Information and solutions to five SCNs:

*Initialization data of SCN 1:*

**Table 1** Parameters related to costs for SCN1.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Spots** | **FC** |  | |  | **HC** | |  | **TC** | |
|  |  |  |  |  |  |  |  |
| s1 | 34 | 0.02 | 0.000012 |  | 0.01 | 0.0 |  | 0.002 | 0.0 |
| s2 | 41 | 0.01 | 0.00001 |  | 0.02 | 0.0 |  | 0.002 | 0.0 |
| p1 | 10 | 0.001 | 0.000003 |  | 0.001 | 0.0 |  | 0.0001 | 0.0 |
| r1 | 10 | 0.0001 | 0.000001 |  | 0.005 | 0.0 |  | 0.005 | 0.0 |
| r2 | 20 | 0.0002 | 0.000001 |  | 0.004 | 0.0 |  | 0.0006 | 0.0 |

**Table 2** Parameters related to production process and holding cost for SCN1.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Manufacturer** |  |  |  | **HC of raw material 1** | |  | **HC of raw material 2** | |
|  |  |  |  |  |
| p1 | 0.3 | 0.7 | 1.0 | 0.001 | 0.0 |  | 0.001 | 0.0 |

**Table 3** Parameters associated with pricing function for SCN1.

|  |  |  |  |
| --- | --- | --- | --- |
| **Market** |  |  |  |
| m1 | 82.9 | 0.0032 | 0.000076 |
| m2 | 92.8 | 0.004 | 0.000045 |

**Table 4** The parameters of transportation cost function for SCN1.

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** |  |  |  |
| 1 | 0.0004 | 0.00002 | 0.5 |
| 2 | 0.0004 | 0.00003 | 0.5 |
| 3 | 0.0005 | 0.00002 | 0.5 |
| 4 | 0.0004 | 0.00004 | 0.5 |
| 5 | 0.0004 | 0.00005 | 0.5 |
| 6 | 0.0006 | 0.00002 | 0.5 |
| 7 | 0.0004 | 0.00006 | 0.5 |
| 8 | 0.0008 | 0.00002 | 0.5 |

*One solution to SCN1 with objective value 0 is given below:*

**Table 5** Equilibrium results of SCN1 associated with links.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| 1 | 93.9405 | 0.5002 | 94.4408 | 0.0000 | 0.4875 |
| 2 | 63.6962 | 0.5006 | 64.1968 | 0.0000 | 1.1375 |
| 3 | 54.7340 | 0.5011 | 55.2350 | 0.0000 | 1.5566 |
| 4 | 54.7340 | 0.5010 | 55.2350 | 0.0000 | 1.6933 |
| 5 | 92.2858 | 0.5000 | 82.9000 | -9.8858 | 0.0000 |
| 6 | 92.2858 | 0.5011 | 92.7869 | 0.0000 | 1.5566 |
| 7 | 92.2853 | 0.5000 | 82.9000 | -9.8853 | 0.0000 |
| 8 | 92.2853 | 0.5016 | 92.7869 | 0.0000 | 1.6933 |

**Table 6** Equilibrium results of SCN1 associated with material suppliers.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Supplier** |  |  |  |  |  |
| s1 | 0.4875 | 0.4875 | 0.0000 | 93.9405 | 0.3465 |
| s2 | 1.1375 | 1.1375 | 0.0000 | 63.6962 | 0.7666 |

**Table 7** Equilibrium results of SCN1 associated with manufacturers.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Manufacturer** |  |  |  |  |  |  |  |  |  |
| p1 | 3.2499 | 3.2499 | 0.0000 | 0.0000 | 0.0000 | 54.7340 | 94.4408 | 64.1968 | 0.3782 |

**Table 8** Equilibrium results of SCN1 associated with retailers.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Retailer** |  |  |  |  |  |  |
| r1 | 1.5566 | 1.5566 | 0.0000 | 55.2350 | 92.2858 | 0.4966 |
| r2 | 1.6933 | 1.6933 | 0.0000 | 55.2350 | 92.2853 | 0.3764 |

