Design Document:Determine whether a given graph is n-partite,bipartite or non-partite

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11 October 2009

1 Introduction

Graph problem can be solved in number of ways. But selecting the *appropriate* method to solve a particular problem is important. This design document consists of one way to find out whether a given graph is *bipartite,n-partite or non-partite.*

2 Algorithm

The algorithm given below will determine the *Chromatic Number,*$\chi(G)$ of a given graph.

Algorithm 1 ChromaticNumber(A[0...n-1],B[0...n-1][max]

Input:An array A[0...n-1] and adjacency matrix B[0...n-1][max]
Output:Chromatic Number of a graph

```
for p ← 0 to limit do
  i ← 0
  minimum ← a[i]
  for q ← 0 to limit do
    if a[q] ≤ minimum then
      minimum ← a[q]
      minpos ← q
    end if
  end for
  a[minpos] ← ∞
  push(pos)
end for
{To assign color to the vertices}
currentcolor ← 0
while !stack_empty do
  a ← highestorderedvertex
  c[a] ← currentcolor
  for k ← 0 to numberofvertices do
    if  b[a][k] ≠ 1 then
      c[r] ← currentcolor
      x ← pop(v) {make use of a temporary stack to remove vertices if they
      are not present on top}
    end if
  end for
  currentcolor ← currentcolor + 1
end while
```

It is presumed that degree of all the vertices are known. The vertices are sorted according to their degree and pushed onto the stack. The vertex with the highest degree is popped and colored. The vertices which are not connected

to the popped vertex are assigned the same color. The total number of colors give the chromatic number of a graph which inturn determines the number of disjoint vertex sets of a given graph. The above algorithm can be implemented using linked lists and queues. But the use of *pointers* will lead to lot of space consumption in lists, so stack is used in this case.

3 Data Structure

Input is read in the form of adjacency matrix. Arrays are used to store the degrees of the vertices. Stack is used to store uncolored vertices.

4 Abstract Input and Output

The array containing degrees of the nodes is fed to the above algorithm. Chromatic number is obtained.

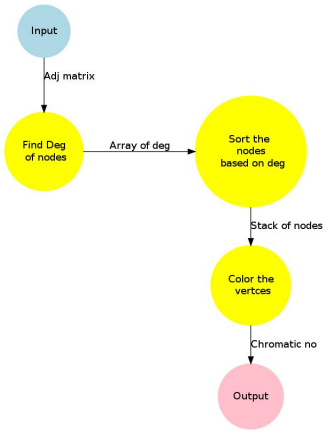

Figure 1: Data Flow Diagram

5 References

- System Requirement Specification
- Anany Levitin:Introduction to the Design and Analysis of algorithms.2nd edition
- *http* : *//scienceblogs.com/goodmath/*2007/06/*graph_coloring_algorithms_*1.*php*