Real life problems on MAD with RTS

D.R.Kirubaharan[1] & Dr.G.Nirmala[2]

Anita Borude, Prof. Shobha Krishnan

[1]Research scholar, Monomaniam Sundaranar University, Thirunelveli.
[2]Research advisor, Kunthavai Natchiyar Govt College for women, Thanjavur.

Abstract- In this paper, the application of matching, using min-weight bipartite graph to find out which disease is matched to that concern treatment's states is presented.

Index Terms- Matching, Near-perfect, Greedy algorithm, MAP, MAD, RTS, Weighted graph.

I. INTRODUCTION

Every human being has affected by some disease. There is a treatment for cure to all kinds of disease. Likewise, a few diseases are uncurable such as HIV, AICD. In this paper describes about the matching between disease and the states of treatments. In particular, bipartite graph and min-weight graph is the major tool to find out proper matching.

II. LITERATURE REVIEW

The motivation for introducing matching is reflected upon by Roberts F.S., *Graph Theory and its applications to the problems of society* The term matching has been used in the literature once introduced by Murugan.M (*1966*).

Matching is also discussed in Bondy .J.A. and Murthy. U.S.R, *Graph Theory with Applications*, Macmillan (1976).Douglas B. West, *Introduction to Graph Theory*, second Edition,(2006) and some other papers and books. Many real life problems have been solved by the help of Graph Theory matching and it has also proved to be an extremely useful tool for solving many tasks.

Definition: 1

A graph G= (V, E), a matching M in G is a set of pairwise non-adjacent edges.

Definition: 2

A vertex is matched (*saturated*) if it is incident to an edge in the matching. Otherwise the vertex is unsaturated.

Definition: 3

A maximal matching is a matching M of a graph G with the property that if any edge not in M is added to M, it is no longer a matching, that is, M is maximal if it is not a proper subset of any other matching in graph G.

Definition: 4

A maximum matching is a matching that contains the largest possible number of edges.

Definition: 5

A perfect matching is a matching which matches all vertices of the graph.

Definition: 6

A near-perfect matching is one in which exactly one vertex is unmatched. This can only occur when the graph has an odd number of vertices, and such a matching must be maximum.

Example: 1

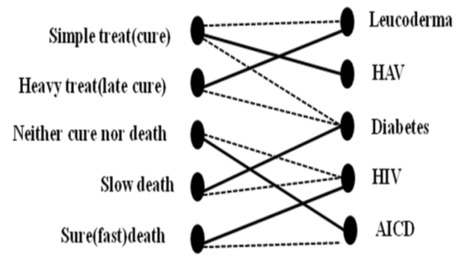

Figure-1

As mentioned earlier, matching graph has a perfect matching, namely HAV is cured by simple treatment. Leucoderma is cured by not simple treatment and AICD is neither cure nor death by any treatment and also Diabetes diseases has not been cured by any treatment, but it may be controlled and it tends to slow death (later) and HIV disease has no treatment and it surely tends to death.

Definition: 7

The weight of matching M is the sum of the weights on the edges in M. The min-weight matching for a graph G is the perfect matching for G with minimum weight.

Example: 2

Every disease has some states to cure or not cure. Those diseases are denoted by {D:D_1,D_2,D_3,D_4,D_5} for {Disease: Leucoderma, HAV, Diabetes, HIV, AICD} respectively and theirs states of treatment (result) are denoted by {P:P_1,P_2,P_3,P_4,P_5} for {States: Simple treatment(for cure),Heavy treatment(for cure),Neither cure nor death, Slow death, Fast(sure)death} respectively, with min-weight 6.

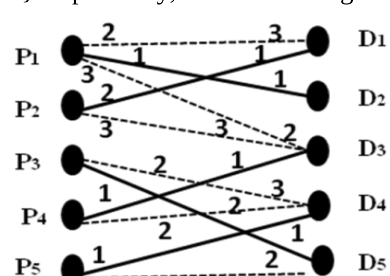

Figure-2

Now a days, in our practical life problems, matching problems are used frequently, which has an elegant solution. Every disease

ISSN 2250-3153

has some preference order of the possible states of treatment. That preferred states do not have to be symmetric.

Example: 3

HIV disease has no treatment, which goes to sure death but if the treatment is not proper for HAV, this disease also leads to death. By heavy treatment HAV disease will be curable. But suppose HAV is not curable and it tends to death that is more than curable state but HIV will be curable by heavy treatment.