**Table 9** Equilibrium results of SCN1 associated with markets.

|  |  |  |
| --- | --- | --- |
| **Market** |  |  |
| m1 | 0.0 | 82.9 |
| m2 | 3.2499 | 92.7869 |

*Initialization data of SCN2:*

**Table 10** The parameters of transportation cost function for SCN2.

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** |  |  |  |
| 1 | 0.0004 | 0.00002 | 0.5 |
| 2 | 0.0004 | 0.00003 | 0.5 |
| 3 | 0.0005 | 0.00002 | 0.5 |
| 4 | 0.0004 | 0.00004 | 0.5 |
| 5 | 0.0004 | 0.00005 | 0.5 |
| 6 | 0.0006 | 0.00002 | 0.5 |
| 7 | 0.0004 | 0.00006 | 0.5 |
| 8 | 0.0008 | 0.00002 | 0.5 |
| 9 | 0.0004 | 0.00006 | 0.5 |
| 10 | 0.0008 | 0.00002 | 0.5 |

*One solution to SCN2 with objective value 0 is given below:*

**Table 11** Equilibrium results of SCN1 associated with links.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| 1 | 1.0278 | 7.5143 | 8.5421 | 0.0000 | 51.7761 |
| 2 | 0.3526 | 89.1498 | 89.5024 | 0.0000 | 120.8110 |
| 3 | 41.2228 | 25.3640 | 66.5868 | 0.0000 | 74.4062 |
| 4 | 41.2228 | 18.4301 | 59.6529 | 0.0000 | 70.7426 |
| 5 | 81.6152 | 0.5826 | 82.1979 | 0.0000 | 11.2797 |
| 6 | 81.6152 | 10.6798 | 92.2951 | 0.0000 | 63.1265 |
| 7 | 81.6724 | 0.5254 | 82.1979 | 0.0000 | 7.7615 |
| 8 | 81.6724 | 10.6226 | 92.2951 | 0.0000 | 62.9812 |
| 9 | 41.2228 | 40.9751 | 82.1979 | 0.0000 | 99.8638 |
| 10 | 41.2228 | 40.9750 | 82.1979 | 0.0000 | 100.1616 |

**Table 12** Equilibrium results of SCN1 associated with material suppliers.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Supplier** |  |  |  |  |  |
| s1 | 51.7761 | 51.7761 | 0.0000 | 1.0278 | 0.5130 |
| s2 | 120.8110 | 120.8110 | 0.0000 | 0.3526 | 0.0000 |

**Table 13** Equilibrium results of SCN1 associated with manufacturers.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Manufacturer** |  |  |  |  |  |  |  |  |  |
| p1 | 345.1743 | 345.1743 | 0.0000 | 0.0000 | 0.0000 | 41.2228 | 8.5421 | 89.5024 | 0.3782 |

**Table 14** Equilibrium results of SCN1 associated with retailers.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Retailer** |  |  |  |  |  |  |
| r1 | 74.4062 | 74.4062 | 0.0000 | 66.5868 | 81.6152 | 0.2231 |
| r2 | 70.7426 | 70.7426 | 0.0000 | 59.6529 | 81.6724 | 0.3626 |

**Table 15** Equilibrium results of SCN1 associated with markets.

|  |  |  |
| --- | --- | --- |
| **Market** |  |  |
| m1 | 219.0666 | 82.1978 |
| m2 | 126.1077 | 92.2950 |

