

**CONCEPTUAL MODEL:  
MALAYSIAN TAX RESIDENT STATUS**

A dissertation submitted in partial fulfilment of the requirements for the award of  
the degree of Master of Science (Information & Communication Technology) in the  
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## ABSTRAK

Taraf pemastautin cukai adalah salah satu keistimewaan bagi orang asing yang bekerja dan menetap di Malaysia dalam tempoh tertentu. Taraf pemastautin cukai ini membolehkan mereka menikmati kelebihan-kelebihan tertentu yang mana ia mengurangkan cukai pekerja tersebut. Akta Cukai Pendapatan 1967 telah menggariskan empat kriteria dalam menentukan sama ada seseorang pekerja itu mendapat taraf mastautin atau sebaliknya. Kriteria tersebut melibatkan prosedur yang begitu rumit dan selalunya dikendalikan oleh agen perculaian yang berpengalaman. Kajian ini menggunakan konsep sistem berdasarkan peraturan untuk menghasilkan model terhadap prosedur tersebut. Kaedah model tersebut adalah rangkaian penakbiran, pohon keputusan dan peraturan. Menurut soal selidik yang telah dibuat, model tersebut terbukti adalah benar mengikut undang-undang dan peraturan yang ditetapkan serta telah ditukar kepada bahasa yang mudah difahami oleh seorang jurutera pengetahuan. Oleh yang demikian model konsep tersebut boleh digunakan dalam pembangunan sistem pakar yang sebenar.

## **ABSTRACT**

Tax resident status is a privilege for foreigner who works and stays in Malaysia for certain period of time. This status will enable them for a tax reduction. Income Tax Act 1967 has stated four main criteria for granting tax resident status. The criterion involves complex procedures, which are usually done only by experienced tax consultants. This study applied rule-based conceptual modeling in order to model the procedures. Three modeling methods have been applied are Inference Network, Decision Tree and rule. The test conducted, showed that the models have been transformed from pure tax regulation into a language that can be understood by the Knowledge Engineer. Therefore these conceptual models can later be developed into a real expert system.

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## **DEDICATION**

To my lovely parents

## TABLE OF CONTENT

|  |             |
|--|-------------|
| <b>CERTIFICATION OF THESIS WORK.....</b> | <b>i</b>    |
| <b>PERMISSION TO USE.....</b>            | <b>ii</b>   |
| <b>ABSTRAK.....</b>                      | <b>iii</b>  |
| <b>ABSTRACT.....</b>                     | <b>iv</b>   |
| <b>ACKNOWLEDGEMENT.....</b>              | <b>v</b>    |
| <b>DEDICATION.....</b>                   | <b>vi</b>   |
| <b>LIST OF TABLES.....</b>               | <b>x</b>    |
| <b>LIST OF FIGURES.....</b>              | <b>xi</b>   |
| <b>LIST OF ABBREVIATION.....</b>         | <b>xiii</b> |

## CHAPTER 1:BACKGROUND OF THE STUDY

|   |   |
|---|---|
| 1.1 Introduction.....                     | 1 |
| 1.2 Problem Statement.....                | 5 |
| 1.3 Research Objective .....              | 5 |
| 1.4 Significance Of The Research.....     | 5 |
| 1.5 Scope and Limitation of Research..... | 6 |

## CHAPTER 2:LITERATURE REVIEW

|                                     |    |
|-------------------------------------|----|
| 2.1 Introduction.....               | 7  |
| 2.2 A Rule-based Expert System..... | 8  |
| 2.3 Knowledge Acquisition.....      | 9  |
| 2.4 Knowledge Representation.....   | 12 |
| 2.5 Conceptual Model.....           | 13 |
| 2.6 Summary.....                    | 15 |

## **CHAPTER 3:TAX MANAGEMENT SYSTEM**

|     |                         |    |
|-----|-------------------------|----|
| 3.1 | Introduction.....       | 16 |
| 3.2 | Tax Resident Rules..... | 16 |
| 3.3 | Summary.....            | 21 |

## **CHAPTER 4:RESEARCH METHODOLOGY**

|       |   |    |
|-------|---|----|
| 4.1   | Introduction .....                                | 22 |
| 4.2   | Initial Spesification.....                        | 23 |
| 4.3   | Knowledge Acquisition.....                        | 24 |
| 4.3.1 | Knowledge Elicitation.....                        | 24 |
| 4.3.2 | Knowledge Analysis.....                           | 25 |
| 4.4   | Expand and Transform Knowledge Specification..... | 26 |
| 4.5   | A Rule-Based Conceptual Model Presentation.....   | 27 |
| 4.6   | Summary.....                                      | 29 |

## **CHAPTER 5:RESULTS AND FINDINGS**

|       |   |    |
|-------|---|----|
| 5.1   | Introduction.....                           | 30 |
| 5.2   | Inference Network.....                      | 30 |
| 5.3   | Decision Tree.....                          | 37 |
| 5.4   | Rule-based Conceptual Model.....            | 44 |
| 5.5   | Rule-based Verification and Validation..... | 49 |
| 5.5.1 | Rule-based Verification.....                | 50 |
| 5.5.2 | Rule-based Validation.....                  | 51 |
| 5.6   | Summary.....                                | 53 |

