

VALID INEQUALITIES AND CUTTING PLANES FOR SOME POLYTOPES

STEFAN M. STEFANOV

Abstract. In this paper we consider multidimensional knapsack polytope. Some important concepts and preliminaries are given at the beginning. Then we give a result connected with valid and dominating inequalities for this polytope, and a modular arithmetic approach for valid inequalities and cutting planes generation for the (one-dimensional) knapsack polytope.

Mathematics subject classification (1991): 90C27, 90C35.

Key words and phrases: Combinatorial optimization, integer programming, knapsack problem, valid inequalities, cutting planes.

REFERENCES

- [1] E. BALAS, *Facets of the knapsack polytope*, *Mathematical Programming*, **8** (1975) 146–164.
- [2] A. BRØNDSTED, *An Introduction to Convex Polytopes*, Springer-Verlag New York Inc., 1983.
- [3] V. A. YEMELICHEV, V. I. KOMLIK, *Method for Construction a Sequence of Plans for Solving Discrete Optimization Problems*, Moscow, Nauka, 1981. (in Russian)
- [4] V. A. YEMELICHEV, M. M. KOVALEV, M. K. KRAVTSOV, *Polytopes, Graphs and Optimization*, Cambridge University Press, Cambridge, 1984.
- [5] F. FORGO, *Nonconvex Programming*, Akademiai Kiado, Budapest, 1988.
- [6] E. G. GOLSHTEIN, D. B. YUDIN, *New Aspects of the Linear Programming*, Moscow, Soviet Radio, 1966. (in Russian)
- [7] R. E. GOMMORY, *Outline of an Algorithm for Integer Solutions to Linear Programs*, *Bulletin of the American Mathematical Society*, **64** (1958) 275–278.
- [8] ———, *Solving Linear Programming Problems in Integers*, in: *Combinatorial Analysis* (R. Bellman and M. Hall, Jr., eds.), *Proceedings of Symposia in Applied Mathematics X*, American Mathematical Society, Providence, R.I., 1960, 211–215.
- [9] ———, *An Algorithm for Integer Solutions to Linear Programs*, in: *Recent Advances in Mathematical Programming* (R. L. Graves and P. Wolfe, eds.), McGraw-Hill, New York, 1963, 269–302.
- [10] P. L. HAMMER, E. L. JOHNSON AND U. N. PELED, *Facets of regular 0-1 polytopes*, *Mathematical Programming*, **8** (1975) 179–206.
- [11] G. L. NEMHAUSER AND L. E. TROTTER, JR., *Properties of vertex packing and independence system polyhedra*, *Mathematical Programming*, **6** (1974) 48–61.
- [12] G. L. NEMHAUSER, L. A. WOLSEY, *Integer and Combinatorial Optimization*, John Wiley & Sons, 1988.
- [13] M. W. PADBERG, *On the facial structure of set packing polyhedra*, *Mathematical Programming*, **5** (1973) 199–215.
- [14] ———, *A note on zero-one programming*, *Operations Research*, **23** (1975) 833–837.
- [15] ———, *(1, k)-configurations and facets for packing problems*, *Mathematical Programming*, **18** (1980) 94–99.
- [16] R. L. RARDIN, M. SUDIT, *Paroids: a canonical format for combinatorial optimization*, *Discrete Applied Mathematics*, **39** (1992) 37–56, North-Holland.

- [17] H. A. TAHA, *Operations Research. An Introduction*, Macmillan Publishing Co., Inc., New York; Collier Macmillan Publishers, London, 1982.
- [18] R. WEISMANTEL, *On the 0/1 knapsack polytope*, *Mathematical Programming*, **77** (1997) 49–68.
- [19] L. A. WOLSEY, *Faces for a linear inequality in 0 – 1 variables*, *Mathematical Programming*, **8** (1975) 165–178.