

Table 2. The demand for retailers and holding capacity

Retailer	Holding Capacity	Period							Retailer	Holding Capacity	Period						
		t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	t ₇			t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	t ₇
m ₁	15	15	15	15	15	15	15	5	m ₂₂	15	15	10					
m ₂	10	10	10	10	10	10			m ₂₃	20	20	20	20	20			
m ₃	22	22	21	20	20	20	20		m ₂₄	20	20	20	17	10			
m ₄	15	15	10	10	10				m ₂₅	10	10	10	7				
m ₅	13	13	13	10	10				m ₂₆	20	20	10					
m ₆	15	15	10	10	10	10			m ₂₇	36	36	30	30	30			
m ₇	15	15	15	15	15	15	10		m ₂₈	13	12	13					
m ₈	10	10	10	10	10	10			m ₂₉	10	10	10					
m ₉	10	10	10	10	10	10			m ₃₀	22	22	20	20				
m ₁₀	15	15	10						m ₃₁	11	11	10	10				
m ₁₁	10	10	5						m ₃₂	20	20	20	20	12			
m ₁₂	15	15	15	10	10	10	10	10	m ₃₃	10	10	5					
m ₁₃	50	50	35	32	28				m ₃₄	15	15	10					
m ₁₄	10	10	10						m ₃₅	20	20	20	20	10			
m ₁₅	10	10	10	10	6				m ₃₆	20	20	15	10				
m ₁₆	15	15	10	10					m ₃₇	25	25	20	10				
m ₁₇	10	10	10	10	10				m ₃₈	10	10	10					
m ₁₈	20	20	11						m ₃₉	15	15						
m ₁₉	10	10	10	10					m ₄₀	20	20	10	10				
m ₂₀	15	15	10	10	10				m ₄₁	20	20	12					
m ₂₁	10	10	10						m ₄₂	15	15	13					

Table 3. Meatpacking facility specifications of the problem

Packing Facility	Inventory Holding Cost (\$)	Warehouse Capacity	Maximum Production Capacity	Fixed Production Cost (\$)	Variable Production Cost (\$)
p ₁	9	4000	900	475	611
p ₂	9	100	300	455	727
p ₃	14	100	600	909	909
p ₄	14	500	900	818	818

Table 4. Trip distances among packing facilities and cold storage facilities (KM)

Node	p ₁	p ₂	p ₃	p ₄	s ₁	s ₂	s ₃	s ₄	s ₅	s ₆	s ₇	s ₈	s ₉	s ₁₀	s ₁₁	s ₁₂
p ₁	0	632	2322	1796	1811	1797	1790	1422	1589	631	1987	1953	1844	1240	690	1488
p ₂	651	0	2008	1482	1496	1481	1476	1226	979	2	1509	1640	1609	1073	754	1172
p ₃	2306	1991	0	612	560	571	612	1188	1488	1991	790	485	923	1387	1781	898
p ₄	1790	1475	617	0	49	45	22	746	879	1477	193	164	794	956	1265	458
s ₁	1804	1489	582	45	0	20	62	724	939	1489	230	130	785	922	1279	433
s ₂	1792	1477	569	42	20	0	50	712	927	1477	232	145	773	910	1267	421
s ₃	1789	1474	630	20	60	53	0	754	876	1474	206	178	791	944	1264	455
s ₄	1399	1217	1200	747	762	747	740	0	1365	1217	938	799	451	200	760	349
s ₅	1616	976	1498	886	927	939	884	1315	0	976	769	1045	1609	1394	1409	1138
s ₆	651	2	2008	1482	1498	1483	1476	1227	981	0	1511	1640	1610	1077	754	1174
s ₇	1978	1504	784	189	226	228	202	934	794	1504	0	332	980	1142	1452	644
s ₈	1939	1624	474	153	122	149	172	788	1030	1596	331	0	849	986	1385	497
s ₉	1765	1620	931	792	786	771	785	449	1600	1620	983	812	0	566	1158	565
s ₁₀	1215	1070	1394	941	957	942	935	201	1396	1069	1132	993	567	0	576	523
s ₁₁	676	747	1799	1247	1289	1274	1267	748	1421	747	1465	1431	1154	566	0	965
s ₁₂	1480	1165	906	454	435	420	447	347	1120	1165	645	506	557	536	955	0