## **CHAPTER 6:CONCLUSION**

|     |   |    |
|-----|---|----|
| 6.1 | Introduction .....                      | 54 |
| 6.2 | Problems and Limitations.....           | 54 |
| 6.3 | Recommendations for Future Project..... | 55 |

|                         |    |
|-------------------------|----|
| <b>REFERENCES .....</b> | 56 |
|-------------------------|----|

## **APPENDIX: TEST SCRIPT**

## LIST OF TABLES

|  |    |
|--|----|
| TABLE 5.1: Tax Resident: Master Rule.....  | 44 |
| TABLE 5.2: Rule: Section 7.1(a).....   | 44 |
| TABLE 5.3: Rule: Section 7.1(b) Old System.....  | 44 |
| TABLE 5.4: Rule: Section 7.1(b) Old System, To test the<br>182 days period.....                            | 45 |
| TABLE 5.5: Rule: Section 7.1(b) Leap Year.....   | 45 |
| TABLE 5.6: Rule: Section 7.1(b) Old System, To test a<br>compulsory date in Malaysia.....                  | 45 |
| TABLE 5.7: Rule: Section 7.1(b) New System.....  | 46 |
| TABLE 5.8: Rule: Exemption.....  | 46 |
| TABLE 5.9: Rule: Ill Health.....   | 47 |
| TABLE 5.10: Rule: Section 7.1(c), To test all the preceding<br>year either tax resident or $\geq 90$ ..... | 47 |
| TABLE 5.11: Rule: Section 7.1(c), To test current year and<br>all preceding year.....                      | 48 |
| TABLE 5.12: Rule: Section 7.1(d), To test the tax resident for all the<br>preceding year.....              | 49 |
| TABLE 5.13: The Results of Verification and Validation.....  | 52 |

## LIST OF FIGURES

|              |   |    |
|--------------|---|----|
| FIGURE 2.1:  | Comparison of Knowledge Acquisition Techniques.....                       | 11 |
| FIGURE 3.1:  | Section 7.1(a) Income Tax Act 1967.....                                   | 17 |
| FIGURE 3.2:  | Section 7.1(b) Income Tax Act 1967<br>(Old System: before year 2002)..... | 18 |
| FIGURE 3.3:  | Section 7.1(b) Income Tax Act 1967<br>(New System: year 2002 onward)..... | 18 |
| FIGURE 3.4:  | Section 7.1(b) Income Tax Act 1967<br>(Old System: before year 2002)..... | 19 |
| FIGURE 3.5:  | Section 7.1(b) Income Tax Act 1967<br>(New System: year 2002 onward)..... | 19 |
| FIGURE 3.6:  | Section 7.1(c) Income Tax Act 1967.....                                   | 20 |
| FIGURE 3.7:  | Section 7.1(d) Income Tax Act 1967.....                                   | 20 |
| FIGURE 4.1:  | Research Methodology (Adapted from Liebowitz).....                        | 23 |
| FIGURE 5.1a: | Inference Network for Malaysian Tax Resident Status.....                  | 31 |
| FIGURE 5.1b: | Inference Network for Malaysian Tax Resident Status<br>(Continue).....    | 32 |
| FIGURE 5.1c: | Inference Network for Malaysian Tax Resident Status<br>(Continue).....    | 33 |
| FIGURE 5.1d: | Inference Network for Malaysian Tax Resident Status<br>(Continue).....    | 34 |
| FIGURE 5.1e: | Inference Network for Malaysian Tax Resident Status<br>(Continue).....    | 35 |
| FIGURE 5.1f: | Inference Network for Malaysian Tax Resident Status<br>(Continue).....    | 36 |
| FIGURE 5.2a: | Decision Tree for Malaysian Tax Resident Status.....                      | 38 |
| FIGURE 5.2b: | Decision Tree for Malaysian Tax Resident Status<br>(Continue).....        | 39 |
| FIGURE 5.2c: | Decision Tree for Malaysian Tax Resident Status<br>(Continue).....        | 40 |

|              |  |    |
|--------------|--|----|
| FIGURE 5.2d: | Decision Tree for Malaysian Tax Resident Status<br>(Continue)..... | 41 |
| FIGURE 5.2e: | Decision Tree for Malaysian Tax Resident Status<br>(Continue)..... | 42 |
| FIGURE 5.2f: | Decision Tree for Malaysian Tax Resident Status<br>(Continue)..... | 43 |

## **LIST OF ABBREVIATION**

|      |  |
|------|--|
| IRB  | Inland Revenue Board                         |
| IEEE | Institute of Electrical Electronics Engineer |
| AI   | Artificial Intelligence                      |

# **CHAPTER 1**

## **BACKGROUND OF STUDY**

### **1.1 INTRODUCTION**

Expert systems represent a class of modern tools that are being increasingly applied to solve specific real world problems requiring human expertise. The knowledge in these systems consists not only of facts but also of heuristic links, connecting facts to form chains of reasoning or plans of action. Expert systems can be viewed as objects that model specific real world objects and their interactions to conclude about their states.