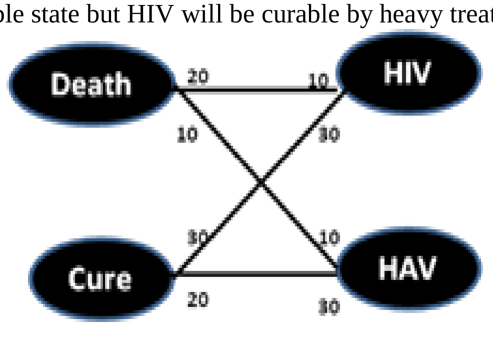

Figure-3

In the fig: 3 suppose the states with disease are matched by as follows.

Suppose to match HAV tends to death and HIV disease is to be curable, that would lead to very dicey situation. It is sufficiency to say that HAV disease tends to death. The main practical problem is HAV disease is not very dangerous but HIV is very dangerous, because there is no treatment.

To show that how to find such a matching graph has a stable matching.

First look at disease verities where a proper stable matching is not possible. This idea has been created by the triangle match with a four diseases, which is last choice of every one.

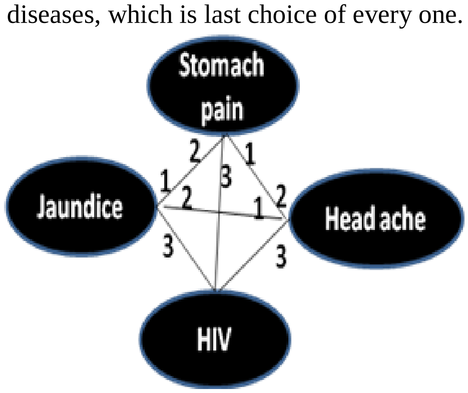

Figure: 4

It turns out HIV doesn't have some matched disease. That's why there is no stable matching.

Theorem: 1

There is no proper stable match for diseases and its symptom's.

Proof:

By contradiction, assume that, there is no proper stable matching. Then there are two disease of the matching triangle that is matched.

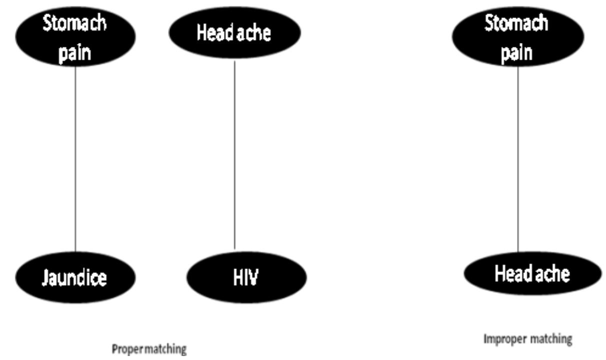

Figure: 5

By symmetry, assume that Jaundice disease is matched to Stomach pain. Then the other pair disease must be Head ache matched with HIV. But there is an improper (rogue) matched pair disease, since if Stomach pain comes, Head ache will come very soon and if Head ache comes, Stomach pain has comes for the disease HIV. So Stomach pain and Head ache is improper pair. Thus, there can't be a stable match.

Next, a stable match is a hard thing to do, for that we can take always do it in bipartite graphs. That is, where the disease are only allowed to match with states of treatments and vice-versa.

We are not making a political or social statement here this is just a fact of mathematics. So let's formalize the statement of the problem is noted here.

Setting the matching for stable between the disease and states of treatment problem:

- Assume the number of classified states of treatment process and particular diseases are same, (N states and N disease).
- Each disease has its own ranked preference list of states and also vice-versa.
- The lists are completed and have no ties, (each disease has some treatment states to take for cure or death and vice-versa).

III. MATCHING ALGORITHM

Initial condition: Each of the N disease has an ordered list of the N states (treatment results) according with its preference states. Each treatments state has an ordered list of the disease according to its preference.

MAD with RTS *(matching algorithm for disease with its result of treatments states):*

Every disease has some treatment period as well as concern treatments cure some concern diseases.

1. First check that concern disease nature and how it cause.
2. If the disease is simple, it needs to cure by simple treatment.
3. If the disease is like AICD, it is uncurable by simple or heavy treatment and it terminates.
4. Some case of disease needs heavy treatment to cure.
5. Some times that treatment may not suit for some bodies, it is very dangerous and it tends to death slowly.
6. Rarely, if any treatments are not suited or not properly treated, it will surely goes to sudden death.

Terminal condition: If there is a day when every disease reaches some states by treatment, stop the processes.

Example: 4

Figure out method for finding a stable matching.

Disease…..States

HIV -1……..A - Sure death
HAV -2……...B - Fast cure
LEACODERMA.-3……...C - Slow cure
DIABETES -4……...D - Slow death
AICD -5……...E - Neither cure nor death

By *greedy algorithm* to find the proper matching.

