The Post Correspondence Problem (PCP), introduced by Emil Post in 1946, is an undecidable decision problem. The PCP problem over an alphabet ∑ is stated as follows −

Given the following two lists, **M** and **N** of non-empty strings over ∑ −

M = (x1, x2, x3,………, xn)

N = (y1, y2, y3,………, yn)

We can say that there is a Post Correspondence Solution, if for some i1,i2,………… ik, where 1 ≤ ij ≤ n, the condition xi1 …….xik = yi1 …….yik satisfies.

Example 1

Find whether the lists

M = (abb, aa, aaa) and N = (bba, aaa, aa)

have a Post Correspondence Solution?

Solution

|  |  |  |  |
| --- | --- | --- | --- |
|  | **x1** | **x2** | **x3** |
| **M** | Abb | aa | aaa |
| **N** | Bba | aaa | aa |

Here,

**x2x1x3 = ‘aaabbaaa’**

and **y2y1y3 = ‘aaabbaaa’**

We can see that

**x2x1x3 = y2y1y3**

Hence, the solution is **i = 2, j = 1, and k = 3.**

Example 2

Find whether the lists **M = (ab, bab, bbaaa)** and **N = (a, ba, bab)** have a Post Correspondence Solution?

Solution

|  |  |  |  |
| --- | --- | --- | --- |
|  | **x1** | **x2** | **x3** |
| **M** | ab | bab | bbaaa |
| **N** | a | ba | bab |

In this case, there is no solution because −

**| x2x1x3 | ≠ | y2y1y3 |** (Lengths are not same)

Hence, it can be said that this Post Correspondence Problem is **undecidable**.