Rule based expert systems have been developed to solve many problems. Determining the rules is still very difficult. A great deal of work has been done on automating the process of knowledge acquisition, i.e., rule determination, but, to date, no really good method has been found.

Expert system development should involve people such as an expert and knowledge engineer. An expert is a person who knows how to define problems and solve them. In his field, the expert also knows what facts or data to collect and investigate, he knows what rules to use, and he knows how to make inferences. To build the rule-

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## REFERENCES

Adelman, L., Gualtieri, J., & Riedel, S. L. (1994). A Multifaceted Approach to Evaluating Expert System. *Artificial Intelligent for Engineering and Manufacturing*, 289-306.

Biagioli, C., Mariani, P., & Tiscornia, D. (1987). ESPLEX: A Rule and Conceptual Based Model for Representing Statuses. *Association for Computing Machinery*, 240-251.

Borenstein, D. (1998). Towards Practical Method to Validate Decision Support System. *Decision Support System*, 227-239.

Bracchi, G., & Pernici, B. (1984). The Design Requirements of Office Systems. *Association for Computing Machinery*, 151-170.

CCH Tax and Accounting. (2004). CompleteTax Pro: Benefit from the exploding 'do-it-yourself' online tax preparation market and tap into new revenue streams. [Brochure].

Ericsson, A., & Simon, H. A. (1993). *Protocol Analysis* (2 ed.). Cambridge, MA: MIT Press.

Fisher, R. (1997). Determination of Residence Status for Taxation Law: Development of a Rule-based Expert System. *Association for Computing Machinery*, 161-169.

Goldman, S. R., Dyer, M. G., & Flowers, M. (1987). Precedent-based Legal Reasoning and Knowledge Acquisition in Contract Law: A Process Model. *Association for Computing Machinery*, 210-221.

Hussain, T., Shamail, S., & Awais, M. M. (2004). Improving Quality in Conceptual Modeling. *Association for Computing Machinery*, 170-171.

Inland Revenue Board Malaysia LHDN, (2004). Retrieved Jun 4, 2005, from [http://www.hasilnet.org.my/english/eng\\_index.asp](http://www.hasilnet.org.my/english/eng_index.asp)

Jacob, R. J., & Froscher, J. N. (1990). A software Engineering Methodology for Rule-based System. *IEEE Trans on Knowledge and Data Engineering*, 173-189.

Kelley, D. H. & Colorado, D. (2002). Using the internet and software for tax researchand planning. Retrieved April 25, 2005, from <http://www.actec.org/Documents/misc/GreatPlains2002.pdf>

Kim, J., Learch, F. J., & Simon, H. A. (1995). Representation Construction and Rule Development in Object-Oriented Design. *Association for Computing Machinery*, 357-390.

Liebowitz, J. (1990). *Expert Systems for Business and Management* (1st ed.). Englewood Cliffs, New Jersey: Prentice Hall Inc.

McDuffie, R. S. (1992). Tax Expert Systems and Benefits from Using Them. *The National Public Accountant*, 16 & 54.

Michaelson, R. H., & Nichols, N. B. (1999). An Examination of the Psychological Traits That Affect the Ability of Tax Experts to Communicate Their Expertise. *International Journal of Intelligent Systems in Accounting, Finance and Management*, 145-158.

Milton, N. (2003, 20 Nov). *Knowledge Acquisition*. Retrieved 14 April, 2005, from <http://www.epistemics.uk.co/Notes/63-0-0.html>

Mommers, L. (2003). Application of a knowledge-based ontology of the legal domain in collaborative workspaces. *Association for Computing Machinery*, 70-76.

Nguyen, T., Perkins, W., Laffrey, T., & Pecora, D. (1987). Knowledge based verification. *AI Magazine*, 2, 69-75.

Radiya, A., & Sargent, R. G. (1994). A Logic-Based Foundation of Discrete Event Modelling and Simulation. *Association for Computing Machinery*, 3-51.

Shanks, G., Tansley, E., & Weber, R. (2003). Using Ontology To Validate Conceptual Model. *Association for Computing Machinery*, 46(10), 85-89.

Sherman, D. M. (1989). Expert Systems and ICAI in Tax Law: Killing Two Birds with One AI Stone. *Association for Computing Machinery*, 74-80.

Su, S. Y. W., Lam, H., Figueroa, J. A., Yu, T. F., & Yang, Z. (1995). An Extensible Knowledge Base Management System for Supporting Rule-based Interoperability among Heterogeneous System. *Association for Computing Machinery*, 1-9.

Vandelin, M. (1990). A Tax Application of an Expert System. *The Tax Adviser*, 448-453.

Yasdi, R. (1985). Formal Representation of a Conceptual Knowledge Model for A Database Based Expert System. *Association for Computing Machinery*, 11-23.