Kathleen Williams
ECE 556
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Week 2 Assignment

Completion of LP Formulation

Variables:

There are 8 variables in my generator model problem: x1, x2, x3, x4, x5, x6, x7, x8. They are defined as given below:

Variable	Definition
x1	G1 Bidding Quantity 20 MW Step
x2	G1 Bidding Quantity 30 MW Step
x3	G1 Bidding Quantity 15 MW Step
x4	G1 = x1 + x2 + x3 or total MW to be bid by G1
x5	G2 Bidding Quantity 18 MW Step
x6	G2 Bidding Quantity 26 MW Step
x7	G2 Bidding Quantity 32 MW Step
x8	G2 = x5 + x6 + x7 or total MW to be bid by G2

Objective Function:

The objective of the problem is to minimize cost of combined bids of both generators.

$$\min \sum (20 \times x1) + (25 \times x2) + (30 \times x3) + (18 \times x5) + (26 \times x6) + (32 \times x7)$$

The objective function is the sum of the unit price of the MW multiplied by the quantity to be bid added to the other bid ranges and their respective products.

Note: In the MATLAB portion of the model, the x4 and x8 variables are set equal to 0 since it is not in the problem definition to minimize these.

Constraints

The constraints of the problem are shown below:

$$x1 + x2 + x3 = x4 \text{.....(1)}$$
$$x5 + x6 + x7 = x8 \text{.....(2)}$$
$$x4 + x8 = 100 \text{.....(3)}$$

Constraint (1) is formulated on the definition that the Generator G1 bids from the given three quantities 20MW, 30MW, or 15 MW. Constraint (2) is formulated on the definition that Generator G2 bids from the given three quantities 15MW, 40MW, or 25MW.

Bounds

The bounds of the model are defined in the problem statement and are shown below:

Variable	Lower Bound	Upper Bound
x1	0	20
x2	0	30
x3	0	15
x4	15	65
x5	0	15
x6	0	40
x7	0	25
x8	10	80

Optimal Solution

Accepted Quantity

The accepted quantity from each generator range is shown below and in the MATLAB results (attached):

G1 Bidding Information

Quantity (MW)	Price ($/MWH)
20	20
30	25
0	30

G2 Bidding Information

Quantity (MW)	Price ($/MWH)
15	18
35	26
0	32

Cost to Supply Load

The minimized cost under the optimal model to supply 100 MW load is **$2,330.00.** The cost to supply load by generator G1 will be $1150 from G2, $1180.

MATLAB CODE

```
% Week 2 Assignment
% Kathleen Williams
% Set Input data

% Objective Function
f = [20 25 30 0 18 26 32 0];

% Quantity
Aeq = [1 1 1 -1 0 0 0 0;
      0 0 0 0 1 1 1 -1;
      0 0 0 1 0 0 0 1];
beq = [0 0 100]';

lb = [0 0 0 15 0 0 0 10];
ub = [20 30 15 65 15 40 25 80];

A = [];
b = [];

% Call LP solver
[x,fval,exitflag,output,lambda]=linprog(f,A,b,Aeq,beq,lb,ub);

% Output results
%1. Optimal solution
x
%2. Objective function value
fval
%3. Shadow price for inequality constraints
lambda.ineqlin
%4. Reduced cost for lower bounds and upper bounds
lambda.lower
lambda.upper
```

MATLAB RESULTS

```
EDU>> prob1
Optimization terminated successfully.

x =

   20.0000
   30.0000
    0.0000
   50.0000
   15.0000
   35.0000
    0.0000
   50.0000


fval =

  2.3300e+003


ans =

   Empty matrix: 0-by-1


ans =

    0.0000
    0.0000
    4.0000
    0.0000
    0.0000
    0.0000
    6.0000
    0.0000


ans =

    6.0000
    1.0000
    0.0000
    0.0000
    8.0000
    0.0000
    0.0000
    0.0000
```