**Letter of Recommendation**

I am very glad to write a few words about Abdus Salam Azad, one of my best thesis supervisees. I know Azad for the last 5 years. Being his mentor for such a long time, I stand as a trustworthy source to affirm Azad’s research abilities and academic accomplishments.

To encourage research among undergraduate students, our university has a policy of assigning final-year students under the supervision of a faculty member. Azad, with another student, worked with me in my ongoing research on Genetic Algorithms as his undergraduate thesis. We focused on at GA’s application on Vehicle Routing Problems (VRP). In initial stages they reviewed the literature of GA and VRP. We had weekly meetings and they would present their findings on the strengths and weaknesses of the existing methods. I was pleased with Azad’s ability to notice the subtle properties of different algorithms. Afterward, they came up with an idea of a new variant of VRPs for periodic multi-depot VRPs which can generate low cost solutions than the previous formulations. We also designed a basic GA framework for solving this variant. The work got the best thesis award in the departmental thesis poster presentation.

I supervised Azad’s Marters’s thesis too. We focused on designing a Memetic algorithm to solve the variant we had previously proposed. The main challenge with such complex variants of VRP is that the search space is very large. Most of the existing methods put an emphasis on greediness to find good quality solutions from this large search space. Such exploitation disrupts the balance between the exploration and exploitation of the search space. The existing methods use additional techniques to restore the balance. Azad came up with a simple idea of introducing stochasticity in the individual learning process to maintain the search balance. After trying with a number of different approaches to incorporate stochasticity, finally we came up with an algorithm which could maintain the balance effectively. This work has been accepted in the reputed journal *IEEE Transactions on Cybernetics* (*Impact Factor: 7.384*).

As Azad’s supervisor, I have found a number of good traits in him, which can lead him to carry out quality research works. First of all, Azad is very hard working. He has been employed in our department as a Lecturer since his graduation. Hence, during the whole period of his Masters he was already doing a full-time job. He used to work for prolonged hours on our research after his office, which is of course praise-worthy. Azad’s writing ability is promising too and improved a lot during this work. Other characteristics that I value highly are his consistency and perseverance. During development of the algorithm, sometimes new approaches failed to improve the results. However, he was sincere throughout the process. In each setback, he conducted a deeper analysis to get a better understanding of the problem. By running experiments and analytical analysis, he found out the shortcomings of the approach and addressed those issues to improve it further.

Azad also took two of my courses during his undergraduate studies, Artificial Intelligence and Machine Learning. He used to be attentive in the classes and participated actively by asking questions or sharing ideas in almost every class. He scored the highest marks in Machine Learning theory with a significant difference than the second highest score.

He also took my Machine Learning lab, in which he showed an exemplary dedication. I remember my encounter with him during the first assignment. He successfully implemented the ID3 algorithm for learning decision trees. However, during the viva I wasn’t quite satisfied on his insight on the algorithm. However, I found him much well prepared in his next assignment as he was answering the questions with great depth. I was quite amazed as he referred me to a research paper while answering one question. This time, he had even studied some relevant papers as a preparation for the viva. For the rest of course, I enjoyed checking his assignments as he continued show a good understanding of the topics. He also submitted an extra report on the impact of *k* in the *k-*Nearest Neighbor algorithm.

After graduation, Azad joined the department as a lecturer. Till now, I have conducted two Lab courses with him: Machine Learning and Artificial Intelligence. As a teacher I find him very dedicated. He gave a great effort in the Artificial Intelligence lab to design new experiments on A\* Search, Local Search, and Adversarial Search under my supervision. Azad is also very lively in delivering his lectures. I particularly remember one where he engaged the students, quite in an unorthodox way, to solve an imaginary problem faced by the tennis player Rafael Nadal. Later he revealed the students, that they had been simulating the ID3 algorithm by their intuition the whole time. Throughout the class he was able to attract and sustain the interest of the students.

Finally, throughout these years Azad has been a sincere learner and has grown a strong foundation for doing novel research work. He has the necessary knowledge and practical experience in the fields of machine learning and artificial intelligence. What I value more is, he has the drive to learn new ideas and concepts when needed. He also has a good acquaintance with the current research frontiers. Based on my long history of interactions with him, I have full confidence that he will be very successful in his Ph.D. with his hard work and determination. Therefore, I strongly recommend him for admission in your graduate program. I wish him all the success in his quest for knowledge and excellence.

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