Table 5. Trip distances among carcass suppliers and packing facilities (KM)

Node	c ₁	c ₂	c ₃	c ₄	c ₅	p ₁	p ₂	p ₃	p ₄
c ₁	0					1806	1584	606	15
c ₂		0				1506	1192	880	438
c ₃			0			1569	952	1500	890
c ₄				0		5	635	2311	1794
c ₅					0	628	4	1993	1482
p ₁	1800	1502	1565	4	628	0	632	2322	1796
p ₂	1492	1187	938	635	3	651	0	2008	1482
p ₃	603	889	1489	2326	2007	2306	1991	0	612
p ₄	12	437	878	1800	1476	1790	1475	617	0

Table 11. Transferred red meat among nodes (Scenario 3)

Node	Vehicle	Period						
		t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	t ₇
c ₂ p ₁	v ₁	277.5						
c ₂ p ₂	v ₁	15						
c ₃ p ₁	v ₁	240						
c ₃ p ₂	v ₁	60						
c ₄ p ₁	v ₁	300	98.75	20				
c ₄ p ₂	v ₁		75	75	52.5			
c ₅ p ₁	v ₂						10	
c ₅ p ₂	v ₁	300	300	300	300	75	40	

Table 9. The inventory level in nodes

Node	Period							Node	Period						
	t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	t ₇		t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	t ₇
p ₁		4						m ₂₁	10						
p ₂				4	8			m ₂₂	5						
m ₁		5	10	15		5		m ₂₃							
m ₂	10			10				m ₂₄							
m ₃	18				20			m ₂₅	10						
m ₄		10						m ₂₆							
m ₅	3	10						m ₂₇		10					
m ₆		10		10				m ₂₈	13						
m ₇		5		5	10			m ₂₉	10						
m ₈	10			10				m ₃₀	20						
m ₉	10			10				m ₃₁	5	10					
m ₁₀	5							m ₃₂							
m ₁₁	5							m ₃₃	5						
m ₁₂	5	10		10		10		m ₃₄	10						
m ₁₃	10		8					m ₃₅							
m ₁₄	10							m ₃₆							
m ₁₅	10		6					m ₃₇	10	10					
m ₁₆		10						m ₃₈	10						
m ₁₇	10		10					m ₃₉							
m ₁₈	11							m ₄₀	20	10					
m ₁₉	10							m ₄₁							
m ₂₀	5		10					m ₄₂	13						

Table 6. Trip distances among cold storage facilities and retailers (KM)

