

OPERATIONS RESEARCH

Chapter 8 - The Transportation Algorithm

Problem 8.9 / 1.21 Problem Statement

Example (8.9 - 1.21): A semiconductor corporation produces a particular solid-state module that it supplies to four different television manufacturers. The module can be produced at each of the corporation's three plants, although the costs vary because of differing production efficiencies at the plants. Specifically, it costs \$1.10 to produce a module at plant A, \$0.95 at plant B, and \$1.03 at plant C. Monthly production capacities of the plants are 7500, 10000, and 8100 modules, respectively. Sales forecasts project monthly demand at 4200, 8300, 6300, and 2700 modules for television manufacturers I, II, III, and IV, respectively. If the cost (in dollars) for shipping a module from a factory to a manufacturer is as shown below, find a production schedule that will meet all needs at minimum total cost.

	I	II	III	IV
A	0.11	0.13	0.09	0.19
B	0.12	0.16	0.10	0.14
C	0.14	0.13	0.12	0.15

INITIAL TABLEAU

	I	II	III	IV	Dummy	Supply	u_i
A	1.21	1.23	1.19	1.29	0	7500	
B	1.07	1.11	1.05	1.09	0	10,000	
C	1.17	1.16	1.15	1.18	0	8100	
Demand	4200	8300	6300	2700	4100		
v_j							

TABLEAU 1

	I	II	III	IV	Dummy	Supply	u_i
A	$\frac{1.21}{4200}$	$\frac{1.23}{3300}$	$\frac{1.19}{(0.02)}$	$\frac{1.29}{(0.09)}$	$\frac{0}{(-0.02)}$	7500	0.02
B	$\frac{1.07}{(-0.02)}$	$\frac{1.11}{5000} (*)$	$\frac{1.05}{5000} (*)$	$\frac{1.09}{(0.01)}$	$\frac{0}{(0.10)}$	10,000	-0.10
C	$\frac{1.17}{(-0.02)}$	$\frac{1.16}{(-0.05)} (*)$	$\frac{1.15}{1300} (*)$	$\frac{1.18}{2700}$	$\frac{0}{4100}$	8100	0
Demand	4200	8300	6300	2700	4100		
v_j	1.19	1.21	1.15	1.18	0		

(*) denotes corner of loop

TABLEAU 2

	I	II	III	IV	Dummy	Supply	u_i
A	$\frac{1.21}{4200}$	$\frac{1.23}{3300}$ (*)	$\frac{1.19}{(0.02)}$	$\frac{1.29}{(0.04)}$	$\frac{0}{(-0.07)}$ (*)	7500	0.07
B	$\frac{1.07}{(-0.02)}$	$\frac{1.11}{3700}$	$\frac{1.05}{6300}$	$\frac{1.09}{(-0.04)}$	$\frac{0}{(0.05)}$	10,000	-0.05
C	$\frac{1.17}{(0.03)}$	$\frac{1.16}{1300}$ (*)	$\frac{1.15}{1300}$	$\frac{1.18}{2700}$	$\frac{0}{4100}$ (*)	8100	0
Demand	4200	8300	6300	2700	4100		
v_j	1.14	1.16	1.10	1.18	0		

(*) denotes corner of loop

TABLEAU 3

	I		II		III	IV	Dummy		Supply	u_i
A	<u>1.21</u>	(*)	<u>1.23</u>		<u>1.19</u>	<u>1.29</u>	<u>0</u>	(*)	7500	0
	4200		(0.07)		(0.09)	(0.11)	3300			
B	<u>1.07</u>	(*)	<u>1.11</u>	(*)	<u>1.05</u>	<u>1.09</u>	<u>0</u>		10,000	-0.05
	(-0.09)		3700		6300	(-0.04)	(0.05)			
C	<u>1.17</u>		<u>1.16</u>	(*)	<u>1.15</u>	<u>1.18</u>	<u>0</u>	(*)	8100	0
	(-0.04)		4600		(0.05)	2700	800			
Demand	4200		8300		6300	2700	4100			
v_j	1.21		1.16		1.10	1.18	0			

(*) denotes corner of loop

TABLEAU 4

	I	II	III	IV	Dummy	Supply	u_i
A	$\frac{1.21}{3400}$	$\frac{1.23}{(-0.02)}$	$\frac{1.19}{(0)}$	$\frac{1.29}{(0.02)}$	$\frac{0}{4100}$	7500	0.14
B	$\frac{1.07}{800}$	$\frac{1.11}{2900} (*)$	$\frac{1.05}{6300}$	$\frac{1.09}{(-0.04)} (*)$	$\frac{0}{(0.14)}$	10,000	0
C	$\frac{1.17}{(0.05)}$	$\frac{1.16}{5400} (*)$	$\frac{1.15}{(0.05)}$	$\frac{1.18}{2700} (*)$	$\frac{0}{(0.09)}$	8100	0.05
Demand	4200	8300	6300	2700	4100		
v_j	1.07	1.11	1.05	1.13	-0.14		

(*) denotes corner of loop

TABLEAU 5

	I		II		III	IV	Dummy	Supply	u_i
A	$\frac{1.21}{3400}$	(*)	$\frac{1.23}{(-0.02)}$	(*)	$\frac{1.19}{(0)}$	$\frac{1.29}{(0.02)}$	$\frac{0}{4100}$	7500	0.14
B	$\frac{1.07}{800}$	(*)	$\frac{1.11}{200}$	(*)	$\frac{1.05}{6300}$	$\frac{1.09}{2700}$	$\frac{0}{(0.14)}$	10,000	0
C	$\frac{1.17}{(0.05)}$		$\frac{1.16}{8100}$		$\frac{1.15}{(0.05)}$	$\frac{1.18}{(0.04)}$	$\frac{0}{(0.09)}$	8100	0.05
Demand	4200		8300		6300	2700	4100		
v_j	1.07		1.11		1.05	1.09	-0.14		

(*) denotes corner of loop

TABLEAU 6

	I	II	III	IV	Dummy	Supply	u_i
A	$\frac{1.21}{3200}$	$\frac{1.23}{200}$	$\frac{1.19}{(0)}$	$\frac{1.29}{(0.06)}$	$\frac{0}{4100}$	7500	0
B	$\frac{1.07}{1000}$	$\frac{1.11}{(0.02)}$	$\frac{1.05}{6300}$	$\frac{1.09}{2700}$	$\frac{0}{(0.14)}$	10,000	-0.14
C	$\frac{1.17}{(0.05)}$	$\frac{1.16}{8100}$	$\frac{1.15}{(0.03)}$	$\frac{1.18}{(0.02)}$	$\frac{0}{(0.07)}$	8100	-0.07
Demand	4200	8300	6300	2700	4100		
v_j	1.21	1.23	1.19	1.23	0		