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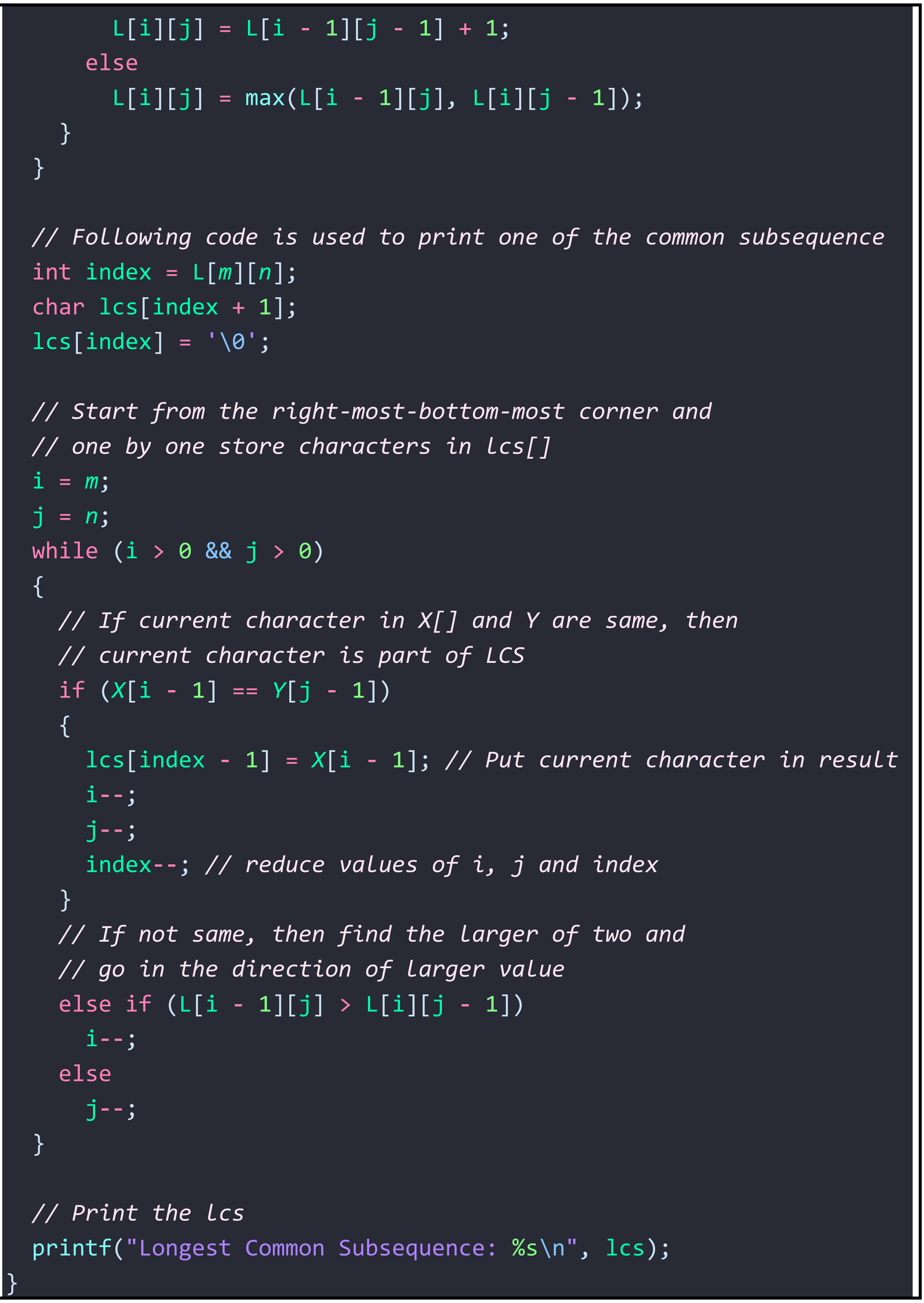
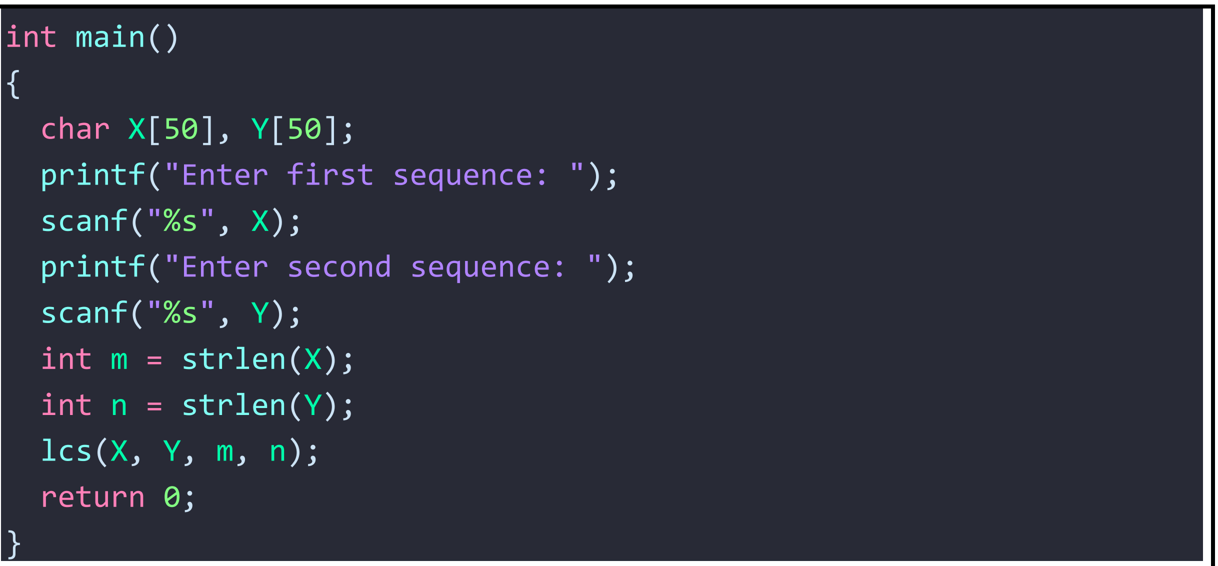
Subject	Design and Analysis of Algorithms (DAA)
Experiment No.	4
Aim	To implement Dynamic Algorithms. a) Assembly Line Scheduling. b) Longest Common Subsequence.
Code:	**Longest Common Subsequence (LCS):**

```
#include <stdio.h>
#include <string.h>

// Function to find the maximum of two integers
int max(int a, int b)
{
  return (a > b) ? a : b;
}

// Function to find the length of longest common subsequence
// and print one of the common subsequences
void lcs(char *X, char *Y, int m, int n)
{
  int L[m + 1][n + 1];
  int i, j;

  // Building the L[m+1][n+1] in bottom-up fashion
  for (i = 0; i <= m; i++)
  {
    for (j = 0; j <= n; j++)
    {
      if (i == 0 || j == 0)
        L[i][j] = 0;
      else if (X[i - 1] == Y[j - 1])
```

