```
"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=35780

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_11_2 _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 =  33
        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] = 38.00      temp_best_value_gen = 38.00
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 38.00   temp_best_value_gen = 38.00
    No, maintain solution  and obj[gen] = 38.00 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    The No. 1  iteration is finished!

Beging the No. 2  iteration:
    obj[gen-1] = 38.00   temp_best_value_gen = 38.00
    No, maintain solution  and obj[gen] = 38.00 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 38.00   temp_best_value_gen = 38.00
    No, maintain solution  and obj[gen] = 38.00 , and the tolerance_counter = 3
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 38.00   temp_best_value_gen = 38.00
    No, maintain solution  and obj[gen] = 38.00 , and the tolerance_counter = 4
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    The No. 4  iteration is finished!

Beging the No. 5  iteration:
    obj[gen-1] = 38.00   temp_best_value_gen = 38.00
    No, maintain solution  and obj[gen] = 38.00 , and the tolerance_counter = 5
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
```

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        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    The No. 5  iteration is finished!

Beging the No. 6  iteration:
    obj[gen-1] = 38.00   temp_best_value_gen = 38.00
    No, maintain solution  and obj[gen] = 38.00 , and the tolerance_counter = 6
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    The No. 6  iteration is finished!

Beging the No. 7  iteration:
    obj[gen-1] = 38.00   temp_best_value_gen = 38.00
    No, maintain solution  and obj[gen] = 38.00 , and the tolerance_counter = 7
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    The No. 7  iteration is finished!

Beging the No. 8  iteration:
    obj[gen-1] = 38.00   temp_best_value_gen = 38.00
    No, maintain solution  and obj[gen] = 38.00 , and the tolerance_counter = 8
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    The No. 8  iteration is finished!

Beging the No. 9  iteration:
    obj[gen-1] = 38.00   temp_best_value_gen = 38.00
    No, maintain solution  and obj[gen] = 38.00 , and the tolerance_counter = 9
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    The No. 9  iteration is finished!

Beging the No. 10  iteration:
    obj[gen-1] = 38.00   temp_best_value_gen = 38.00
    No, maintain solution  and obj[gen] = 38.00 , and the tolerance_counter = 10
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    The No. 10  iteration is finished!


----------------------------------------------------------------------------------
The iteration is terminated and then visulize the solution:
    solution chromosome =
        first level: [ [ 1.5  7.5 13.5 16.5 22.5 25.5  2.5  4.   2.5  3.   3.5]
        second level:  [ 2.  1.  4.  8.  4.  1.  4.  0.  6.  9. 13.]
        third level:  [2. 3. 3. 3. 5. 6. 4. 7. 2. 2. 2.] ]
    Objective function values and some other indicators:
        Obj0 = 15.00            Obj1 = 95.00            Obj0 + Obj1 = 110.00
        Total movement of crane: 30.00
        Total waiting time in berth position: 52.00
        Total index of q during berthing: 415.00
    Specific arrangement for each vessel:
        V_id:  0            li: 3.0             xi: 1.5             bow of i: 0.0             tail of i: 3.0             gama_i0: 2.0             gama_i1: 4.0
                    duration_time_i: 2.0            demand_i: 60.0            work load_i: 60.0            work load gap_i: 0
        V_id:  1            li: 9.0             xi: 7.5             bow of i: 3.0             tail of i: 12.0             gama_i0: 1.0             gama_i1: 2.0
                    duration_time_i: 1.0            demand_i: 60.0            work load_i: 60.0            work load gap_i: 0
        V_id:  2            li: 3.0             xi: 13.5             bow of i: 12.0             tail of i: 15.0             gama_i0: 4.0             gama_i1: 6
    .0                duration_time_i: 2.0            demand_i: 80.0            work load_i: 80.0            work load gap_i: 0
        V_id:  3            li: 3.0             xi: 16.5             bow of i: 15.0             tail of i: 18.0             gama_i0: 8.0             gama_i1:
    11.0                duration_time_i: 3.0            demand_i: 160.0            work load_i: 160.0            work load gap_i: 0
        V_id:  4            li: 9.0             xi: 22.5             bow of i: 18.0             tail of i: 27.0             gama_i0: 4.0             gama_i1: 5
    .0                duration_time_i: 1.0            demand_i: 100.0            work load_i: 100.0            work load gap_i: 0
        V_id:  5            li: 9.0             xi: 25.5             bow of i: 21.0             tail of i: 30.0             gama_i0: 1.0             gama_i1: 2
    .0                duration_time_i: 1.0            demand_i: 100.0            work load_i: 100.0            work load gap_i: 0
        V_id:  6            li: 5.0             xi: 2.5             bow of i: 0.0             tail of i: 5.0             gama_i0: 4.0             gama_i1: 6.0
                    duration_time_i: 2.0            demand_i: 140.0            work load_i: 140.0            work load gap_i: 0
        V_id:  7            li: 8.0             xi: 4.0             bow of i: 0.0             tail of i: 8.0             gama_i0: 0.0             gama_i1: 1.0
                    duration_time_i: 1.0            demand_i: 80.0            work load_i: 80.0            work load gap_i: 0
        V_id:  8            li: 5.0             xi: 2.5             bow of i: 0.0             tail of i: 5.0             gama_i0: 6.0             gama_i1: 9.0
                    duration_time_i: 3.0            demand_i: 120.0            work load_i: 120.0            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: 9.0             gama_i1: 13.0
                    duration_time_i: 4.0            demand_i: 140.0            work load_i: 140.0            work load gap_i: 0
        V_id:  10            li: 7.0             xi: 3.5             bow of i: 0.0             tail of i: 7.0             gama_i0: 13.0             gama_i1: 16.
    0                duration_time_i: 3.0            demand_i: 120.0            work load_i: 120.0            work load gap_i: 0
```

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153
154  Algorithm finished and the total CPU time: 1261 s
155  End
156
```