Exercise 163:-

3.   An automotive company has three assembly lines (Line 1, Line 2, Line 3) to produce different car models. Each line has a series of stations, and each station takes a certain amount of time to complete its task. Additionally, there are transfer times between lines, and certain dependencies must be respected due to the sequential nature of some tasks. Your goal is to minimize the total production time by determining the optimal scheduling of tasks across these lines, considering the transfer times and dependencies.

Program:-

```python
def assembly_line_three(a1, a2, a3, t12, t13, t21, t23, t31, t32, e1, e2, e3, x1, x2, x3):
    n = len(a1)
    T1 = [0] * n
    T2 = [0] * n
    T3 = [0] * n
    T1[0] = e1 + a1[0]
    T2[0] = e2 + a2[0]
    T3[0] = e3 + a3[0]
    for i in range(1, n):
        T1[i] = min(T1[i - 1] + a1[i], T2[i - 1] + t21[i - 1] + a1[i], T3[i - 1] + t31[i - 1] + a1[i])
        T2[i] = min(T2[i - 1] + a2[i], T1[i - 1] + t12[i - 1] + a2[i], T3[i - 1] + t32[i - 1] + a2[i])
        T3[i] = min(T3[i - 1] + a3[i], T1[i - 1] + t13[i - 1] + a3[i], T2[i - 1] + t23[i - 1] + a3[i])
    T1[n - 1] += x1
    T2[n - 1] += x2
    T3[n - 1] += x3
    return min(T1[n - 1], T2[n - 1], T3[n - 1])
a1 = [4, 5, 3, 2]
a2 = [2, 10, 1, 4]
a3 = [3, 8, 2, 6]
t32 = [0, 6, 5, 3]
t12 = [0, 7, 4, 5]
t13 = [0, 9, 2, 8]
t21 = [0, 6, 3, 4]
t23 = [0, 8, 2, 7]
t31 = [0, 5, 6, 4]
e1 = 10
e2 = 12
e3 = 15
x1 = 18
x2 = 7
x3 = 10
print(
    f"Minimum time to process the product: {assembly_line_three(a1, a2, a3, t12, t13, t21, t23, t31, t32, e1, e2, e3, x1, x2, x3)}")
```

Output:-

```
C:\Users\afree\PycharmProjects\pythonProject\.venv\Scripts\python.exe C:\Users\afree\PycharmProjects\pythonProject\0.py
Minimum time to process the product: 36

Process finished with exit code 0
```

Time complexity:-O(n)