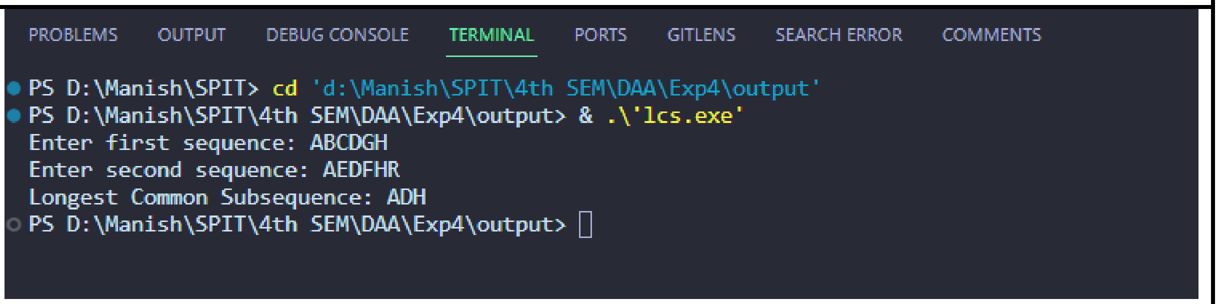


```
        L[i][j] = L[i - 1][j - 1] + 1;
      else
        L[i][j] = max(L[i - 1][j], L[i][j - 1]);
    }
  }

  // Following code is used to print one of the common subsequence
  int index = L[m][n];
  char lcs[index + 1];
  lcs[index] = '\0';

  // Start from the right-most-bottom-most corner and
  // one by one store characters in lcs[]
  i = m;
  j = n;
  while (i > 0 && j > 0)
  {
    // If current character in X[] and Y are same, then
    // current character is part of LCS
    if (X[i - 1] == Y[j - 1])
    {
      lcs[index - 1] = X[i - 1]; // Put current character in result
      i--;
      j--;
      index--; // reduce values of i, j and index
    }
    // If not same, then find the larger of two and
    // go in the direction of larger value
    else if (L[i - 1][j] > L[i][j - 1])
      i--;
    else
      j--;
  }

  // Print the lcs
  printf("Longest Common Subsequence: %s\n", lcs);
}
```



```c
int main()
{
  char X[50], Y[50];
  printf("Enter first sequence: ");
  scanf("%s", X);
  printf("Enter second sequence: ");
  scanf("%s", Y);
  int m = strlen(X);
  int n = strlen(Y);
  lcs(X, Y, m, n);
  return 0;
}
```

