```
"E:\1 □□□□\3 □□□□□\1 □□□□□□\1 □□□□□□□\1_□□□□□□_□□□□\1_LW_□□□□2\6 □□□□\2 python code\01_My_Python_Code\Scripts\python.exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=43612

import sys; print('Python %s on %s' % (sys.version, sys.platform))
sys.path.extend(['E:\\1 □□□□\\3 □□□□□\\1 □□□□□□□\\1 □□□□□□□□□\\1_□□□□□□_□□□□\\1_LW_□□□□2\\6 □□□□\\2 python code\\01_My_Python_Code', 'E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□□/1_□□□□□□_□□□□/1_LW_□□□□2/6 □□□□/2 python code/01_My_Python_Code'])

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_□□□□2/6 □□□□/2 python code/01_My_Python_Code/main_BACASP_official_ENSGA-II.py', wdir='E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□□/1_□□□□□□_□□□□/1_LW_□□□□2/6 □□□□/2 python code/01_My_Python_Code')
Backend TkAgg is interactive backend. Turning interactive mode on.
Waiting 1s.....

This is the  R_13_7 _standerd_test.xlsx  optimization process solved by ENSGA-II algorithm.

Start

Before iteration:
    Read basic data
    Parameter setting:
        trail =  58
        Pop_size =  30
        Tolerance_iteration_unchanged_number =  10
        Chrom_size =  39
        Iter_num_GA =  300
        Select_rate =  0.85
        Crossover_rate =  0.95
        Mutation rate =  0.95
        Mu_oper_type =  1
        vessel_move_way =  2
        coefficient for Obj1=  1.9
        coefficient for Obj2=  0.10000000000000009
        gen =  0

Iteration begin:
Beging the No. 0  iteration:
    obj[0] = 63.50      temp_best_value_gen = 63.50
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 63.50   temp_best_value_gen = 63.50
    No, maintain solution  and obj[gen] = 63.50 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 4.5 11.  14.5 19.5 25.5  4.5  2.   2.5  4.   3.   3.   2.5  1.5]
        second level:  [ 6.  1.  0.  3.  4.  0.  7.  1.  4. 11. 15. 17. 20.]
        third level:  [7. 2. 3. 7. 2. 7. 2. 2. 6. 2. 6. 3. 2.] ]
    The No. 1  iteration is finished!

Beging the No. 2  iteration:
    obj[gen-1] = 63.50   temp_best_value_gen = 63.50
    No, maintain solution  and obj[gen] = 63.50 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [ 4.5 11.  14.5 19.5 25.5  4.5  2.   2.5  4.   3.   3.   2.5  1.5]
        second level:  [ 6.  1.  0.  3.  4.  0.  7.  1.  4. 11. 15. 17. 20.]
        third level:  [7. 2. 3. 7. 2. 7. 2. 2. 6. 2. 6. 3. 2.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 63.50   temp_best_value_gen = 58.40
    Yes, update solution and obj[gen] = 58.40
    solution chromosome =
        first level: [ [ 4.5 11.   1.5 19.5 25.5  4.5  2.5  2.5  4.   3.   3.   2.5 14.5]
        second level:  [ 6.  1. 20.  3.  4.  0.  1.  7.  9. 11. 15. 17.  0.]
        third level:  [7. 2. 2. 7. 2. 7. 2. 2. 6. 2. 6. 3. 3.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 58.40   temp_best_value_gen = 58.40
    No, maintain solution  and obj[gen] = 58.40 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 4.5 11.   1.5 19.5 25.5  4.5  2.5  2.5  4.   3.   3.   2.5 14.5]
        second level:  [ 6.  1. 20.  3.  4.  0.  1.  7.  9. 11. 15. 17.  0.]
        third level:  [7. 2. 2. 7. 2. 7. 2. 2. 6. 2. 6. 3. 3.] ]
    The No. 4  iteration is finished!

Beging the No. 5  iteration:
    obj[gen-1] = 58.40   temp_best_value_gen = 58.40
    No, maintain solution  and obj[gen] = 58.40 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [ 4.5 11.   1.5 19.5 25.5  4.5  2.5  2.5  4.   3.   3.   2.5 14.5]
```

```
        second level:  [ 6.  1. 20.  3.  4.  0.  1.  7.  9. 11. 15. 17.  0.]
        third level:  [7. 2. 2. 7. 2. 7. 2. 2. 6. 2. 6. 3. 3.] ]
    The No. 5  iteration is finished!

Beging the No. 6  iteration:
    obj[gen-1] = 58.40   temp_best_value_gen = 58.40
    No, maintain solution  and obj[gen] = 58.40 , and the tolerance_counter = 3
    solution chromosome =
        first level: [ [ 4.5 11.   1.5 19.5 25.5  4.5  2.5  2.5  4.   3.   3.   2.5 14.5]
        second level:  [ 6.  1. 20.  3.  4.  0.  1.  7.  9. 11. 15. 17.  0.]
        third level:  [7. 2. 2. 7. 2. 7. 2. 2. 6. 2. 6. 3. 3.] ]
    The No. 6  iteration is finished!

