Homework 15 in Optimization in Engineering
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Exercise 1. (Simplex method and graphical solution) A smartphone manufacturer produces two models M_1 and M_2. The profit for the models is 30 Euro for M_1 and 50 Euro for M_2. The assembling lasts 1 TU (time unit) for M_1 and 2 TUs for M_2. Overall, 170 TUs are available. The packaging of each smartphone takes 1 TU and may last at maximum 150 TUs in total. Each smartphone of type M_2 will be signed by hand on the faceplate which takes 3 TUs. Altogether, there are 180 TUs available. The manufacturer wants to know the number of smartphones of type M_1 and M_2 to maximize its profit.

(a) Formulate the problem as optimization problem.

(b) Solve the optimization problem graphically.

(c) Give all vertices of the feasible set.

(d) Apply the simplex method and start with vertex $V_1 = (0, 0)$.

Exercise 2. (Branch-and-bound algorithm for a 0-1 linear program)

(a) A network operator can offer $n \in \mathbb{N}$ different services to its customers with revenues $c_1, \ldots, c_n \in \mathbb{R}$ corresponding to each service. Each service requires a certain bandwidth $v_1, \ldots, v_n \in \mathbb{R}$ within the frequency band available to the network operator, whose width is given as $B \in \mathbb{R}$. A service can at most be offered to one customer. Formulate the optimization problem which maximizes the revenue as an integer linear programming problem.

(b) Solve the knapsack problem by using branch-and-bound algorithm for $n = 3$, and $c_i = v_i$ for $1 \le i \le 3$, where $c_1 = c_2 = 2$, $c_3 = 3$ and $B = 6$.