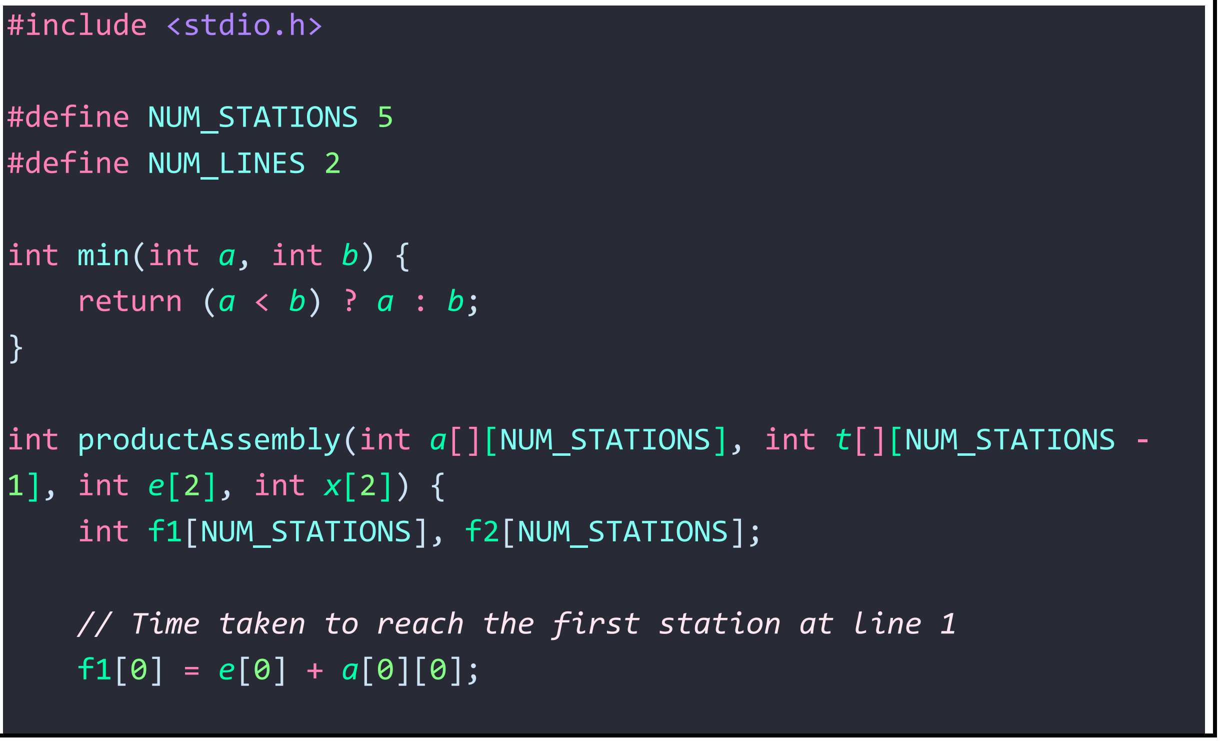
Output



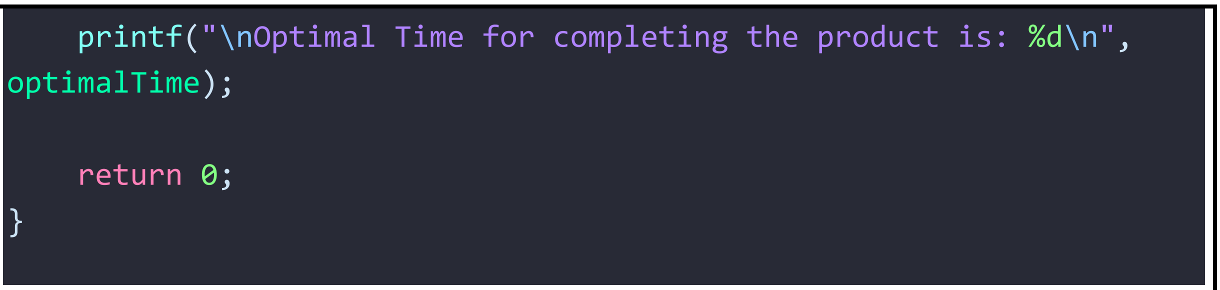
```
PS D:\Manish\SPIT> cd 'd:\Manish\SPIT\4th SEM\DAA\Exp4\output'
PS D:\Manish\SPIT\4th SEM\DAA\Exp4\output> & .\'lcs.exe'
Enter first sequence: ABCDGH
Enter second sequence: AEDFHR
Longest Common Subsequence: ADH
PS D:\Manish\SPIT\4th SEM\DAA\Exp4\output>
```