*Initialization data of SCN3:*

**Table 16** Parameters related to costs for SCN2.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Spots** | **FC** |  | |  | **HC** | |  | **TC** | |
|  |  |  |  |  |  |  |  |
| s1 | 334 | 0.02 | 0.000012 |  | 0.01 | 0.05 |  | 0.002 | 0.01 |
| s2 | 411 | 0.01 | 0.00001 |  | 0.02 | 0.0 |  | 0.002 | 0.02 |
| s3 | 350 | 0.002 | 0.000002 |  | 0.01 | 0.0 |  | 0.001 | 0.02 |
| s4 | 415 | 0.004 | 0.000014 |  | 0.01 | 0.0 |  | 0.0002 | 0.01 |
| p1 | 80 | 0.001 | 0.000003 |  | 0.001 | 0.0 |  | 0.0001 | 0.0 |
| p2 | 100 | 0.001 | 0.000001 |  | 0.001 | 0.0 |  | 0.0002 | 0.0 |
| r1 | 10 | 0.00014 | 0.000001 |  | 0.005 | 0.0 |  | 0.005 | 0.0 |
| r2 | 12 | 0.0002 | 0.0000021 |  | 0.004 | 0.0 |  | 0.0006 | 0.0 |
| r3 | 0 | 0.0002 | 0.000001 |  | 0.001 | 0.0 |  | 0.0001 | 0.0 |

**Table 17** Parameters related to production process and holding cost for SCN2.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Manufacturer** |  |  |  | **HC of material one** | |  | **HC of material two** | |
|  |  |  |  |  |
| p1 | 0.55 | 0.45 | 1.0 | 0.001 | 0.0 |  | 0.001 | 0.0 |
| p2 | 0.6 | 0.4 | 1.0 | 0.004 | 0.0 |  | 0.008 | 0.0 |

**Table 18** Parameters associated with pricing function for SCN2.

|  |  |  |  |
| --- | --- | --- | --- |
| **Market** |  |  |  |
| m1 | 63..2 | 0.0032 | 0.000076 |
| m2 | 63.8 | 0.004 | 0.000055 |
| m3 | 63.7 | 0.00316 | 0.000068 |
| m4 | 63.5 | 0.0046 | 0.000087 |

**Table 19** The parameters associated with transportation cost function for SCN2.

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | (E-4) | (E-5) |  |
| 1 | 4 | 2 | 0.35 |
| 2 | 4 | 3 | 0.45 |
| 3 | 5 | 2 | 0.35 |
| 4 | 4 | 4 | 0.5 |
| 5 | 4 | 5 | 0.42 |
| 6 | 6 | 2 | 0.35 |
| 7 | 4 | 6 | 0.15 |
| 8 | 4.8 | 4.2 | 0.15 |
| 9 | 5 | 9 | 0.28 |
| 10 | 4 | 4 | 0.45 |
| 11 | 6 | 2 | 0.35 |
| 12 | 4 | 4 | 0.54 |
| 13 | 7 | 2 | 0.25 |
| 14 | 2 | 3 | 0.51 |
| 15 | 4 | 2 | 0.45 |
| 16 | 6 | 3 | 0.25 |
| 17 | 4 | 2 | 0.35 |
| 18 | 4 | 5 | 0.35 |
| 19 | 2 | 2 | 0.45 |
| 20 | 4 | 7 | 0.68 |
| 21 | 5 | 2 | 0.52 |
| 22 | 3 | 8 | 0.53 |
| 23 | 6 | 2 | 0.37 |
| 24 | 4 | 3 | 0.49 |
| 25 | 5 | 3 | 0.45 |
| 26 | 4 | 6 | 0.5 |

