Exam

Veronika Dulkeviča

May 2019

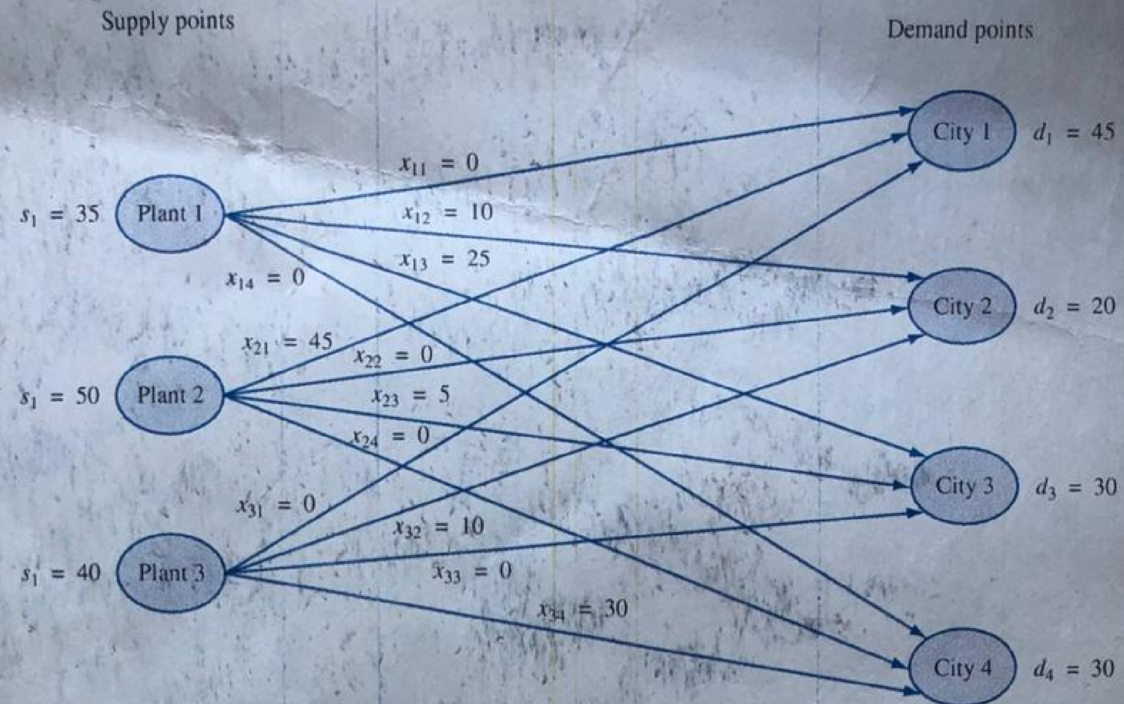

FIGURE 1
Graphical Representation of Powerco Problem and Its Optimal Solution

$$
\begin{aligned}
x_{11} + x_{21} + x_{31} &\geq 45 \quad \text{(Demand constraints)}\\
x_{12} + x_{22} + x_{32} &\geq 20\\
x_{13} + x_{23} + x_{33} &\geq 30\\
x_{14} + x_{24} + x_{34} &\geq 30\\
x_{ij} \geq 0 \quad (i = 1, 2, 3;\ j &= 1, 2, 3, 4)
\end{aligned}
$$

In Section 7.3, we will find that the optimal solution to this LP is $z = 1020$, $x_{12} = 10$, $x_{13} = 25$, $x_{21} = 45$, $x_{23} = 5$, $x_{32} = 10$, $x_{34} = 30$. Figure 1 is a graphical representation of the Powerco problem and its optimal solution. The variable x_{ij} is represented by a line, or arc, joining the ith supply point (plant i) and the jth demand point (city j).

General Description of a Transportation Problem

In general, a transportation problem is specified by the following information:

1 A set of m *supply points* from which a good is shipped. Supply point i can supply at most s_i units. In the Powerco example, $m = 3$, $s_1 = 35$, $s_2 = 50$, and $s_3 = 40$.

2 A set of n *demand points* to which the good is shipped. Demand point j must receive at least d_j units of the shipped good. In the Powerco example, $n = 4$, $d_1 = 45$, $d_2 = 20$, $d_3 = 30$, and $d_4 = 30$.

3 Each unit produced at supply point i and shipped to demand point j incurs a *variable cost* of c_{ij}. In the Powerco example, $c_{12} = 6$.

