

224

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION

SUMMER SEMESTER, 2018-2019

DURATION: 1 Hour 30 Minutes

FULL MARKS: 75

CSE 6263: Advanced Optimization Techniques

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **3 (three)** questions. Answer any **all** of them.

Figures in the right margin indicate marks.

1. a) Distributed power generation is a key concept in the next generation of power systems. Small scale generators and renewable energy sources can be collected together to supply heterogeneous power demands. Because of its distributed structure, the system is more reliable in terms of maintenance and services, as well as is more flexible in using renewable energy sources. 10

Integrating distributed power units into a framework, using information, communication and smart technologies, is known as a smart power grid. This grid, characterized by power flexibility and reliability, enables the incorporation of various components such as renewable power resources and distributed micro-generators.

A unit of the grid, known as a microgrid (MG), is a group of small generators and loads connected to the grid in multiple points. As a considerable capability, each MG can operate in islanded and grid-connected operation modes. In the grid-connected operation mode, as in Figure 1 given below, each MG interacts with other MGs to establish a set of regulating power flows in the grid. As a result of this regulation, a grid-wide balance between supply and demand is provided, which results in a low operational cost.

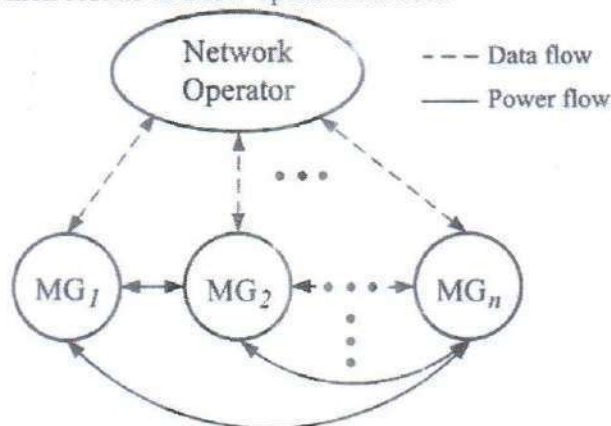


Figure 1.

Consider a distributed power grid consisting of a set N of MGs interconnected through a power and data transmission infrastructure. Power demand within each MG_i , $i = 1, 2, \dots, N$, is assumed to be γ_i . Moreover, it is assumed that total power generated in MG_i must not exceed σ_i . The objective of the network operator is to establish a set $X = \{x_{ij}\}$ of power flows among MGs in order to minimize a cost function of the system-wide power generation. x_{ij} is the amount of power transmitted from MG_i to MG_j .

Under the assumption of a quadratic cost function for power generation at each MG, i.e., the square of the sum of the total power generated at an MG, formulate the optimization problem.

- b) The Whitt Window Company is a company with only three employees which makes two different kinds of hand-crafted windows: a wood-framed and an aluminum-framed window. They earn \$60 profit for each wood-framed window and \$30 profit for each aluminum-framed window. Doug makes the wood frames, and can make 6 per day. Linda makes the aluminum

frames, and can make 4 per day. Bob forms and cuts the glass, and can make 48 square feet of glass per day. Each wood-framed window uses 6 square feet of glass and each aluminum-framed window uses 8 square feet of glass.

The company wishes to determine how many windows of each type to produce per day to maximize total profit.

- i. Formulate an optimization problem for this problem. 7
- ii. Use the graphical model to solve this model. 8

2. a) Consider the constrained optimization problem: 12

Minimize $f(x_1, x_2, x_3) = x_1^2 + 3x_3^2 + 2x_1x_3 + 4x_1 + 6x_2 + 5x_3$
subject to

$$x_1 + 2x_3 = 3$$

$$4x_1 + 5x_2 = 6$$

Use the method of direct substitution to solve this problem.

- b) Use the method of constrained variations to solve the constrained optimization problem: 13

Minimize $f(x_1, x_2) = 2x_1 + x_2^2$

Subject to $x_1^2 + x_2^2 = 4$

3. Consider the following LP problem:

Minimize $Z = 3x_1 + 2x_2,$

Subject to

$$2x_1 + x_2 \geq 10$$

$$-3x_1 + 2x_2 \leq 6$$

$$x_1 + x_2 \geq 6$$

$$x_1 \geq 0, \quad x_2 \geq 0.$$

- a) Using the Big M method, construct the complete first simplex tableau for the simplex method and identify the corresponding initial (artificial) BF solution. 4
- b) Work through the simplex method step by step to solve the problem. 8
- c) Using the two-phase method, construct the complete first simplex tableau for phase 1 and work through phase 1 step by step. Construct the complete first simplex tableau for phase 2 and Work through phase 2 step by step to solve the problem. 13