This thesis focuses on topic of Differential Item Functioning (DIF), a phenomenon that can arise in various contexts of educational, psychological, or health-related multi-item measurements. We discuss several statistical methods and models to detect DIF among dichotomous, ordinal, and nominal items.

In the first part, generalized logistic regression models for DIF detection among dichotomous items are introduced, which account for possibility of guessing and/or inattention. Techniques for estimation of item parameters are presented, including a newly proposed algorithm based on a parametric link function. Two simulation studies are presented. The first compares the generalized logistic regression models to other widely used DIF detection methods. The second illustrates differences between the techniques to estimate item parameters. Implementation of the models into the **R** software and its **difNLR** package is illustrated.

In the second part, generalized logistic regression models for DIF detection among polytomous items are discussed. Cumulative logit, adjacent category logit, and nominal models are introduced together with the maximum likelihood method to estimate item parameters and with examples of implementation in the **difNLR** package.

The third part deals with a nonparametric comparison of regression curves for DIF detection based on kernel smoothing. We discuss several settings and we newly propose an estimate of an optimal weight function for a test statistic to identify DIF. Nonparametric approaches are compared to the logistic regression method in a simulation study.

In the fourth and last part, further topics of DIF detection are discussed, including item purification, multiple comparison corrections, and DIF effect sizes. Different approaches are compared in a complex simulation study on three of the most used DIF detection methods.