**Chapter 2\_ Bipartite Matching.**

Residue Graph:

It is oriented bipartite graph

In this the matched edges are from right to left

How to decide whether this graph is maximum matching or not?

If there are no reachable vertexes of the whole (left and right) are present in the unmatched vertex in the right then it is said to be maximum. This can be achieved by using any algorithms such as BFS and other graph traversal algorithm.

Matching covering the edges and Hall’s Marriage Theorem:

Reference: <https://www.youtube.com/watch?v=XQG9rXMlewI>

Hall’s Condition: (will help to check if the bipartite graph has perfect matching or not)

Let G be a bipartite graph consisting of sets u and w such that |u| <= |w|. G satisfies Hall’s condition if |N(x)| >= |x| for every non empty set x subset of u. (the subset which we choose should have more adjacent nodes)

Theorem: A bipartite graph G consisting of sets u and w, |u| <= |w| has a matching of size |u| (small side) if and only if it satisfies Hall’s condition

k- regular bipartite graph:

A graph is said to be regular where each vertex has same number neighbor’s . A graph is said to be k-regular bipartite graph if the degree of vextex is exactly k. So now using the hall’s condition(Marriage theorem) we can prove whether k-regular bipartite graph has perfect matching or not.