*One solution to SCN3 with objective value 0.19268 is given below:*

**Table 20** Equilibrium results of SCN2 associated with links.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| 1 | 91.1460 | 0.3510 | 91.4861 | -0.0109 | 1.7394 |
| 2 | 91.1460 | 0.4518 | 91.5979 | 0.0000 | 2.4174 |
| 3 | 91.1325 | 0.3536 | 91.4861 | 0.0000 | 3.1273 |
| 4 | 91.1325 | 0.5012 | 91.5979 | -0.0358 | 1.8357 |
| 5 | 120.7559 | 0.4212 | 121.1771 | 0.0000 | 1.9482 |
| 6 | 120.7559 | 0.3510 | 121.1068 | 0.0000 | 1.4016 |
| 7 | 121.0257 | 0.1514 | 121.1771 | 0.0000 | 2.0336 |
| 8 | 121.0257 | 0.1509 | 121.1068 | -0.0697 | 1.4338 |
| 9 | 61.7569 | 0.4579 | 62.2148 | 0.0000 | 13.6961 |
| 10 | 61.7569 | 0.4554 | 62.2123 | 0.0000 | 4.0010 |
| 11 | 61.7569 | 0.3500 | 62.1069 | 0.0000 | 0.0000 |
| 12 | 61.8217 | 0.5400 | 62.2148 | -0.1470 | 0.0540 |
| 13 | 61.8217 | 0.3906 | 62.2123 | 0.0000 | 14.1231 |
| 14 | 61.8217 | 0.5100 | 62.1069 | -0.2248 | 0.0000 |
| 15 | 63.3793 | 0.4500 | 63.2000 | -0.6293 | 0.0000 |
| 16 | 63.3793 | 0.3419 | 63.7212 | 0.0000 | 13.7501 |
| 17 | 63.3793 | 0.3500 | 63.6611 | -0.0682 | 0.0000 |
| 18 | 63.3793 | 0.3500 | 63.5000 | -0.2293 | 0.0000 |
| 19 | 63.0295 | 0.4500 | 63.2000 | -0.2795 | 0.0000 |
| 20 | 63.0295 | 0.6917 | 63.7212 | 0.0000 | 5.8904 |
| 21 | 63.0295 | 0.6316 | 63.6611 | 0.0000 | 12.2337 |
| 22 | 63.0295 | 0.5300 | 63.5000 | -0.0595 | 0.0000 |
| 23 | 65.1579 | 0.3700 | 63.2000 | -2.3279 | 0.0000 |
| 24 | 65.1579 | 0.4900 | 63.7212 | -1.9267 | 0.0000 |
| 25 | 65.1579 | 0.4500 | 63.6611 | -1.9468 | 0.0000 |
| 26 | 65.1579 | 0.5000 | 63.5000 | -2.1579 | 0.0000 |

**Table 21** Equilibrium results of SCN2 associated with material suppliers.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Supplier** |  |  |  |  |  |
| s1 | 4.1567 | 4.1567 | 0.0000 | 91.1460 | 0.1334 |
| s2 | 4.9631 | 4.9631 | 0.0000 | 91.1325 | 0.0990 |
| s3 | 3.3498 | 3.3498 | 0.0000 | 120.7559 | 0.1550 |
| s4 | 3.4674 | 3.4674 | 0.0000 | 121.0257 | 0.0109 |

**Table 22** Equilibrium results of SCN2 associated with manufacturers.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Manufacturer** |  |  |  |  |  |  |  |  |  |
| p1 | 17.6971 | 17.6971 | 0.0000 | 0.0000 | 0.0000 | 61.7569 | 91.4861 | 121.1771 | 0.0845 |
| p2 | 14.1771 | 14.1771 | 0.0000 | 0.0000 | 0.0000 | 61.8217 | 91.5979 | 121.1068 | 0.0522 |

**Table 23** Equilibrium results of SCN2 associated with retailers.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Retailer** |  |  |  |  |  |  |
| r1 | 1.375E+01 | 1.375E+01 | 0.000E+00 | 6.221E+01 | 6.338E+01 | 6.864E-03 |
| r2 | 1.812E+01 | 1.812E+01 | 0.000E+00 | 6.221E+01 | 6.303E+01 | 2.452E-03 |
| r3 | 4.486E-08 | 4.486E-08 | 0.000E+00 | 6.211E+01 | 6.516E+01 | 4.912E-02 |

**Table 24** Equilibrium results of SCN2 associated with markets.

|  |  |  |
| --- | --- | --- |
| **Market** |  |  |
| m1 | 1.253E-07 | 6.320E+01 |
| m2 | 1.964E+01 | 6.372E+01 |
| m3 | 1.223E+01 | 6.366E+01 |
| m4 | 4.214E-08 | 6.350E+01 |