Node	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
m1	44	47	32	758	880	1487	190	156	803	957	1274	467
m2	59	57	31	762	874	1492	190	177	809	962	1280	473
m3	37	42	36	758	893	1487	199	147	801	957	1288	452
m4	53	58	37	766	881	1492	188	160	818	966	1284	473
m5	33	40	34	755	891	1485	205	146	799	955	1273	466
m6	47	45	19	750	876	1479	191	164	796	949	1267	460
m7	59	55	32	762	877	1491	186	168	809	961	1280	472
m8	44	50	35	760	892	1489	194	153	806	959	1277	470
m9	63	63	43	773	888	1502	183	163	819	972	1290	483
m10	42	46	40	755	887	1485	192	152	802	950	1273	466
m11	93	91	44	727	852	1456	230	210	775	926	1244	437
m12	24	41	75	762	932	1526	233	111	807	996	1314	455
m13	934	939	890	1292	30	952	813	1051	1615	1371	1395	1141
m14	768	773	725	1239	241	1111	517	886	1450	1364	1486	1007
m15	1146	1131	1124	1008	522	458	1052	1287	1387	1086	1047	862
m16	318	320	295	1026	679	1432	80	424	1073	1225	1388	737
m17	162	147	140	575	955	1364	338	257	658	774	1153	285
m18	125	142	176	781	1033	1584	335	8	842	979	1372	490
m19	312	329	363	920	1220	1724	522	190	823	1119	1512	630
m20	304	321	354	950	1211	1753	288	182	924	1148	1541	659
m21	451	455	428	1089	547	1307	213	557	1242	1214	1397	803
m22	259	264	215	892	662	1371	231	376	940	1091	1230	602
m23	744	761	794	1352	1652	2155	953	622	1005	1550	1943	1061
m24	599	589	649	1207	1507	2010	808	477	1120	1405	1798	916
m25	649	634	665	878	1543	1814	854	596	434	995	1534	658
m26	567	558	618	1175	1475	1978	558	445	1089	1374	1767	885
m27	430	416	435	321	1139	1184	641	502	531	501	925	37
m28	1049	1034	1027	295	1666	1360	1224	1086	475	305	744	635
m29	519	504	531	268	1335	1280	728	590	487	457	968	131
m30	799	783	798	430	1612	1602	995	824	22	548	1106	547
m31	1486	1472	1465	1216	969	9	1500	1628	1599	1064	722	1163
m32	940	925	918	182	1379	1076	1116	976	547	22	580	507
m33	764	748	742	6	1317	1217	939	801	446	195	753	350
m34	471	455	486	1009	1364	1812	675	417	598	1216	1600	718
m35	478	463	494	786	892	1779	683	425	473	959	1277	587
m36	998	982	976	727	938	519	1173	1139	1110	574	496	673
m37	468	453	467	611	1281	1565	664	493	316	860	1285	409
m38	267	252	267	561	1081	1490	464	338	525	785	1279	302
m39	564	581	614	1172	1471	1975	773	442	938	1370	1763	881
m40	1286	1270	1264	768	1417	726	1461	1427	1168	585	2	961
m41	301	286	317	731	1195	1643	506	248	568	1038	1431	549
m42	625	610	603	386	931	870	801	767	768	464	658	301

Table 7. Trip distances among packing facilities and retailers (KM)

Node	p ₁	p ₂	p ₃	p ₄	Node	p ₁	p ₂	p ₃	p ₄
m ₁	1802	1487	608	13	m ₂₂	1757	1371	829	217
m ₂	1806	1492	629	18	m ₂₃	2470	2155	188	775
m ₃	1802	1489	600	30	m ₂₄	2325	2010	121	630
m ₄	1810	1496	613	22	m ₂₅	2129	1814	621	663
m ₅	1799	1485	598	15	m ₂₆	2293	1978	328	599
m ₆	1794	1479	616	6	m ₂₇	1499	1184	894	441
m ₇	1806	1491	620	18	m ₂₈	1403	1360	1397	1033
m ₈	1804	1489	606	16	m ₂₉	1595	1280	990	537
m ₉	1817	1502	616	29	m ₃₀	1747	1602	943	804
m ₁₀	1799	1485	604	12	m ₃₁	651	9	1997	1471
m ₁₁	1771	1456	663	55	m ₃₂	1221	1076	1377	930
m ₁₂	1841	1526	563	56	m ₃₃	1394	1217	1201	748
m ₁₃	1592	952	1504	892	m ₃₄	2127	1812	326	484
m ₁₄	1751	1111	1338	727	m ₃₅	1804	1489	461	492
m ₁₅	1098	458	1656	1130	m ₃₆	834	519	1508	982
m ₁₆	1915	1432	874	279	m ₃₇	1880	1565	628	473
m ₁₇	1679	1352	658	147	m ₃₈	1805	1490	612	273
m ₁₈	1899	1584	462	157	m ₃₉	2290	1975	18	595
m ₁₉	2038	1724	276	344	m ₄₀	655	724	1795	1270
m ₂₀	2068	1753	472	335	m ₄₁	1958	1643	444	315
m ₂₁	1923	1307	1011	416	m ₄₂	1185	870	1135	609

