College admissions with ties and common quotas: Integer programming approach *

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Admission to universities is organised in a centralised scheme in Hungary. In this paper we investigate two major specialities of this application: ties and common quotas. A tie occur when some students have the same score at a programme. If not enough seats are available for the last tied group of applicants at a programme then there are three reasonable policies used in practice: 1) all must be rejected, as in Hungary 2) all can be accepted, as in Chile 3) a lottery decides which students are accepted from this group, as in Ireland. Even though student-optimal stable matchings can be computed efficiently for each of the above three cases, we developed (mixed) integer programming (IP) formulations for solving these problems, and we compared the solutions obtained by the three policies for a real instance of the Hungarian application from 2008. Common quotas are arising in Hungary from the faculty quotas on their programmes and from the national quotas over state-financed students in each subject. The overlapping structure of common quotas makes the computational problem of finding a stable solution NP-hard, even for strict rankings. In the case of ties and common quotas we propose two reasonable stable solution concepts corresponding to the Hungarian and Chilean policies. We developed (mixed) IP formulations for solving these stable matching problems and tested their performances on the large scale real instance from 2008. We demonstrate that the most general case is also solvable in practice with the IP technique.

*Based on a joint work with Kolos Csaba Ágoston, Endre Kováts, Zsuzsanna Jankó.