Let

$$x_{ij} = \text{number of units shipped from supply point } i \text{ to demand point } j$$

then the general formulation of a transportation problem is

$$\min \sum_{i=1}^{i=m} \sum_{j=1}^{j=n} c_{ij}x_{ij}$$

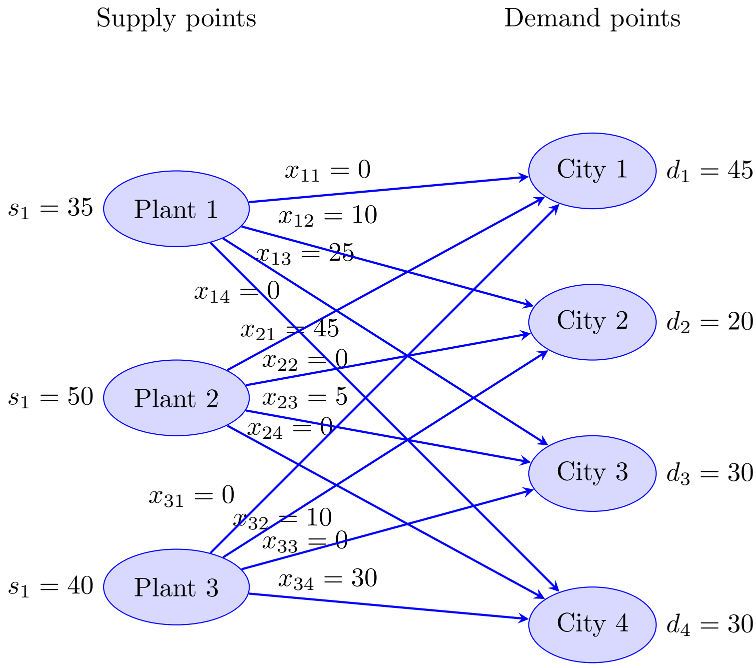

FIGURE 1
Graphical Representation of Powerco Problem and Its Optimal Solution

$$
\begin{array}{lll}
x_{11} + x_{21} + x_{31} & \geq 45 & \text{(Demand constraints)} \\
x_{12} + x_{22} + x_{32} & \geq 20 & \\
x_{13} + x_{23} + x_{33} & \geq 30 & \\
x_{14} + x_{24} + x_{34} & \geq 30 & \\
 & x_{ij} \geq 0 & (i = 1, 2, 3; j = 1, 2, 3, 4)
\end{array}
$$

In Section 7.3, we will find that the optimal solution to this LP is $z = 1020$, $x_{12} = 10$, $x_{13} = 25$, $x_{21} = 45$, $x_{23} = 5$, $x_{32} = 10$, $x_{34} = 30$. Figure 1 is a graphical representation of the Powerco problem and its optional solution. The variable x_{ij} is represented by a line, or arc, joining the ith supply point (plant i) and the jth demand point (city j).

General Description of a Transportation Problem

In general, a transportation problem is specified by the following information:

1 A set of $msupplypoints$ from which a good is shipped. Supply point i can supply at most s_i units. In the Powerco example, $m = 3$, $s_1 = 35$, $s_2 = 50$, and $s_3 = 40$.

2 A set of $ndemandpoints$ to which the good is shipped. Demand point j must receive at least d_j units of the shipped good. In the Powerco example, $n = 4$, $d_1 = 45$, $d_2 = 20$, $d_3 = 30$, and $d_4 = 30$.

3 Each unit produced at supply point i and shipped to demand point j incurs a $variablecost$ of c_{ij}. In the Powerco example, $c_{12} = 6$.