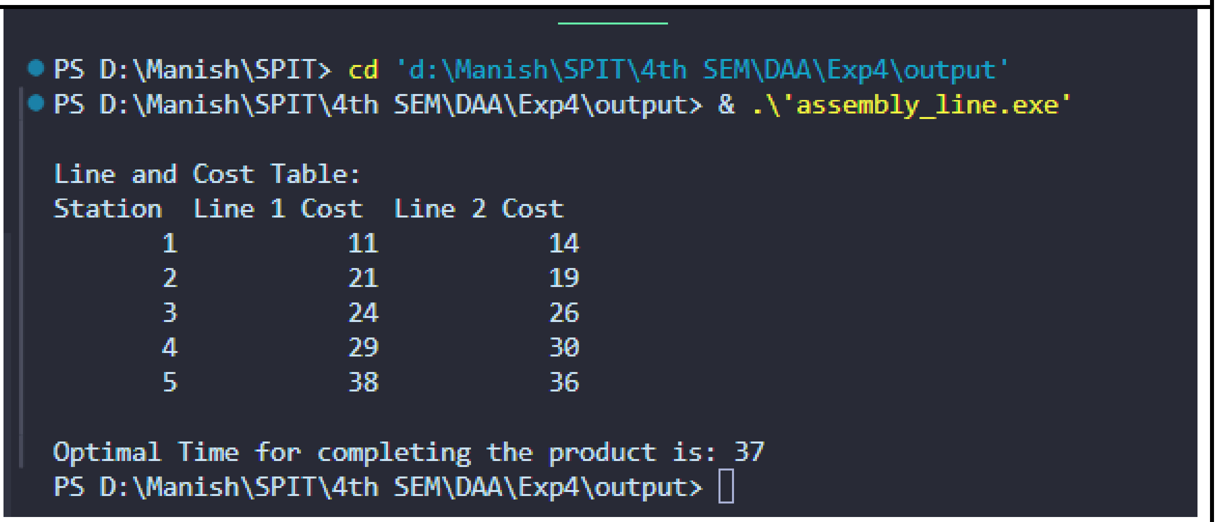
Code

Assembly Line Scheduling:



```c
#include <stdio.h>

#define NUM_STATIONS 5
#define NUM_LINES 2

int min(int a, int b) {
    return (a < b) ? a : b;
}

int productAssembly(int a[][NUM_STATIONS], int t[][NUM_STATIONS - 1], int e[2], int x[2]) {
    int f1[NUM_STATIONS], f2[NUM_STATIONS];

    // Time taken to reach the first station at line 1
    f1[0] = e[0] + a[0][0];
    // Time taken to reach the first station at line 2
    f2[0] = e[1] + a[1][0];

    // Fill tables f1[] and f2[] using the given recursive relations
    for (int j = 1; j < NUM_STATIONS; j++) {
        f1[j] = min(f1[j - 1] + a[0][j], f2[j - 1] + t[1][j - 1] + a[0][j]);
        f2[j] = min(f2[j - 1] + a[1][j], f1[j - 1] + t[0][j - 1] + a[1][j]);
    }

    // Display the table of line and cost for each line
    printf("\nLine and Cost Table:\n");
    printf("Station  Line 1 Cost  Line 2 Cost\n");

    for (int i = 0; i < NUM_STATIONS; i++) {
        printf("%8d %12d %12d\n", i + 1, f1[i], f2[i]);
    }

    // Consider exit times and return minimum
    return min(f1[NUM_STATIONS - 1] + x[0], f2[NUM_STATIONS - 1] + x[1]);
}

int main() {
    int a[NUM_LINES][NUM_STATIONS] = {{8, 10, 4, 5, 9}, {9, 6, 7, 5, 6}};
    int t[NUM_LINES][NUM_STATIONS - 1] = {{2, 3, 1, 3}, {2, 1, 2, 2}};
    int e[NUM_LINES] = {3, 5};
    int x[NUM_LINES] = {2, 1};

    // Calculate and display the optimal time for completing the product
    int optimalTime = productAssembly(a, t, e, x);
```

