## Abstract

One of the critical requirement towards the success of any business organization is efficient management of its human capital. In a typically resource constrained organizational environment, maximizing the utilization of the available workforce is imperative. However, tasks cannot simply be assigned to arbitrary employees since the employee needs to have the necessary capabilities for executing a task. Furthermore, security constraints forbid any arbitrary assignment of tasks to employees and also enforce major dependencies on other employees who have access to the same tasks. Given the increasing size and scale of organizations, both in terms of employees and resources that need to be managed, it is crucial that computational solutions are developed to automate the process of employee to task assignment.

Since role-based access control (RBAC) is still the most commonly used access control model for commercial information systems, we consider organizational policies and constraints to be modeled with RBAC for the first problem in this thesis. This work aims to identify an employee to role assignment such that it permits the maximal flexibility in assigning tasks to employees while ensuring that the required security constraints are met. We prove that finding an optimal solution is NP-complete and therefore provide a greedy solution to the problem.

Because of certain limitations related to extendability in RBAC, Attribute Based Access Control (ABAC) model was proposed and has been poised to emerge as the *de facto* model for specifying access control policies in commercial information systems. To keep in pace with state of the art inventions in the field of access control, we considered security constraints in the context of ABAC for the subsequent objectives of the dissertation. The second problem considered answers the question of whether a given set of employees can be replaced by a smaller set of employees while ensuring that the desired security constraints are not violated. We prove that the problem is NP-hard and use CNF-SAT to obtain a solution. Furthermore, the problem to select the minimum number of employees from the set of aspiring candidates to fill the vacant positions created by the retired or downsized employees, while satisfying the security constraints was considered. This problem was also proved to be NP-hard and a greedy heuristic is proposed to obtain a solution.

Experimental evaluation of the proposed approaches for all the three problems shows that they are both efficient and effective considering real-world requirements. Thus, providing a solution for three important aspects of workforce optimization in business organizations supporting constrained access control models.

**Keywords:** Workforce Optimization, Role Based Access Control (RBAC), Attribute Based Access Control (ABAC), Separation of Duty (SoD), Binding of Duty (BoD), Statically Mutually Exclusive Roles (SMER), Mutually Exclusive Rules (MER)