Let

$$x_{ij} = number\ of\ shipped\ from\ supply\ point\ i\ to\ demand\ point\ j$$

then the general formulation of a transportation problem is

$$min \sum_{i=1}^{i=m} \sum_{j=1}^{j=n} C_{ij} X_{ij}$$

```
    \documentclass[10pt]{extarticle}
\usepackage[utf8]{inputenc}
\usepackage{amsmath,amssymb}
\usepackage{fancyhdr}
\usepackage{graphicx}
\usepackage{changepage}
\usepackage{xcolor}
\usepackage{titlesec}
\usepackage{incgraph,tikz}
\usepackage[dvipsnames]{color}
\usetikzlibrary{shapes.geometric}
\usetikzlibrary{arrows,automata}
\usetikzlibrary{positioning}
\usepackage[margin=2.9cm,paperwidth=210mm,paperheight=308mm]{geometry}

\tikzstyle{arrow} = [thick,->,>=stealth, draw=blue]
\tikzstyle{1} = [ellipse, minimum width=1.2cm, minimum height=1cm, text centered, draw=blue, fill=
\tikzstyle{t} = [rectangle, minimum width=4cm, minimum height=1cm, text centered, text width=4cm,
\tikzstyle{5} = [draw=none, fill=none]

\title{Exam}
\author{Veronika Dulkeviča}
\date{May 2019}

\begin{document}

\maketitle
\pagebreak

\thispagestyle{plain}

\incgraph[documentpaper][width=\paperwidth,height=\paperheight]{1.jpeg}

\pagebreak

\thispagestyle{fancy}
\renewcommand{\headrulewidth}{0pt}
\lfoot{\textbf{\textcolor{blue}{362}}}
\cfoot{\textbf{CHAPTER 7 Transportation, Assignment, and Transshipment Problem}}

\begin{tikzpicture}[node distance=2cm]
\node (p1) [1, label=left:{$s_1 = 35$}, xshift=0cm, yshift=2.5cm] {Plant 1};
\node (p2) [1, label=left:{$s_1 = 50$}, xshift=0cm] {Plant 2};
\node (p3) [1, label=left:{$s_1 = 40$}, xshift=0cm, yshift=-2.5cm] {Plant 3};

\node (c1) [1, label=right:{$d_1 = 45$}, xshift=5.5cm, yshift=3cm] {City 1};
\node (c2) [1, label=right:{$d_2 = 20$}, xshift=5.5cm, yshift=1cm] {City 2};
\node (c3) [1, label=right:{$d_3 = 30$}, xshift=5.5cm, yshift=-1cm] {City 3};
\node (c4) [1, label=right:{$d_4 = 30$}, xshift=5.5cm, yshift=-3cm] {City 4};

\node (t) [t, left of=p2, xshift=-2.5cm] {\raggedleft{\textcolor{blue}{FIGURE 1} \\ Graphical \\ R
\node (t1) [t, above of=p1, yshift=0.5cm] {Supply points};
\node (t2) [t, above of=c1] {Demand points};

\node (x11) [5, xshift=2cm, yshift=3cm] {$x_{11}=0$};
\node (x12) [5, xshift=2cm, yshift=2.4cm] {$x_{12}=10$};
\node (x13) [5, xshift=1.7cm, yshift=1.9cm] {$x_{13}=25$};
\node (x14) [5, xshift=0.8cm, yshift=1.4cm] {$x_{14}=0$};
```

```
\node (x21) [5, xshift=1.5cm, yshift=0.9cm] {$x_{21}=45$};
\node (x22) [5, xshift=1.7cm, yshift=0.5cm] {$x_{22}=0$};
\node (x23) [5, xshift=1.7cm, yshift=0cm] {$x_{23}=5$};
\node (x24) [5, xshift=1.5cm, yshift=-0.4cm] {$x_{24}=0$};

\node (x31) [5, xshift=0.2cm, yshift=-1.3cm] {$x_{31}=0$};
\node (x32) [5, xshift=1.4cm, yshift=-1.6cm] {$x_{32}=10$};
\node (x33) [5, xshift=1.7cm, yshift=-1.9cm] {$x_{33}=0$};
\node (x34) [5, xshift=2cm, yshift=-2.4cm] {$x_{34}=30$};

\draw [arrow] (p1) -- (c1);
\draw [arrow] (p1) -- (c2);
\draw [arrow] (p1) -- (c3);
\draw [arrow] (p1) -- (c4);

\draw [arrow] (p2) -- (c1);
\draw [arrow] (p2) -- (c2);
\draw [arrow] (p2) -- (c3);
\draw [arrow] (p2) -- (c4);

\draw [arrow] (p3) -- (c1);
\draw [arrow] (p3) -- (c2);
\draw [arrow] (p3) -- (c3);
\draw [arrow] (p3) -- (c4);

\end{tikzpicture}

\begin{center}
    \hspace{1.05cm} $x_{11} + x_{21} + x_{31}$ \hspace{1cm} $\geq$ 45 \hspace{0.5cm} (Demand const
    \\
    \hspace{-2.94cm}$x_{12} + x_{22} + x_{32}$ \hspace{1cm} $\geq$ 20
    \\
    \hspace{-2.94cm}$x_{13} + x_{23} + x_{33}$ \hspace{1cm} $\geq$ 30
    \\
    \hspace{-3.04cm}$x_{14} + x_{24} + x_{34}$ \hspace{1cm} $\geq$30
    \\
    \hspace{4.04cm}$x_{ij}$$\geq$ 0 \hspace{0.15cm} $(i = 1, 2, 3; j = 1, 2, 3, 4)$
\end{center}

In Section 7.3, we will find that the optimal solution to this LP is $z = 1020$, $x_{12} = 10$, $x
\\
\\
\color{blue}\rule[0cm]{15.2cm}{0.2cm}
\section*{General Description of a Transportation Problem}
\color{black}
In general, a transportation problem is specified by the following information:
  \\
  \\
\textbf{\textcolor{blue}{1}} A set of $m supply points$ from which a good is shipped. Supply point
  \\
  \\
\textbf{\textcolor{blue}{2}} A set of $n demand points$ to which the good is shipped. Demand point
  \\
  \\
\textbf{\textcolor{blue}{3}} Each unit produced at supply point $i$ and shipped to demand point $j
  \\
  \\
Let
$$x_{ij} = number \hspace{3pt} of \hspace{3pt} shipped \hspace{3pt} from \hspace{3pt} supply \hspa
```

```
  \\
\hspace{-0.45cm}then the general formulation of a transportation problem is
$$min \sum_{i=1}^{i=m} \sum_{j=1}^{j=n}C_{ij}X_{ij}$$
\pagebreak
```