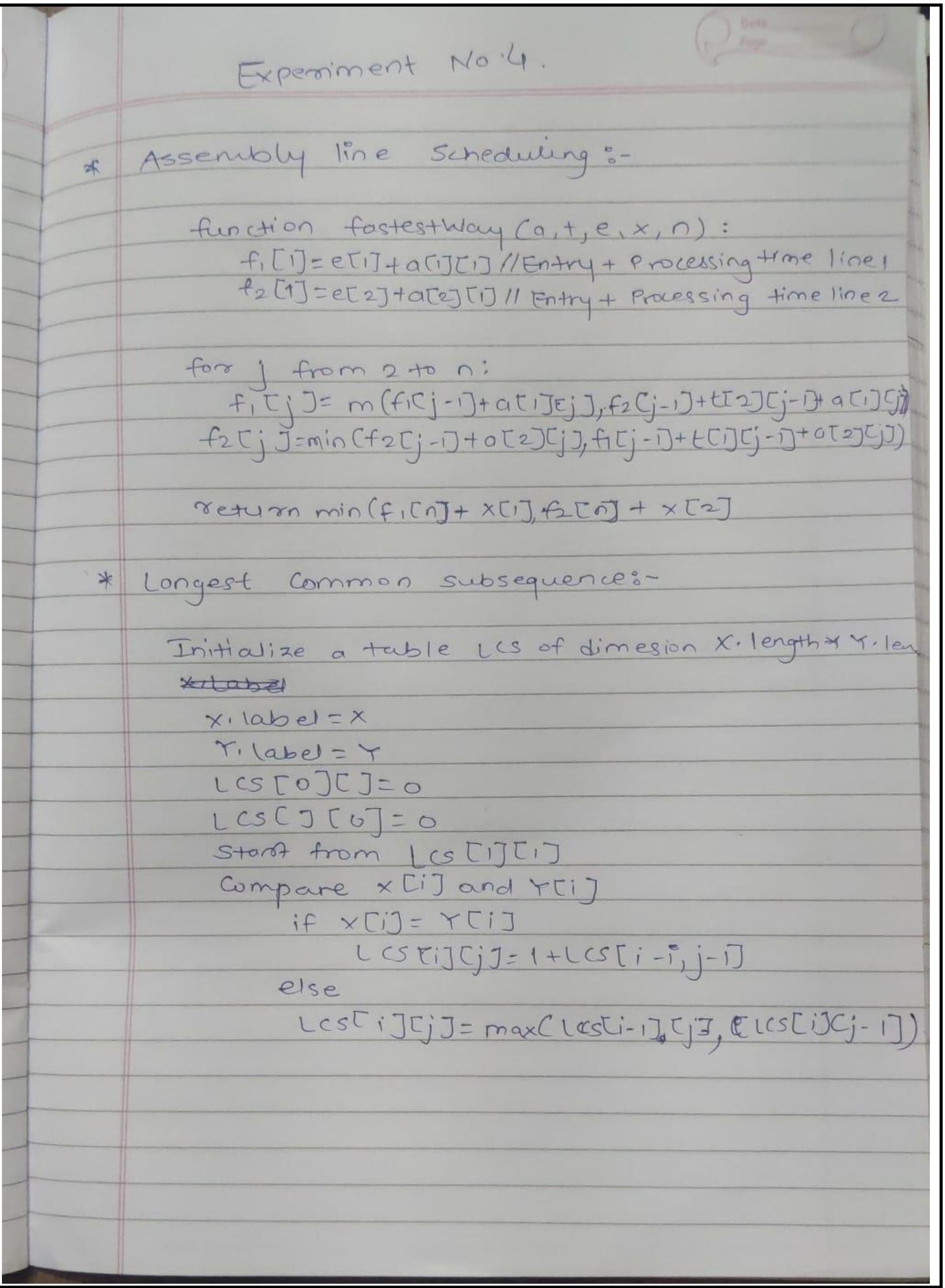
<table>
<tr>
<td></td>
<td>
<pre>
    printf("\nOptimal Time for completing the product is: %d\n",
optimalTime);

    return 0;
}
</pre></td>
</tr>
<tr>
<td><b>Output</b></td>
<td>
<pre>
● PS D:\Manish\SPIT> cd 'd:\Manish\SPIT\4th SEM\DAA\Exp4\output'
● PS D:\Manish\SPIT\4th SEM\DAA\Exp4\output> & .\'assembly_line.exe'

  Line and Cost Table:
  Station Line 1 Cost Line 2 Cost
         1   11   14
         2   21   19
         3   24   26
         4   29   30
         5   38   36

  Optimal Time for completing the product is: 37
  PS D:\Manish\SPIT\4th SEM\DAA\Exp4\output>
</pre></td>
</tr>
</table>

Pseudo Code



Experiment No.4.

* Assembly line Scheduling :-

```
function fastestWay (a, t, e, x, n) :
    f1 [1] = e[1] + a[1][1] //Entry + Processing time line1
    f2 [1] = e[2] + a[2][1] // Entry + Processing time line2

for j from 2 to n:
    f1 [j] = m (f1[j-1] + a[1][j], f2[j-1] + t[2][j-1] + a[1][j])
   f2 [j] = min (f2[j-1] + a[2][j], f1[j-1] + t[1][j-1] + a[2][j])

return min (f1[n] + x[1], f2[n] + x[2]
```

* Longest Common subsequence:-

```
Initialize a table LCS of dimesion X.length * Y.len
~~X.label~~
  X.label = X
  Y.label = Y
  LCS [0][] = 0
  LCS[] [0] = 0
  Start from LCS [1][1]
  Compare x[i] and Y[i]
        if x[i] = Y[i]
             LCS [i][j] = 1 + LCS[i-i, j-1]
       else
        LCS[i][j] = max(LCS[i-1], [j], LCS[i][j-1])
```

Conclusion	Hence, by completing this experiment I came to know about implementation of Dynamic Algorithms. a) Longest Common Subsequence. b) Assembly Line Scheduling.