Data and Detailed Results for "Network Migration Problem: A Hybrid Logic-based Benders Decomposition Approach"

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This document describes the data files of the paper Daryalal et al. (2023). The files contain both the data used in the numerical experiments, as well as the detailed results.

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1. Networks

File: `network` + "`.gml`":

- `network` is one of the networks given in Table 4 of Section 4.1.

The data given in these text files represents the topology of the network `network`. These files can be read as follows:

```
graph [
# Set of information on the network, e.g., when it was recorded, the
    reference, etc.
node [
  id
  label
  Country
  Longitude
  Internal # whether this node is an internal node of the network
  Latitude
]
.
.
.
```

```
  edge [
    source
    target
    id
  ]
.
.
.
]
```

2. Problem Sets

File: `network` + "`M`" + `ep_per_site` + "`.xlsx`":

- `network` is one of the networks given in Table 4 of Section 4.1.
- `ep_per_site`is average number of endpoints per site.

These Excel files (provided in the folders "`DataSets`" contain parameters and data used for the computational results. Each Excel file has 5 Sheets, four of which contain the parameters of the instances, such as costs, and Sheet `circuits` contains the detailed info on the circuits.

3. Detailed Results

We have reported the detailed results of our experiments in the following tables (also reported in the paper and e-companion):

References

Daryalal M, Pouya H, De Santis MA (2023) Network migration problem: A hybrid logic-based benders decomposition approach. *INFORMS Journal on Computing* .

Table 3.1 Solution and computational effort

Dataset	Gap		Cost ($)		#ITER.		Time (s)	
	Mean	CI width	Mean	CI width	Mean	CI width	Mean	CI width
5	0.6%	1.1%	10472.0	448.7	3.5	0.6	1124.1	268.6
6	1.0%	1.9%	11424.0	923.4	10.5	4.3	4607.1	2309.7
7	4.7%	1.9%	11877.3	648.9	6.5	2.0	1459.0	509.7
8	4.9%	2.9%	12693.3	611.3	7.3	1.6	2582.6	539.9
9	3.7%	3.0%	13328.0	615.6	10.8	6.1	5109.8	3376.7
5	1.2%	2.2%	13192.0	954.9	6.0	3.0	699.2	560.3
6	2.6%	2.1%	14960.0	1443.7	4.8	2.3	675.7	374.2
7	2.4%	1.7%	15640.0	243.3	5.3	2.0	997.9	415.8
8	1.8%	1.3%	16048.0	615.6	8.2	4.1	2445.6	399.6
9	4.1%	2.5%	16864.0	721.8	8.0	2.9	3120.4	1939.1
5	1.9%	1.7%	15912.0	821.6	5.7	1.6	1817.2	796.4
6	3.2%	2.1%	17136.0	533.1	9.2	2.0	4929.4	1385.8
5	1.3%	1.5%	11832.0	625.1	8.3	2.3	2387.6	697.1
6	5.2%	2.4%	12648.0	498.7	5.7	2.3	3635.1	2640.4
5	1.3%	1.4%	18224.0	1109.8	4.5	1.4	619.6	475.2
6	3.1%	2.1%	19312.0	721.8	6.0	1.6	855.6	460.3
7	4.2%	2.2%	19856.0	721.8	6.0	3.7	2472.6	2731.3
5	4.9%	1.8%	17272.0	877.3	5.8	3.5	2259.2	899.9
6	3.8%	1.9%	17952.0	377.0	7.3	3.1	3308.0	769.4

