**Breaking the problem into smaller sub-problems:**

We can easily find the ith factorial if (i-1)th factorial is known. Can we apply the similar funda here?

If the minimum time taken by the chassis to leave station Si, j-1 is known, the minimum time taken to leave station Si, j can be calculated quickly by combining ai, j and ti, j.

**T1(j)** indicates the minimum time taken by the car chassis to leave station j on assembly line 1.

**T2(j)** indicates the minimum time taken by the car chassis to leave station j on assembly line 2.

***Base cases:***

The entry time ei comes into picture only when the car chassis enters the car factory.

Time taken to leave first station in line 1 is given by:

T1(1) = Entry time in Line 1 + Time spent in station S1,1

T1(1) = e1 + a1,1

Similarly, time taken to leave first station in line 2 is given by:

T2(1) = e2 + a2,1

***Recursive Relations:***

If we look at the problem statement, it quickly boils down to the below observations:  
The car chassis at station S1,j can come either from station S1, j-1 or station S2, j-1.

Case #1: Its previous station is S1, j-1

The minimum time to leave station S1,j is given by:

T1(j) = Minimum time taken to leave station S1, j-1 + Time spent in station S1, j

.  
T1(j) = T1(j-1) + a1, j

Case #2: Its previous station is S2, j-1

The minimum time to leave station S1, j is given by:

T1(j) = Minimum time taken to leave station S2, j-1 + Extra cost incurred to change the assembly line + Time spent in station S1,

j  
T1(j) = T2(j-1) + t2, j + a1, j

The minimum time T1(j) is given by the minimum of the two obtained in cases #1 and #2.  
T1(j) = min((T1(j-1) + a1, j), (T2(j-1) + t2, j + a1, j))

Similarly the minimum time to reach station S2, j is given by:

T2(j) = min((T2(j-1) + a2, j), (T1(j-1) + t1, j + a2, j))

The total minimum time taken by the car chassis to come out of the factory is given by:  
Tmin = min(Time taken to leave station Si,n + Time taken to exit the car factory)  
Tmin = min(T1(n) + x1, T2(n) + x2)

**Why dynamic programming?**

The above recursion exhibits overlapping sub-problems. There are two ways to reach station S1, j:

1. From station S1, j-1
2. From station S2, j-1

So, to find the minimum time to leave station S1, j the minimum time to leave the previous two stations must be calculated(as explained in above recursion).

Similarly, there are two ways to reach station S2, j:

1. From station S2, j-1
2. From station S1, j-1

Please note that the minimum times to leave stations S1, j-1 and S2, j-1 have already been calculated.

So, we need two tables to store the partial results calculated for each station in an assembly line. The table will be filled in bottom-up fashion.

**Note:**  
In this post, the word “leave” has been used in place of “reach” to avoid the confusion. Since the car chassis must spend a fixed time in each station, the word leave suits better.