A Blackboard System for University Timetabling Based on Pattern Technology

李杰濃、張顧耀

E-mail: 9509709@mail.dyu.edu.tw

ABSTRACT

The timetabling has always been a necessary job for the administrative work of universities. It is a very complicated problem due to the consideration of many factors and restrictions. Although many computer-based solutions have been proposed in the literature, none of them can be universally applied to each department. In this paper, we analyze every factors and restrictions of the timetabling problem. And based on the pattern technology, we use the blackboard pattern as the system architecture to simulate the manual timetabling process and seek viable solutions. Furthermore, we propose a method of evaluating a timetable and use computer science and information engineering department of DA-YEH university as our experimental target. We also compare the results of our method and existing manual approach.

Keywords : Timetabling System、Object-Oriented、Pattern Technology、 Blackboard Architecture

Table of Contents

封面內頁 簽名頁 授權書.....iii 中文摘要.....iv 英文摘要.....v 誌謝.....vi 目錄.....vii 圖目錄.....ix 表目錄.....xi 第一章 緒論.....1 1.1 研究動機與背景.....1 1.2 研究目的.....2 1.3 論文架構.....3 第二章 問題探討與文獻回顧.....4 2.1 排課問題探討.....4 2.2 文獻回顧.....9 2.3 樣式技術.....13 第三章 系統分析與設計.....20 3.1 系統分析.....20 3.2 系統設計.....39 第四章 系統實作與結果.....49 4.1 資料模型.....49 4.2 使用者介面.....54 4.3 排課結果.....60 第五章 結論與未來發展.....71 參考文獻.....73

REFERENCES

[1]賴永進，1994，結合人工智慧技術與群體決策支援環境的 大專院校自動化排課系統－排課群體協商，大葉大學電機 工程研究所碩士論文。

[2]張獻文，1998，運用哈普費爾德－譚克類神經網路開發自 動化排課系統，大葉大學資訊管理研究所碩士論文。

[3]蘇家輝、林文揚，1999，“群體決策線上排課系統之建置”， 第五屆資訊管理研究暨實務研討會，台北。

[4]Abramson, D.,“Constructing school timetables using simulated annealing: sequential and parallel algorithms,”Management Science, Vol. 37, No. 1, 1991, pp. 98-113.

[5]Aust, R. J.,“An improvement algorithm for school timetabling,”The Computer Journal, Vol. 19, No. 4, 1976, pp. 339-343.

[6]Burke, E.K., Elliman, D.G. and weare, R.F.,“A Hybrid Genetic Algorithm for Highly Constrained Timetabling Problems,”Proceedings of the 6th International Conference on Genetic Algorithms, Pittsburgh, USA, 1995, pp.605-610.

[7]Burke E.K. and Petrovic S.,“Recent research directions in automated timetabling,”European Journal of Operational Research, Vol. 140, 2002, pp. 266-280.

[8]Cangalovic, M. and J. A. M. Schreuder,“Exact coloring algorithm for weighted graphs applied to timetabling problems with lectures of different lengths,”European Journal of Operational Research, Vol. 51, 1991, pp. 248-258.

[9]Chu, S. and Fang H.,“Genetic algorithms vs. tabu search in timetable scheduling,”Third International Conference on Knowledge-Based Intelligent Information Engineering Systems, Adelaide, Australia, 1999, pp. 492-495.

[10]Colorni, A., M. Dorigo and V. Maniezzo,“Genetic algorithms and highly constrained problems: The timetable case,”Proceedings of the First International workshop on Parallel Problem Solving from Nature, Dortmund, Germany, 1991, pp. 55-59.

[11]Eiself, H. and Laporte, G.“Combinatorial Optimization Problems with Soft and Hard Requirements,”Journal of the Operational Research Society, Vol. 38, 1987, pp. 785-795.

[12]Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides.（1995）Design Patterns: Elements of Reusable Object-Oriented Software, Addison wesley. ISBN: 0-201-63361-2.
[13]Even, S., A. Itai and A. Shamir,“ On the Complexity of Timetable and Multicommodity Flow Problem,” SIAM J. Computing, 1976, pp.691-703.
[14]Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad and Michael Stal. （1996） Pattern-Oriented Software Architecture Volume 1:A System of Patterns. John wiley and Sons Ltd.. ISBN:0-471-95869-7.
[15]Gorodetski, Vladimir I. and Lebedev, A.,“ Multi-Agent Technology for Planning,Scheduling and Resource Allocation,” International Conference on Multi Agent Systems, Paris, France, 1998, pp. 429-430.
[16]Hertz, A.,“ Tabu search for large scale timetabling problems,” European Journal of Operational Research, Vol. 54, 1991, pp. 39-47.
[17]John M. Vlissides（2003）Data Access Patterns: Database Interactions in Object-Oriented Applications, Addison-wesley. ISBN:0-131-40157-2.
[18]Kingston, J. H and Yin-Sun Lynn, B.“ A software architecture for timetable construction,” PATAT'00, Constance, Germany, August 2000, p472-480.
[19]Lawrie, N.L.,“ An Integer Linear Programming Model of a School Timetabling Problem,” The Computer Journal, Vol. 12, 1969, pp. 307-316.
[20]Schaerf, A.,“ A Survey of automated timetabling,” Artificial Intelligence Review, Vol. 13, No. 2, 1999, pp. 87-127.
[21]Slim Abdennadher and Michael Marte,“ University Course Timetabling Using Constraint Handling Rules,” Applied Artificial Intelligence, Vol. 14, No. 4, 2000, pp. 311-325.
[22]Zervoudakis K. and Stamatopoulos P.,“ A Generic Object-Oriented Constraint Based Model for University Course Timetabling”, PATAT'00, Constance, Germany, August 2000, p128-147.