



September 12, 2009

To whom it may concern:

I am Dr. Masafumi Yamashita, a professor at the Department of Informatics, Graduate School of Information Science and Electrical Engineering, Kyushu University, Japan. I would like to submit a report on the habilitation thesis of Dr. Akka Zemhari to the committee.

Sincerely yours,

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Review Report on the Dr. Akka Zemmari's HdR Dissertation

0. General Information

Since I cannot read French well, I am writing this review report by reading an English overview of the dissertation and a set of his articles written in English, both of which were provided by Dr. Zemmari.

Dr. Zemmari and I belong to the same research society known as the distributed computing, whose main concern is the theoretical aspects of distributed systems. A part of his research topics overlaps with mine, but we have not written co-authored papers.

1. Curriculum Vitae

Dr. Akka Zemmari obtained his Ph.D in 2000 and started his carrier in academia. Since 2001, he is an associate professor at Universite Montesquieu Bordeaux IV. He has supervised one Ph.D. candidate and two Master course students. They have successfully received their degrees. Although the number of students that he supervised is not large, this fact witnesses his ability of supervising students.

2. Summary of Papers in Dissertation

Distributed systems consist of autonomous computing entities (i.e., nodes, processes, processors, or agents) communicating each other through communication links. To collaborate with and to resolve conflicts among the entitiies, agreement problems repeatedly emerge in distributed systems. The agreement problems are thus considered to be the most fundamental problem in the distributed computing. The dissertation investigates the following agreement problems:

Leader Election Problem: selecting a one from the entities of distributed system.

Maximal Independent Set Problem: selecting a maximal independent set of the communication network.



Coloring Problem: deciding the colors of vertices (i.e., entities) in such a way that neighboring vertices always have distinct colors.

Handshake Problem: extracting a matching from the communication network.

The above problems are indeed agreement problems in the sense that all the entities need to agree on (i.e., consistently choose) the leader, the maximal independent set, the colors or the matching.

However, these problems are shown to be unsolvable in a deterministic way when an order among the entities is not provided a-priori, e.g., when the distributed system is anonymous (i.e., when the entities do not have unique identifiers). This motivates the introduction of probabilistic algorithms. The dissertation investigates probabilistic agreement problems on anonymous networks. It presents many agreement algorithms and analyzes their performances. In the following, we look at each of the four agreement problems mentioned above.

3. Leader Election Problem

The leader election problem is the problem of electing an entity (called leader) from the set of entities. Angluin proposed an election algorithm for a tree, which repeatedly removes a leaf from the current tree one-by-one until a single vertex remains. The remaining vertex becomes the leader. Dr. Zemmari discussed two issues on Angluin's algorithm.

First, he investigated how to control the distribution that each of the entities is elected in a distributed manner, and proposed such a method to realize it. This problem setting and the solutions are interesting and important, not only from the view of practice, but also from the view of the probability theory. This random process of election seems to have still another deep relationship with a conventional stochastic process.

Second, Dr. Zemmari considered an extension of this algorithm to other classes of communication networks. He only considered polyominoes. The result is technically interesting, but the class of polyominoes is specific. I hope that he continues to do this research direction until he obtains an election algorithm for general graphs.



In summary, the papers in this category shows that his ability of analyzing algorithms using mathematical tools is deep and impressive.

4. Maximal Independent Set and Coloring Problems:

A set of vertices (i.e., entities) is called independent if they do not share an edge in the communication graph. Intuitively, two non-adjacent vertices can proceed their executions independently, so that a set of independent vertices represents a set of simultaneously executable entities. Thus a maximal (or a maximum) independent set is looked for to extract maximal (or maximum) parallelism. The essence of difficulty is in the symmetry breaking and Dr. Zemmari made use of random bits (i.e., coin flips) to break symmetry. This basic idea is a conventional one, but by elegantly implementing this idea in the algorithm, he could design an algorithm that shows better performance than the previous ones. That is, its time complexity is $O(\log n)$, its message size (number of bits) is 1, and its bit complexity (per channel) is $O(\log n)$, all of which are the best among the known algorithms, and this is the first algorithm to realize message size 1. The algorithm does not need any global information, e.g., the order or the size, on the network, which is the feature that I want to emphasize.

The coloring problem is to color vertices in such a way that two end-vertices of each edge do not have the same colors. Since the set of vertices having the same color is an independent set, coloring problem is considered to be an extension of the independent set problem.

The idea behind his coloring algorithm is a conventional one and using a trick (to implement it into a one-bit protocol) similar to the one in his maximal independent set algorithm, Dr. Zemmari obtained an algorithm that performs well.

In summary, these papers show that the quality of his techniques to implement ideas in algorithms is high.

5. Handshake Problem:

In order for two end-vertices of an edge to start communication, both of them select each other as communication parties. The problem asks a protocol to select the partners. In articles they use terms rendezvous and hand shake, but they refer to the same concept.



We can restate the problem as the maximal matching problem to extract matching edges from a given communication graph.

I rank the papers in this category best because of their sophisticated analysis based on the probability theory. It may be interesting to consider a problem (like in the case of leader election) of controlling the probability that an edge is selected in a distributed manner.

6. Publications

Dr. Akka Zemhari has 9 journal papers and 20 conference papers in his 9 years career, 3 papers/year. I have examined their qualities in above. As for quantity, I believe that it is sufficient.

7. Concluding Remarks

I have examined Dr. Zemhari's career and publications. As a result, I conclude that the quantity and quality of their publications show that he is a leading researcher in distributed computing. The above as well as the fact that all of the students that he has supervised successfully obtained their degrees witness that Dr. Akka Zemhari is at the high scientific level, and has sufficient talent to supervise young researchers.