printf("\n e1%d \t", i + 1);

        for (j = 0; j < e2; j++)
            printf("%d\t", m[i][j]);
    }

    for (i = 0; i < e1; i++) {
        for (j = 0; j < e2; j++) {
```



```
            if (m[i][j] == 1) { // Change the timestamp if the message is sent
                p2[j] = max1(p2[j], p1[i] + 1);
                for (k = j + 1; k < e2; k++)
                    p2[k] = p2[k - 1] + 1;
            }

            if (m[i][j] == -1) { // Change the timestamp if the message is sent
                p1[i] = max1(p1[i], p2[j] + 1);
                for (k = i + 1; k < e1; k++)
                    p1[k] = p1[k - 1] + 1;
            }
        }
    }

    display(e1, e2, p1, p2);
}

int main()
{
    int e1 = 5, e2 = 3, m[5][3];

    /*dep[i][j] = 1, message sent from ei to ej
    dep[i][j] = -1, message received by ei from ej
    dep[i][j] = 0, otherwise*/
    m[0][0] = 0;
    m[0][1] = 0;
    m[0][2] = 0;
    m[1][0] = 0;
    m[1][1] = 0;
    m[1][2] = 1;
    m[2][0] = 0;
    m[2][1] = 0;
    m[2][2] = 0;
    m[3][0] = 0;
    m[3][1] = 0;
    m[3][2] = 0;
    m[4][0] = 0;
    m[4][1] = -1;
    m[4][2] = 0;
    lamportLogicalClock(e1, e2, m);
    return 0;
}
```

Output:



```
Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\documents\DS> cd "d:\documents\DS\" ; if ($?) { gcc assgn7.c -o assgn7 } ; if ($?) { .\assgn7 }
        e21     e22     e23
 e11    0       0       0
 e12    0       0       1
 e13    0       0       0
 e14    0       0       0
 e15    0       -1      0
The time stamps of events in P1:
1 2 3 4 5
The time stamps of events in P2:
1 2 3
PS D:\documents\DS>
```

Time Complexity: O(e1 * e2 * (e1 + e2))