*Initialization data of SCN4:*

**Table 25** Parameters related to costs for SCN3.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Spots** | **FC** |  | |  | **HC** | |  | **TC** | |
|  |  |  |  |  |  |  |  |
| s1 | 20 | 0.02 | 0.000012 |  | 0.0001 | 0.0 |  | 0.002 | 0.0 |
| s2 | 10 | 0.02 | 0.00001 |  | 0.0001 | 0.0 |  | 0.002 | 0.0 |
| s3 | 30 | 0.002 | 0.000002 |  | 0.0001 | 0.0 |  | 0.001 | 0.0 |
| s4 | 20 | 0.004 | 0.000014 |  | 0.0001 | 0.0 |  | 0.0002 | 0.0 |
| p1 | 50 | 0.003 | 0.000003 |  | 0.01 | 0.04 |  | 0.0001 | 0.0 |
| p2 | 80 | 0.001 | 0.000001 |  | 0.01 | 0.03 |  | 0.0002 | 0.0 |
| r1 | 10 | 0.0001 | 0.000001 |  | 0.0005 | 0.0 |  | 0.005 | 0.0 |
| r2 | 10 | 0.0002 | 0.000001 |  | 0.04 | 0.0 |  | 0.0006 | 0.0 |
| r3 | 10 | 0.0002 | 0.000001 |  | 0.01 | 0.0 |  | 0.0001 | 0.0 |
| r4 | 20 | 0.0002 | 0.000001 |  | 0.01 | 0.0 |  | 0.0001 | 0.0 |

**Table 26** Parameters related to production process and holding cost for SCN3.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Manufacturer** |  |  |  | **HC of material one** | |  | **HC of material two** | |
|  |  |  |  |  |
| p1 | 0.6 | 0.4 | 1.0 | 0.05 | 0.06 |  | 0.05 | 0.06 |
| p2 | 0.3 | 0.7 | 1.0 | 0.04 | 0.05 |  | 0.08 | 0.05 |

**Table 27** Parameters associated with pricing function for SCN3.

|  |  |  |  |
| --- | --- | --- | --- |
| **Market** |  |  |  |
| m1 | 32.0 | 0.0032 | 0.00076 |
| m2 | 30.8 | 0.005 | 0.00045 |

**Table 28** The parameters associated with transportation cost function for SCN3.

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | (E-4) | (E-5) |  |
| 1 | 4 | 3.2 | 0.5 |
| 2 | 4 | 3 | 0.5 |
| 3 | 5 | 2 | 0.5 |
| 4 | 4 | 4 | 0.5 |
| 5 | 4 | 5 | 0.5 |
| 6 | 6 | 2 | 0.5 |
| 7 | 4 | 5 | 0.5 |
| 8 | 8 | 2 | 0.5 |
| 9 | 5 | 9 | 0.5 |
| 10 | 4 | 4 | 0.5 |
| 11 | 6 | 2 | 0.5 |
| 12 | 4 | 4 | 0.5 |
| 13 | 7 | 2 | 0.5 |
| 14 | 2 | 3 | 0.5 |
| 15 | 6.4 | 2 | 0.5 |
| 16 | 6 | 3 | 0.5 |
| 17 | 4 | 2 | 0.5 |
| 18 | 8.4 | 7.5 | 0.5 |
| 19 | 2 | 2 | 0.5 |
| 20 | 4 | 7 | 0.5 |
| 21 | 5 | 2 | 0.5 |
| 22 | 3 | 8 | 0.5 |
| 23 | 6 | 2 | 0.5 |
| 24 | 4 | 5.3 | 0.5 |