Beging the No. 7  iteration:
    obj[gen-1] = 58.40   temp_best_value_gen = 58.40
    No, maintain solution  and obj[gen] = 58.40 , and the tolerance_counter = 4
    solution chromosome =
        first level: [ [ 4.5 11.   1.5 19.5 25.5  4.5  2.5  2.5  4.   3.   3.   2.5 14.5]
        second level:  [ 6.  1. 20.  3.  4.  0.  1.  7.  9. 11. 15. 17.  0.]
        third level:  [7. 2. 2. 7. 2. 7. 2. 2. 6. 2. 6. 3. 3.] ]
    The No. 7  iteration is finished!

Beging the No. 8  iteration:
    obj[gen-1] = 58.40   temp_best_value_gen = 58.40
    No, maintain solution  and obj[gen] = 58.40 , and the tolerance_counter = 5
    solution chromosome =
        first level: [ [ 4.5 11.   1.5 19.5 25.5  4.5  2.5  2.5  4.   3.   3.   2.5 14.5]
        second level:  [ 6.  1. 20.  3.  4.  0.  1.  7.  9. 11. 15. 17.  0.]
        third level:  [7. 2. 2. 7. 2. 7. 2. 2. 6. 2. 6. 3. 3.] ]
    The No. 8  iteration is finished!


----------------------------------------------------------------------------------
The iteration is terminated and then visulize the solution:
    solution chromosome =
        first level: [ [ 4.5 11.   1.5 19.5 25.5  4.5  2.5  2.5  4.   3.   3.   2.5 14.5]
        second level:  [ 6.  1. 20.  3.  4.  0.  1.  7.  9. 11. 15. 17.  0.]
        third level:  [7. 2. 2. 7. 2. 7. 2. 2. 6. 2. 6. 3. 3.] ]
    Objective function values and some other indicators:
        Obj0 = 22.00            Obj1 = 166.00           Obj0 + Obj1 = 188.00
        Total movement of crane: 23.00
        Total waiting time in berth position: 94.00
        Total index of q during berthing: 468.00
    Specific arrangement for each vessel:
        V_id:  0            li: 9.0             xi: 4.5             bow of i: 0.0               tail of i: 9.0          gama_i0: 6.0            gama_i1: 7.0
                duration_time_i: 1.0            demand_i: 140.0         work load_i: 140.0      work load gap_i: 0
        V_id:  1            li: 4.0             xi: 11.0            bow of i: 9.0               tail of i: 13.0         gama_i0: 1.0            gama_i1: 4
    .0              duration_time_i: 3.0            demand_i: 120.0         work load_i: 120.0      work load gap_i: 0
        V_id:  2            li: 3.0             xi: 1.5             bow of i: 0.0               tail of i: 3.0          gama_i0: 20.0           gama_i1: 23.0
                duration_time_i: 3.0            demand_i: 100.0         work load_i: 100.0      work load gap_i: 0
        V_id:  3            li: 7.0             xi: 19.5            bow of i: 16.0              tail of i: 23.0         gama_i0: 3.0            gama_i1: 4
    .0              duration_time_i: 1.0            demand_i: 60.0          work load_i: 60.0       work load gap_i: 0
        V_id:  4            li: 9.0             xi: 25.5            bow of i: 21.0              tail of i: 30.0         gama_i0: 4.0            gama_i1: 8
    .0              duration_time_i: 4.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  5            li: 9.0             xi: 4.5             bow of i: 0.0               tail of i: 9.0          gama_i0: 0.0            gama_i1: 1.0
                duration_time_i: 1.0            demand_i: 140.0         work load_i: 140.0      work load gap_i: 0
        V_id:  6            li: 4.0             xi: 2.5             bow of i: 0.5               tail of i: 4.5          gama_i0: 1.0            gama_i1: 5.0
                duration_time_i: 4.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  7            li: 5.0             xi: 2.5             bow of i: 0.0               tail of i: 5.0          gama_i0: 7.0            gama_i1: 9.0
                duration_time_i: 2.0            demand_i: 60.0          work load_i: 60.0       work load gap_i: 0
        V_id:  8            li: 8.0             xi: 4.0             bow of i: 0.0               tail of i: 8.0          gama_i0: 9.0            gama_i1: 11.0
                duration_time_i: 2.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  9            li: 6.0             xi: 3.0             bow of i: 0.0               tail of i: 6.0          gama_i0: 11.0           gama_i1: 15.0
                duration_time_i: 4.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  10           li: 6.0             xi: 3.0             bow of i: 0.0               tail of i: 6.0          gama_i0: 15.0           gama_i1: 17.
    0               duration_time_i: 2.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  11           li: 5.0             xi: 2.5             bow of i: 0.0               tail of i: 5.0          gama_i0: 17.0           gama_i1: 20.
    0               duration_time_i: 3.0            demand_i: 140.0         work load_i: 140.0      work load gap_i: 0
        V_id:  12           li: 3.0             xi: 14.5            bow of i: 13.0              tail of i: 16.0         gama_i0: 0.0            gama_i1
    : 3.0               duration_time_i: 3.0            demand_i: 140.0         work load_i: 140.0      work load gap_i: 0

Algorithm finished and the total CPU time: 1208 s
End
```