CHAPTER V

CONCLUSION AND SUGGESTION FOR FUTURE WORK

5.1. Conclusion

This research has three purposes as listed in section 1.3, i.e. (1). to suggest for a mathematical model applicable for the selected hospital, (2). to suggest a metaheuristic algorithm to solve the model, (3). to recommend optimum parameter values for the algorithm. The mathematical model is presented in section 4.3. For the second and third purposes, experiments are conducted on four selected BPSO algorithms; Native BPSO, Adaptive Native BPSO, Novel BPSO and Adaptive Novel BPSO. Based on the experiments, we can conclude that:

1. The best solution is obtained in the algorithm of Novel BPSO. This algorithm does not give the best fitness value, yet it is the one algorithm capable of assigning the highest number of working days closest to the number of working days that have to be fulfilled by physicians in a month (Refer to Table 4.4). In terms of execution time, it is higher than the average execution time of Native BPSO and Adaptive Native BPSO without P-best, however the difference is considered acceptable, as the the entire duration is still less than 100ms.
2. Parameters contributing to the equation of velocity in Novel BPSO comprise of inertia weight w, constant values of c_1, c_2 as the learning

factors and r_1, r_2, r_3 as random variables. Recommended values for the parameters are presented in Table-5.1. below.

Table 5.1. Novel BPSO Recommended Parameters' Values

c_1	c_2	r_1	r_2	r_3	w
2	2	Random {0,…,1}	Random {0,…,1}	0	1.2 – 2.0

- inertia weight w: in general, increasing inertia weight is proposed for binary PSO, which confirms the research finding of Liu et al. (2015) that suggest for the use of increasing inertia weight. The range of inertia weight that produces best performance is on the high range from 1.2 – 2.0, which confirms the research findings of Shi & Eberhart (1998) that says when inertia weight is high (w > 1.2), the PSO will have its best chance to find the global optimum.
- constant values of c_1, c_2 are recommended to be of value 2 (Logenthiran & Srinivasan, 2010).
- r_1, r_2 random variables are recommended to take the values from 0 to 1 (Logenthiran & Srinivasan, 2010).
- r_3 as random variable: it generally works well for the value of 0, as it gives 50:50 probability of a bit to change its bit position.

5.2. Suggestion for Future Work

The followings are suggested for future work:

1. The current mathematical model has fulfilled the general requirements from the hospital, defined as hard constraints. Further enhancement on the model can be made to support for the soft constraints on physicians' preferences.
2. Adaptive Native and Adaptive Novel BPSO have opportunities to expedite the algorithms' process in finding the global best position with the minimum fitness/objective function. Further research can be done to impose constraints in the mathematical model to increase number of working days assigned for physicians in a month close the requirement from the regulation.
3. The current software for the binary PSO algorithms is developed using PHP. It has limitations on the number of instances (particles and iterations) that can be run. Further experiments can be developed on other software using either python or MATLAB to exercise for more particles and iterations.