*One solution to SCN4 with objective value 0.01190 is given below:*

**Table 29** Equilibrium results of SCN3 associated with links.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| 1 | 9.9497 | 0.5005 | 10.4502 | 0.0000 | 1.1215 |
| 2 | 9.9497 | 0.5004 | 10.4501 | 0.0000 | 0.9374 |
| 3 | 10.0000 | 0.5000 | 10.4502 | -0.0498 | 0.0000 |
| 4 | 10.0000 | 0.5000 | 10.4501 | -0.0499 | 0.0000 |
| 5 | 10.0000 | 0.5000 | 8.4067 | -2.0933 | 0.0000 |
| 6 | 10.0000 | 0.5000 | 8.4083 | -2.0917 | 0.0000 |
| 7 | 7.9064 | 0.5003 | 8.4067 | 0.0000 | 0.7477 |
| 8 | 7.9064 | 0.5019 | 8.4083 | 0.0000 | 2.1872 |
| 9 | 25.6968 | 0.5000 | 26.1968 | 0.0000 | 0.0892 |
| 10 | 25.6968 | 0.5000 | 26.1961 | -0.0007 | 0.0000 |
| 11 | 25.6968 | 0.5001 | 26.1969 | 0.0000 | 0.1209 |
| 12 | 25.6968 | 0.5021 | 26.1957 | -0.0032 | 3.5283 |
| 13 | 25.6956 | 0.5016 | 26.1968 | -0.0003 | 2.0697 |
| 14 | 25.6956 | 0.5005 | 26.1961 | 0.0000 | 1.8981 |
| 15 | 25.6956 | 0.5014 | 26.1969 | -0.0001 | 2.0096 |
| 16 | 25.6956 | 0.5002 | 26.1957 | 0.0000 | 0.2718 |
| 17 | 31.4646 | 0.5010 | 31.9656 | 0.0000 | 2.1589 |
| 18 | 31.4646 | 0.5000 | 30.8000 | -1.1646 | 0.0000 |
| 19 | 31.4652 | 0.5005 | 31.9656 | 0.0000 | 1.8982 |
| 20 | 31.4652 | 0.5000 | 30.8000 | -1.1652 | 0.0000 |
| 21 | 31.4644 | 0.5012 | 31.9656 | 0.0000 | 2.1306 |
| 22 | 31.4644 | 0.5000 | 30.8000 | -1.1644 | 0.0000 |
| 23 | 31.4628 | 0.5028 | 31.9656 | 0.0000 | 3.8001 |
| 24 | 31.4628 | 0.5000 | 30.8000 | -1.1628 | 0.0000 |

**Table 30** Equilibrium results of SCN3 associated with material suppliers.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Supplier** |  |  |  |  |  |
| s1 | 2.059E+00 | 2.059E+00 | 0.000E+00 | 9.950E+00 | 2.197E-02 |
| s2 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+01 | 2.115E-06 |
| s3 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+01 | 4.959E-02 |
| s4 | 2.935E+00 | 2.935E+00 | 0.000E+00 | 7.906E+00 | 1.595E-01 |

**Table 31** Equilibrium results of SCN3 associated with manufacturers.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Manufacturer** |  |  |  |  |  |  |  |  |  |
| p1 | 3.7385 | 3.7385 | 0.0000 | 0.0000 | 0.0000 | 25.6968 | 10.4502 | 8.4067 | 0.4124 |
| p2 | 6.2493 | 6.2493 | 0.0000 | 0.0000 | 0.0000 | 25.6956 | 10.4501 | 8.4083 | 0.4842 |

**Table 32** Equilibrium results of SCN3 associated with retailers.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Retailer** |  |  |  |  |  |  |
| r1 | 2.1589 | 2.1589 | 0.0000 | 26.1968 | 31.4646 | 0.0205 |
| r2 | 1.8982 | 1.8982 | 0.0000 | 26.1961 | 31.4652 | 0.0000 |
| r3 | 2.1306 | 2.1306 | 0.0000 | 26.1969 | 31.4644 | 0.0186 |
| r4 | 3.8001 | 3.8001 | 0.0000 | 26.1957 | 31.4628 | 0.0001 |

**Table 33** Equilibrium results of SCN3 associated with markets.

|  |  |  |
| --- | --- | --- |
| **Market** |  |  |
| m1 | 9.9877 | 31.9656 |
| m2 | 6.953E-07 | 30.8000 |

