```
"E:\1 □□□□\3 □□□□□\1 □□□□□□\1 □□□□□□□\1_□□□□□□_□□□□\1_LW _□□□□\4 □□□□\3 python_code\1 exzample\2 □□□□□□\9 Code for this paper\Scripts\python.exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=4151

import sys; print('Python %s on %s' % (sys.version, sys.platform))
sys.path.extend(['E:\\1 □□□□\\3 □□□□□□\\1 □□□□□□□\\1 □□□□□□□□□\\1_□□□□□□_□□□□\\1_LW _□□□□\\4 □□□□\\3 python_code\\9 Code for this paper', 'E:/1 □□□□/3 □□□□□/1 □□□□□□/1 □□□□□□□/1_□□□□□□_□□□□/1_LW _□□□□/4 □□□□/3 python_code/9 Code for this paper'])

PyDev console: starting.

Python 3.9.7 (tags/v3.9.7:1016ef3, Aug 30 2021, 20:19:38) [MSC v.1929 64 bit (AMD64)] on win32
>>> runfile('E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□/1_□□□□□□_□□□□/1_LW _□□□□/4 □□□□/3 python_code/9 Code for this paper/main_RO_BDC.py', wdir='E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□/1_□□□□□□□_□□□□/1_LW _□□□□/4 □□□□/3 python_code/9 Code for this paper')
Backend TkAgg is interactive backend. Turning interactive mode on.
Waiting 5s.....

Optimize the  ./R_20_1.xlsx  instance by BDC

        Master protblem status =  2 , is Optimal
        sol_MP_obj =  832.0
The initial lb =  -inf        ub =  inf

The current iteration cnt =  0
    Optimization was stopped with status 9
        Dual problem status =  9
        Add optimal cut
        Master protblem status =  2 , is Optimal
        Deterministic Sub problem Status=  2 , is Optimal
        lb =  858.0223715978941                ub =  858.0223715978941
        MPObj =  858.0223715978941      MPObj_Remove_Hua =  853.0       DualSPObj =  5.022371597894138        Hua =  5.022371597894139        Deterministic_SP_SPObj =  733.0

ub - lb =  0.0

Iteration cycle stopped by termination criterion 1: Because ub - lb <= eps, the iteration stop, and cnt =  0
    i: 0.0  l_i: 5.0   p_i: 18.0    aI_i: 64.0      sol_a_i: 64.0  sol_g_i: 0.0    d_i: 75.0    sol_taoi: 64.0    sol_deltai: 75.0  sol_deltai - sol_taoi: 11.0  sol_taoP: 64.0  sol_deltaP: 66.0    sol_deltaP - sol_taoP: 2.0  cI_i: 2461678.0     sol_c_i: 2461678.0    sol_gp_i: 0.0  total work: 2636440.0    wasted work: 0.6628711444220237
    i: 1.0  l_i: 6.0   p_i: 7.0   aI_i: 12.0      sol_a_i: 12.0  sol_g_i: 0.0    d_i: 20.0    sol_taoi: 12.0    sol_deltai: 21.0  sol_deltai - sol_taoi: 9.0    sol_taoP: 12.0    sol_deltaP: 14.0    sol_deltaP - sol_taoP: 2.0  cI_i: 1987031.0     sol_c_i: 1987031.0    sol_gp_i: 0.0  total work: 2372796.0    wasted work: 1.4632041692585456
    i: 2.0  l_i: 6.0   p_i: -0.0    aI_i: 63.0      sol_a_i: 63.0  sol_g_i: 0.0    d_i: 76.0    sol_taoi: 63.0    sol_deltai: 73.0  sol_deltai - sol_taoi: 10.0  sol_taoP: 63.0  sol_deltaP: 66.0    sol_deltaP - sol_taoP: 3.0  cI_i: 2239066.0     sol_c_i: 2239066.0    sol_gp_i: 0.0  total work: 3163728.0    wasted work: 3.507237031754942