Table 3.2 Breakdown of solution times

Dataset	Iterations		Sol Time		LBBD MP Time		CG Time		CP Time	
	Mean	CI width	Mean	CI width	Mean	CI width	Mean	CI width	Mean	CI width
5	3.5	0.6	1124.1	268.6	548.2	198.3	540.1	196.0	575.8	147.6
6	10.5	4.3	4607.1	2309.7	2953.3	1929.8	2939.2	1928.9	1653.5	680.5
7	6.5	2.0	1459.0	509.7	45.7	23.4	27.6	13.7	1413.2	497.5
8	7.3	1.6	2582.6	539.9	693.8	271.9	531.6	225.2	1888.4	563.5
9	10.8	6.1	5109.8	3376.7	2201.9	1889.0	1384.5	1000.8	2907.4	1817.8
5	6.0	3.0	699.2	560.3	18.0	16.1	4.6	2.7	680.9	561.0
6	4.8	2.3	675.7	374.2	94.8	42.8	17.6	6.3	580.8	361.1
7	5.3	2.0	997.9	415.8	177.6	63.9	32.9	15.0	820.1	381.1
8	8.2	4.1	2445.6	399.6	1182.4	626.9	135.9	66.9	1262.8	433.9
9	8.0	2.9	3120.4	1939.1	1980.7	1546.1	67.1	42.6	1139.5	543.4
5	5.7	1.6	1817.2	796.4	812.9	505.1	726.2	475.5	1004.1	322.2
6	9.2	2.0	4929.4	1385.8	3267.2	1306.1	2961.9	1167.6	1661.8	272.9
5	8.3	2.3	2387.6	697.1	836.1	293.6	748.0	319.1	1551.2	480.3
6	5.7	2.3	3635.1	2640.4	2630.0	2194.2	2473.5	2132.5	1005.0	490.1
5	4.5	1.4	619.6	475.2	400.5	408.2	27.1	12.1	218.8	94.4
6	6.0	1.6	855.6	460.3	608.2	393.2	36.1	15.3	247.1	108.7
7	6.0	3.7	2472.6	2731.3	2184.8	2503.3	96.2	108.1	287.3	251.1
5	5.8	3.5	2259.2	899.9	1217.2	523.3	1112.4	507.2	1041.8	541.1
6	7.3	3.1	3308.0	769.4	1759.4	718.7	139.2	36.3	1548.3	996.6

Table 3.3 The number of cuts and columns generated during the solution process

Dataset	$\#\text{Cut}_{\text{OPT}}^{\text{LBBD}}$		$\#\text{Cut}_{\text{FEAS}}^{\text{LBBD}}$		$\#\text{Cut}_{\text{OPT}}^{\text{BD}}$		#Columns	
	Mean	CI width	Mean	CI width	Mean	CI width	Mean	CI width
5	121.8	35.3	27.3	11.2	33.0	11.6	408.8	180.2
6	566.8	273.0	84.0	30.5	79.2	43.0	951.2	375.3
7	361.2	101.1	66.3	44.1	76.8	36.8	1350.8	565.1
8	463.7	114.1	88.3	29.0	170.8	62.0	3693.8	1120.1
9	919.2	605.7	119.3	104.5	480.7	464.9	7318.7	4824.6
5	218.3	136.2	59.2	23.6	35.3	28.4	45.5	0.9
6	237.5	167.3	42.7	25.4	115.8	43.8	159.8	162.7
7	267.7	130.6	61.5	40.4	220.5	50.3	274.8	411.2
8	434.3	148.6	66.0	31.4	386.2	164.1	1405.5	646.1
9	622.3	317.5	103.7	32.8	666.5	405.6	1456.2	991.8
5	289.0	96.7	76.0	20.5	110.0	73.0	741.5	462.9
6	666.8	159.0	124.8	36.9	308.2	70.9	2101.8	1108.5
5	476.8	185.9	78.3	36.1	232.7	165.6	1026.8	691.0
6	307.7	161.8	37.0	17.9	365.5	260.5	1024.3	582.1
5	215.8	83.0	50.0	29.9	176.0	107.9	57.0	0.0
6	343.3	137.5	72.2	13.6	219.0	83.0	57.0	0.0
7	375.7	320.2	65.2	42.6	661.0	728.0	57.0	0.0
5	385.5	322.0	63.3	43.9	136.7	53.6	1772.0	1091.4
6	571.3	328.8	115.8	53.0	411.5	102.8	4607.8	1571.0