*Initialization data of SCN5:*

**Table 34** Parameters related to costs for SCN3.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Spots** | **FC** |  | |  | **HC** | |  | **TC** | |
|  |  |  |  |  |  |  |  |
| s1 | 10 | 0.02 | 0.000012 |  | 0.0001 | 0.0 |  | 0.002 | 0.0 |
| s2 | 15 | 0.02 | 0.00001 |  | 0.0001 | 0.0 |  | 0.002 | 0.0 |
| s3 | 20 | 0.002 | 0.000002 |  | 0.0001 | 0.0 |  | 0.001 | 0.0 |
| s4 | 22 | 0.004 | 0.000014 |  | 0.0001 | 0.0 |  | 0.0002 | 0.0 |
| p1 | 50 | 0.003 | 0.000003 |  | 0.01 | 0.04 |  | 0.0001 | 0.0 |
| p2 | 80 | 0.001 | 0.000001 |  | 0.01 | 0.03 |  | 0.0002 | 0.0 |
| w1 | 1 | 0.00005 | 0.0000001 |  | 0.00001 | 0.0 |  | 0.002 | 0.0 |
| r1 | 10 | 0.0001 | 0.000001 |  | 0.0005 | 0.0 |  | 0.005 | 0.0 |
| r2 | 10 | 0.0002 | 0.000001 |  | 0.04 | 0.0 |  | 0.0006 | 0.0 |
| r3 | 10 | 0.0002 | 0.000001 |  | 0.01 | 0.0 |  | 0.0001 | 0.0 |
| r4 | 20 | 0.0002 | 0.000001 |  | 0.01 | 0.0 |  | 0.0001 | 0.0 |

**Table 35** Parameters related to production process and holding cost for SCN3.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Manufacturer** |  |  |  | **HC of material one** | |  | **HC of material two** | |
|  |  |  |  |  |
| p1 | 0.6 | 0.4 | 1.0 | 0.05 | 0.06 |  | 0.05 | 0.06 |
| p2 | 0.3 | 0.7 | 1.0 | 0.04 | 0.05 |  | 0.08 | 0.05 |

**Table 36** Parameters associated with pricing function for SCN3.

|  |  |  |  |
| --- | --- | --- | --- |
| **Market** |  |  |  |
| m1 | 33.0 | 0.0032 | 0.00066 |
| m2 | 32.8 | 0.005 | 0.00055 |

**Table 37** The parameters associated with transportation cost function for SCN3.

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | (E-4) | (E-5) |  |
| 1 | 4 | 3.2 | 0.5 |
| 2 | 4 | 3 | 0.5 |
| 3 | 5 | 2 | 0.5 |
| 4 | 4 | 4 | 0.5 |
| 5 | 4 | 5 | 0.5 |
| 6 | 6 | 2 | 0.5 |
| 7 | 4 | 5 | 0.5 |
| 8 | 8 | 2 | 0.5 |
| 13 | 7.7 | 2 | 0.5 |
| 14 | 5.2 | 3 | 0.5 |
| 15 | 8.4 | 2 | 0.5 |
| 16 | 7.6 | 3 | 0.5 |
| 17 | 4 | 2 | 0.5 |
| 18 | 8.4 | 7.5 | 0.5 |
| 19 | 2 | 2 | 0.5 |
| 20 | 4 | 7 | 0.5 |
| 21 | 5 | 2 | 0.5 |
| 22 | 3 | 8 | 0.5 |
| 23 | 6 | 2 | 0.5 |
| 24 | 4 | 5.3 | 0.5 |
| 25 | 0.4 | 0.5 | 0.15 |
| 26 | 0.6 | 0.2 | 0.15 |
| 27 | 0.4 | 0.5 | 0.15 |
| 28 | 0.8 | 0.2 | 0.15 |
| 29 | 0.5 | 0.9 | 0.15 |
| 30 | 0.4 | 0.4 | 0.51 |