    i: 3.0  l_i: 5.0   p_i: 23.0    aI_i: 67.0      sol_a_i: 67.0  sol_g_i: 0.0    d_i: 78.0    sol_taoi: 67.0    sol_deltai: 78.0  sol_deltai - sol_taoi: 11.0  sol_taoP: 67.0  sol_deltaP: 70.0    sol_deltaP - sol_taoP: 3.0  cI_i: 2634265.0     sol_c_i: 2634265.0    sol_gp_i: 0.0  total work: 2636440.0    wasted work: 0.008249761041404319
    i: 4.0  l_i: 6.0   p_i: 12.0    aI_i: 58.0      sol_a_i: 58.0  sol_g_i: 0.0    d_i: 66.0    sol_taoi: 58.0    sol_deltai: 65.0  sol_deltai - sol_taoi: 7.0    sol_taoP: 58.0  sol_deltaP: 60.0    sol_deltaP - sol_taoP: 2.0  cI_i: 1408749.0     sol_c_i: 1408749.0    sol_gp_i: 0.0  total work: 2109152.0    wasted work: 2.65662408399205
    i: 5.0  l_i: 7.0   p_i: 13.0    aI_i: 8.0       sol_a_i: 8.0   sol_g_i: 0.0    d_i: 19.0    sol_taoi: 8.0   sol_deltai: 18.0  sol_deltai - sol_taoi: 10.0  sol_taoP: 8.0    sol_deltaP: 12.0    sol_deltaP - sol_taoP: 4.0  cI_i: 2138353.0     sol_c_i: 2138353.0    sol_gp_i: 0.0  total work: 2504618.0    wasted work: 1.389240794404576
    i: 6.0  l_i: 5.0   p_i: -0.0    aI_i: 33.0      sol_a_i: 33.0  sol_g_i: 0.0    d_i: 42.0    sol_taoi: 33.0    sol_deltai: 40.0  sol_deltai - sol_taoi: 7.0    sol_taoP: 33.0  sol_deltaP: 35.0    sol_deltaP - sol_taoP: 2.0  cI_i: 1416678.0     sol_c_i: 1416678.0    sol_gp_i: 0.0  total work: 1581864.0    wasted work: 0.6265494378783512
    i: 7.0  l_i: 6.0   p_i: 6.0   aI_i: 59.0      sol_a_i: 59.0  sol_g_i: 0.0    d_i: 62.0    sol_taoi: 59.0    sol_deltai: 65.0  sol_deltai - sol_taoi: 6.0    sol_taoP: 59.0    sol_deltaP: 61.0    sol_deltaP - sol_taoP: 2.0  cI_i: 1124285.0     sol_c_i: 1124285.0    sol_gp_i: 0.0  total work: 1186398.0    wasted work: 0.23559421037459605
    i: 8.0  l_i: 5.0   p_i: 8.0   aI_i: 0.0       sol_a_i: 0.0   sol_g_i: 0.0    d_i: 6.0   sol_taoi: 0.0   sol_deltai: 9.0    sol_deltai - sol_taoi: 9.0    sol_taoP: -0.0    sol_deltaP: 2.0   sol_deltaP - sol_taoP: 2.0   cI_i: 2096347.0     sol_c_i: 2096347.0    sol_gp_i: 0.0  total work: 2636440.0    wasted work: 2.0485692828207736
    i: 9.0  l_i: 5.0   p_i: 6.0   aI_i: 47.0      sol_a_i: 47.0  sol_g_i: 0.0    d_i: 60.0    sol_taoi: 47.0    sol_deltai: 57.0  sol_deltai - sol_taoi: 10.0  sol_taoP: 47.0    sol_deltaP: 50.0    sol_deltaP - sol_taoP: 3.0  cI_i: 2232920.0     sol_c_i: 2232920.0    sol_gp_i: 0.0  total work: 2372796.0    wasted work: 0.5305487703114806
    i: 10.0   l_i: 5.0   p_i: 5.0   aI_i: 36.0      sol_a_i: 36.0  sol_g_i: 0.0    d_i: 45.0    sol_taoi: 36.0    sol_deltai: 42.0  sol_deltai - sol_taoi: 6.0    sol_taoP: 36.0  sol_deltaP: 38.0    sol_deltaP - sol_taoP: 2.0  cI_i: 1093581.0     sol_c_i: 1093581.0    sol_gp_i: 0.0  total work: 1318220.0    wasted work: 0.8520542853241493
    i: 11.0   l_i: 5.0   p_i: 23.0    aI_i: 57.0      sol_a_i: 57.0  sol_g_i: 0.0    d_i: 64.0    sol_taoi: 57.0    sol_deltai: 65.0  sol_deltai - sol_taoi: 8.0    sol_taoP: 57.0    sol_deltaP: 59.0    sol_deltaP - sol_taoP: 2.0  cI_i: 1604130.0     sol_c_i: 1604130.0    sol_gp_i: 0.0  total work: 1845508.0    wasted work: 0.9155452048975133