Table 8. Transferred red meat among nodes

Node	Vehicle	Period							Node	Vehicle	Period						
		t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	t ₇			t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	t ₇
c ₅	p ₁	v ₁	817.5	98.75	20				p ₂	m ₅	v ₁		20				
c ₅	p ₂	v ₁	375	375	375	357.5	80	40	p ₂	m ₆	v ₁			20			
p ₁	m ₁	v ₁	15						p ₂	m ₇	v ₂		10				
p ₁	m ₂	v ₁	20						p ₂	m ₇	v ₁			20	20		
p ₁	m ₃	v ₁	40						p ₂	m ₈	v ₂		10				
p ₁	m ₄	v ₁	15						p ₂	m ₈	v ₁	20		20			
p ₁	m ₅	v ₁	16						p ₂	m ₉	v ₂		10				
p ₁	m ₆	v ₁	15	20					p ₂	m ₉	v ₁			20			
p ₁	m ₇	v ₁	15	20					p ₂	m ₁₀	v ₂		5				
p ₁	m ₉	v ₁	20						p ₂	m ₁₁	v ₁	15					
p ₁	m ₁₀	v ₁	20						p ₂	m ₁₂	v ₁		20		20		
p ₁	m ₁₂	v ₁	20						p ₂	m ₁₃	v ₂		5				
p ₁	m ₁₇	v ₁	20						p ₂	m ₁₃	v ₁	60	20	40	20		
p ₁	m ₁₈	v ₁	31						p ₂	m ₁₄	v ₁	20					
p ₁	m ₁₉	v ₁	20						p ₂	m ₁₅	v ₁	20		16			
p ₁	m ₂₀	v ₁	20						p ₂	m ₁₆	v ₁	15	20				
p ₁	m ₂₅	v ₁	20						p ₂	m ₁₇	v ₁			20			
p ₁	m ₂₇	v ₁	36						p ₂	m ₁₉	v ₂			10			
p ₁	m ₂₈	v ₂	5						p ₂	m ₂₀	v ₂		5				
p ₁	m ₂₈	v ₁	20						p ₂	m ₂₀	v ₁			20			
p ₁	m ₂₉	v ₁	20						p ₂	m ₂₁	v ₁	20					
p ₁	m ₃₀	v ₂	2						p ₂	m ₂₂	v ₂		5				
p ₁	m ₃₀	v ₁	40						p ₂	m ₂₂	v ₁	20					
p ₁	m ₃₂	v ₁	20	20	20				p ₂	m ₂₃	v ₁	20	20	20	20		
p ₁	m ₃₃	v ₁	15						p ₂	m ₂₄	v ₂				10		
p ₁	m ₃₄	v ₁	20						p ₂	m ₂₄	v ₁	20	20	17			
p ₁	m ₃₆	v ₁	20	15					p ₂	m ₂₅	v ₂			7			
p ₁	m ₃₇	v ₁	35						p ₂	m ₂₆	v ₂		10				
p ₁	m ₃₈	v ₁	20						p ₂	m ₂₆	v ₁	20					
p ₁	m ₃₉	v ₁	15						p ₂	m ₂₇	v ₂				10		
p ₁	m ₄₀	v ₁	40						p ₂	m ₂₇	v ₁		40	20	20		
p ₁	m ₄₁	v ₁	20						p ₂	m ₃₀	v ₁			20			
p ₁	m ₄₂	v ₁	19						p ₂	m ₃₁	v ₁	16	15				
p ₂	m ₁	v ₁		20	20	20		20	p ₂	m ₃₂	v ₁				12		
p ₂	m ₂	v ₂			10				p ₂	m ₃₄	v ₂	5					
p ₂	m ₂	v ₁				20			p ₂	m ₃₅	v ₂				10		
p ₂	m ₃	v ₂		3					p ₂	m ₃₅	v ₁	20	20	20			
p ₂	m ₃	v ₁			20	20	40		p ₂	m ₃₆	v ₂			10			
p ₂	m ₄	v ₂				10			p ₂	m ₃₇	v ₁		20				
p ₂	m ₄	v ₁		20					p ₂	m ₄₁	v ₁		12				
p ₂	m ₅	v ₂				10			p ₂	m ₄₂	v ₂	9					

Table 10. Transferred red meat among nodes (Scenario 2)