*One solution to SCN5 with objective value 0.14627 is given below:*

**Table 38** Equilibrium results of SCN3 associated with links.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| 1 | 10.0000 | 0.5000 | 8.1206 | -2.3794 | 0.0000 |
| 2 | 10.0000 | 0.5000 | 8.1196 | -2.3804 | 0.0000 |
| 3 | 7.6190 | 0.5016 | 8.1206 | 0.0000 | 2.6460 |
| 4 | 7.6190 | 0.5006 | 8.1196 | 0.0000 | 1.3133 |
| 5 | 12.0617 | 0.5007 | 12.5614 | -0.0011 | 1.4491 |
| 6 | 12.0617 | 0.5009 | 12.5626 | 0.0000 | 1.3485 |
| 7 | 12.0612 | 0.5001 | 12.5614 | 0.0000 | 0.3150 |
| 8 | 12.0612 | 0.5015 | 12.5626 | -0.0001 | 1.7159 |
| 13 | 18.0749 | 0.5000 | 18.5749 | 0.0000 | 0.0420 |
| 14 | 18.0749 | 0.5039 | 18.5776 | -0.0012 | 4.9353 |
| 15 | 18.0749 | 0.5025 | 18.5774 | 0.0000 | 2.6656 |
| 16 | 18.0749 | 0.5009 | 18.5758 | 0.0000 | 1.1122 |
| 17 | 32.4397 | 0.5014 | 32.9410 | 0.0000 | 2.7866 |
| 18 | 32.4397 | 0.5000 | 32.7999 | -0.1398 | 0.0001 |
| 19 | 32.4383 | 0.5029 | 32.9410 | -0.0002 | 5.8743 |
| 20 | 32.4383 | 0.5000 | 32.7999 | -0.1385 | 0.0125 |
| 21 | 32.4342 | 0.5069 | 32.9410 | -0.0001 | 7.4552 |
| 22 | 32.4342 | 0.5000 | 32.7999 | -0.1343 | 0.0000 |
| 23 | 32.4402 | 0.5009 | 32.9410 | -0.0001 | 1.4462 |
| 24 | 32.4402 | 0.5000 | 32.7999 | -0.1403 | 0.0008 |
| 25 | 13.9672 | 0.1542 | 14.1214 | 0.0000 | 8.8202 |
| 26 | 18.0749 | 0.1500 | 14.1214 | -4.1036 | 0.0004 |
| 27 | 18.4275 | 0.1503 | 18.5749 | -0.0028 | 2.7446 |
| 28 | 18.4275 | 0.1501 | 18.5776 | 0.0000 | 0.9515 |
| 29 | 18.4275 | 0.1510 | 18.5774 | -0.0011 | 4.7896 |
| 30 | 18.4275 | 0.5100 | 18.5758 | -0.3617 | 0.3348 |

**Table 39** Equilibrium results of SCN3 associated with material suppliers.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Supplier** |  |  |  |  |  |
| s1 | 0.0000 | 0.0000 | 0.0000 | 10.0000 | 0.0578 |
| s2 | 3.9594 | 3.9594 | 0.0000 | 7.6190 | 0.9995 |
| s3 | 2.7976 | 2.7976 | 0.0000 | 12.0617 | 0.6865 |
| s4 | 2.0309 | 2.0309 | 0.0000 | 12.0612 | 0.1130 |

**Table 40** Equilibrium results of SCN3 associated with manufacturers.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Manufacturer** |  |  |  |  |  |  |  |  |  |
| p1 | 8.8202 | 8.8202 | 0.0000 | 0.0000 | 0.0000 | 13.9672 | 8.1206 | 12.5614 | 0.3151 |
| p2 | 8.7555 | 8.7555 | 0.0000 | 0.0000 | 0.0000 | 18.0749 | 8.1196 | 12.5626 | 0.2252 |

**Table 41** Equilibrium results of SCN3 associated with wholesaler and retailers.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| w1 | 8.8206 | 8.8206 | 0.0000 | 14.1214 | 18.4275 | 0.2944 |
| r1 | 2.7867 | 2.7867 | 0.0000 | 18.5749 | 32.4397 | 0.4633 |
| r2 | 5.8868 | 5.8868 | 0.0000 | 18.5776 | 32.4383 | 0.5998 |
| r3 | 7.4552 | 7.4552 | 0.0000 | 18.5774 | 32.4342 | 0.6283 |
| r4 | 1.4470 | 1.4470 | 0.0000 | 18.5758 | 32.4402 | 0.0013 |

**Table 42** Equilibrium results of SCN3 associated with markets.

|  |  |  |
| --- | --- | --- |
| **Market** |  |  |
| m1 | 17.5623 | 32.9410 |
| m2 | 0.0135 | 32.7999 |