    i: 12.0   l_i: 6.0   p_i: 22.0    aI_i: 8.0       sol_a_i: 8.0   sol_g_i: 0.0    d_i: 19.0    sol_taoi: 8.0   sol_deltai: 19.0  sol_deltai - sol_taoi: 11.0  sol_taoP: 8.0    sol_deltaP: 12.0    sol_deltaP - sol_taoP: 4.0  cI_i: 2533621.0     sol_c_i: 2533621.0    sol_gp_i: 0.0  total work: 2636440.0    wasted work: 0.38999180713386233
    i: 13.0   l_i: 6.0   p_i: -0.0    aI_i: 49.0      sol_a_i: 53.0  sol_g_i: 0.8    d_i: 69.0    sol_taoi: 53.0    sol_deltai: 61.0  sol_deltai - sol_taoi: 8.0    sol_taoP: 53.0    sol_deltaP: 58.0    sol_deltaP - sol_taoP: 5.0  cI_i: 1644208.0     sol_c_i: 2487868.8    sol_gp_i: 0.8  total work: 2636440.0    wasted work: 0.5635296081079038
    i: 14.0   l_i: 5.0   p_i: 29.0    aI_i: 3.0       sol_a_i: 6.2   sol_g_i: 0.4    d_i: 25.0    sol_taoi: 7.0   sol_deltai: 15.0  sol_deltai - sol_taoi: 8.0    sol_taoP: 7.0    sol_deltaP: 9.0    sol_deltaP - sol_taoP: 2.0  cI_i: 1741922.0     sol_c_i: 2480125.2    sol_gp_i: 0.4  total work: 2636440.0    wasted work: 0.592901033211451
    i: 15.0   l_i: 7.0   p_i: -0.0    aI_i: 5.0       sol_a_i: 7.0   sol_g_i: 0.2    d_i: 28.0    sol_taoi: 7.0   sol_deltai: 21.0  sol_deltai - sol_taoi: 14.0  sol_taoP: 7.0    sol_deltaP: 12.0    sol_deltaP - sol_taoP: 5.0  cI_i: 3309707.0     sol_c_i: 3626079.8    sol_gp_i: 0.6  total work: 3691016.0    wasted work: 0.24630258985601866
```

```
47      i: 16.0    l_i: 6.0    p_i: 28.0    aI_i: 9.0        sol_a_i: 16.0  sol_g_i: 1.0    d_i: 29.0    sol_taoi: 16.0     sol_deltai: 24.0  sol_deltai - sol_taoi: 8.0
    sol_taoP: 16.0     sol_deltaP: 18.0     sol_deltaP - sol_taoP: 2.0  cI_i: 1828571.0     sol_c_i: 2619503.0    sol_gp_i: 0.6  total work: 2636440.0    wasted work
    : 0.06424193230265055
48      i: 17.0    l_i: 6.0    p_i: 22.0    aI_i: 13.0       sol_a_i: 14.4  sol_g_i: 0.2    d_i: 33.0    sol_taoi: 20.0     sol_deltai: 26.0  sol_deltai - sol_taoi: 6.0
    sol_taoP: 20.0     sol_deltaP: 22.0     sol_deltaP - sol_taoP: 2.0  cI_i: 1088452.0     sol_c_i: 2353943.2    sol_gp_i: 0.6  total work: 2504618.0    wasted work
    : 0.5715085494075337
49      i: 18.0    l_i: 5.0    p_i: 17.0    aI_i: 9.0        sol_a_i: 15.0  sol_g_i: 1.0    d_i: 27.0    sol_taoi: 19.0     sol_deltai: 29.0  sol_deltai - sol_taoi: 10.0
    sol_taoP: 19.0     sol_deltaP: 21.0     sol_deltaP - sol_taoP: 2.0  cI_i: 2211540.0     sol_c_i: 2211540.0    sol_gp_i: 0.0  total work: 2372796.0    wasted work
    : 0.6116429731000895
50      i: 19.0    l_i: 5.0    p_i: -0.0    aI_i: 39.0       sol_a_i: 42.6  sol_g_i: 0.4    d_i: 62.0    sol_taoi: 43.0     sol_deltai: 50.0  sol_deltai - sol_taoi: 7.0
    sol_taoP: 43.0     sol_deltaP: 48.0     sol_deltaP - sol_taoP: 5.0  cI_i: 1546270.0     sol_c_i: 3655422.0    sol_gp_i: 1.0  total work: 3954660.0    wasted work
    : 1.1350078135667794
51
52  Optimal objective =  1586.0
53
54  Time: 411.000000
55
56
57
58
```