Node		Vehicle	Period						
			t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	t ₇
c ₅	p ₁	v ₁	476.25	318.75	100				
c ₅	p ₂	v ₁	375	375	375	320	120	60	18.75
p ₁	m ₃	v ₁	22	21	20				
p ₁	m ₅	v ₁		13					
p ₁	m ₆	v ₁	15						
p ₁	m ₇	v ₁	15	15	15				
p ₁	m ₁₀	v ₁	15						
p ₁	m ₁₂	v ₁	15	15					
p ₁	m ₁₈	v ₁	20						
p ₁	m ₂₀	v ₁	15						
p ₁	m ₂₃	v ₁	20						
p ₁	m ₂₄	v ₁	20	20					
p ₁	m ₂₇	v ₁	36	30					
p ₁	m ₂₈	v ₁	12	13					
p ₁	m ₃₀	v ₁	22	20	20				
p ₁	m ₃₂	v ₁	20	20	20				
p ₁	m ₃₃	v ₂	10	5					
p ₁	m ₃₄	v ₁	15						
p ₁	m ₃₅	v ₁	20	20					
p ₁	m ₃₆	v ₁	20	15					
p ₁	m ₃₇	v ₁	14	20					
p ₁	m ₄₀	v ₂		10	10				
p ₁	m ₄₀	v ₁	20						
p ₁	m ₄₁	v ₁	20						
p ₁	m ₄₂	v ₁	15	13					
p ₂	m ₁	v ₁	15	15	15	15	15	15	
p ₂	m ₁	v ₂							5
p ₂	m ₂	v ₂	10	10	10	10	10		
p ₂	m ₃	v ₁				20	20	20	
p ₂	m ₄	v ₂		10	10	10			
p ₂	m ₄	v ₁	15						
p ₂	m ₅	v ₂			10	10			
p ₂	m ₅	v ₁	13						
p ₂	m ₆	v ₂		10	10	10	10		
p ₂	m ₇	v ₂						10	
p ₂	m ₇	v ₁				15	15		
p ₂	m ₈	v ₂	10	10	10	10	10		
p ₂	m ₉	v ₂	10	10	10	10	10		
p ₂	m ₁₀	v ₂		10					
p ₂	m ₁₁	v ₂	10	5		20			
p ₂	m ₁₂	v ₂							10
p ₂	m ₁₂	v ₂			10	10	10	10	
p ₂	m ₁₃	v ₁	50	35	32	28			
p ₂	m ₁₄	v ₂	10	10					
p ₂	m ₁₅	v ₂	10	10	10	6			
p ₂	m ₁₆	v ₂		10	10				
p ₂	m ₁₆	v ₁	15						
p ₂	m ₁₇	v ₂	10	10	10	10			
p ₂	m ₁₈	v ₂		11					
p ₂	m ₁₉	v ₂	10	10	10				

Node		Vehicle	Period						
			t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	t ₇
p ₂	m ₂₀	v ₂		10	10	10			
p ₂	m ₂₁	v ₂	10	10					
p ₂	m ₂₂	v ₂		10					
p ₂	m ₂₂	v ₁	15						
p ₂	m ₂₃	v ₁		20	20	20			
p ₂	m ₂₄	v ₂				10			
p ₂	m ₂₄	v ₁			17				
p ₂	m ₂₅	v ₂	10	10	7				
p ₂	m ₂₆	v ₂		10					
p ₂	m ₂₆	v ₁	20						
p ₂	m ₂₇	v ₁			30	30			
p ₂	m ₂₉	v ₂	10	10					
p ₂	m ₃₁	v ₂		10	10				
p ₂	m ₃₁	v ₁	11						
p ₂	m ₃₂	v ₂				12			
p ₂	m ₃₄	v ₂		10					
p ₂	m ₃₅	v ₂				10			
p ₂	m ₃₅	v ₁			20				
p ₂	m ₃₆	v ₂			10				
p ₂	m ₃₇	v ₂			10				
p ₂	m ₃₇	v ₁	11						
p ₂	m ₃₈	v ₂	10	10					
p ₂	m ₃₉	v ₁	15						
p ₂	m ₄₁	v ₁		12					