IV. PREFERENCE ITERATION LIST

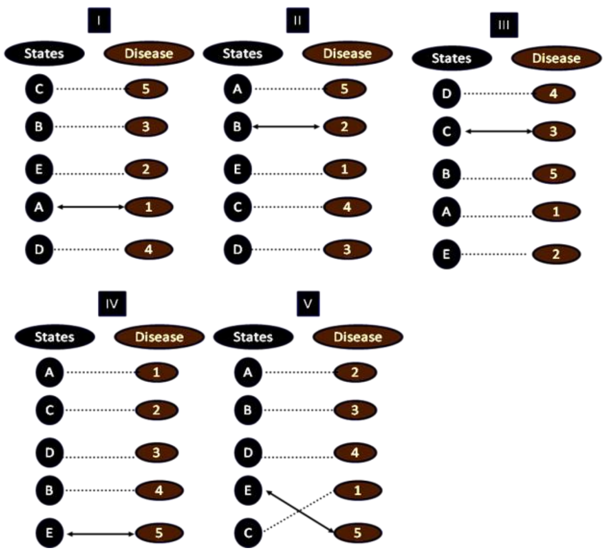

Figure:6

Theorem: 2

MAD with RTS will be terminates within N^2+1 stages.

Proof:

By contradiction, that MAD doesn't terminate within N^2+1 stage. Assume that something must be happen on a stage in which MAD doesn't terminate-it must be that some proper treatment treats particular disease neither cure nor death .If MAD doesn't terminate, then some disease have not proper treatment. If any disease has proper treatment for cure or death, then the other simple treatments are rejected.

So if MAD doesn't terminate in N^2+1 stages ,there are at least N^2+1stages crossed off in total. But at that start, each list is of size at most N .So the total size of all the lists put together is at most N^2.So we couldn't off N^2+1stages and thus we have our contradiction.

Lemma: 1

If any patient cure or death, then that patient courted every other treatments if it is matched better.

Lemma: 2

If any patient is neither cure nor death, then the patient wants some heavy treatment.

Theorem: 3

Every disease is matched by its states of treatment in matching algorithm.

Proof:

By contradiction, assume that some treatments are not matched to some disease. But then, by lemma 2, if a treatment states are not suit, then it courted every disease. But every disease will neither cure nor death by some treatment. But since there are an equal number of states and disease, it must be the neither cure nor death that every disease is matched, which is a contradiction. Hence the theorem.

V. CONCLUSION

Every disease has some particular states of treatment by min-weighted graph.

ACKNOWLEDGEMENT

I wish to thank everyone who contributed to the success of this work and the resident on it.

REFERENCES

[1] Appel. K. and Haken .W., *Every Planar Map is Four Colorable*, Bull. Amer. Math. Soc.82 (1976).

[2] Babai. L., *Some applications of graph contractions*, Graph Theory, Vol.1 (1977).

[3] Bela Bollobas, *Modern Graph Theory*, Springer - Verlag, New York, Inc. (1998).

[4] Bertram E. and Horak P., *Some applications of graph theory to other parts of Mathematics*, The Mathematical Intelligencer (Springer - Verlag, New York) (1999) 6 - 11.

[5] Bondy .J.A. and Murthy. U.S.R, *Graph Theory with Applications*, Macmillan (1976).

[6] Douglas B. West, *Introduction to Graph Theory*, second Edition,(2006).

[7] Foulds. L.R, *Graph Theory Applications*, Springer – Verlag, New York, Inc. (1992).

[8] Harary, *Graph Theory*, Narosa Publishing House, New Delhi (1988).

[9] Murugan.M, Topics in Graph Theory and Algorithms

[10] Parthasarathy .K.R., *Basic Graph Theory*, Tata McGraw - Hill Publishing Company Limited, New Delhi (1994).

[11] Prabhakar. M. Ghare, James. M. Moore, Cinodchachra, *Applications of Graph Theory Algorithms* (1979).

[12] Roberts F.S., *Graph Theory and its applications to the problems of society*, CBMS-NSF Monograph 29, SIAM Publications, Philadelphia (1978).

[13] Ronald Gould, *Graph Theory*, the Benjamin Cummings Publishing Company, Inc. California (1988).

AUTHORS

First Author: D.R.Kirubaharan, Research scholar, Monomaniam Sundaranar University, Thirunelveli.
Email id - jagkans@yahoo.com

Second Author: Dr.G.Nirmala, Research advisor, Kunthavai Natchiyar Govt College for women, Thanjavur.
E.mail ID: nirmalamanokar11@yahoo.com