Technical University of Denmark

46750 - Optimization in Modern Energy Systems
Exercise 2

Name:

Student Number:

1. Economic dispatch

We consider a power system with 3 generators (G_1, G_2, G_3) and 1 inflexible load (D_1). The production costs (in DKK/MWh), generation capacity and demand (in MWh) are summarized in Figure 1. The system operator wants to dispatch the generators in order to cover this load at the lowest possible cost.

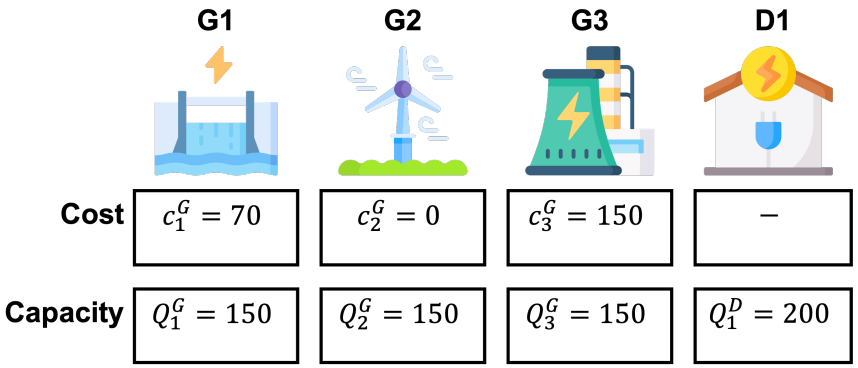

Figure 1: Economic dispatch parameters

(a) Formulate this economic dispatch problem as an optimization problem. Specify the number of variables and constraints of this optimization problem. What do the dual variables associated with each constraint of the economic dispatch represent?

(b) Solve this optimization problem using Python. Provide the values of the optimal primal variables, objective value, and dual variables associated with each constraint. What do you observe w.r.t. to the values (zero or non-zero) taken by the dual variables at optimality and the constraints they are associated with?

(c) Formulate the dual of the economic dispatch problem. What do the dual variables associated with each constraint of the dual problem represent?

(d) Solve this optimization problem using Python. Provide the optimal values of its primal variables and objective value, as well as the values of the dual variables associated with each constraint.

(e) Formulate the strong-duality theorem for the economic dispatch, and provide its primal-dual formulation.