```
"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=35811

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_20_4 _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 =  60
        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] = 159.60    temp_best_value_gen = 159.60
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 159.60     temp_best_value_gen = 159.60
    No, maintain solution  and obj[gen] = 159.60 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 2.58  7.26  4.63  6.06  3.09  3.27  2.93  8.86  4.8   3.26  8.58  6.81
  2.32  1.84 16.   15.5   5.   13.5  16.   15.5 ]
        second level:  [ 5.  1.  3.  8. 12. 15. 17.  5. 20. 22. 26. 27. 29. 33.  2.  6.  0.  8.
 10. 12.]
        third level:  [2. 3. 2. 2. 3. 4. 3. 7. 3. 2. 6. 7. 2. 2. 3. 6. 6. 2. 4. 3.] ]
    The No. 1  iteration is finished!

Beging the No. 2  iteration:
    obj[gen-1] = 159.60     temp_best_value_gen = 159.60
    No, maintain solution  and obj[gen] = 159.60 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [ 2.58  7.26  4.63  6.06  3.09  3.27  2.93  8.86  4.8   3.26  8.58  6.81
  2.32  1.84 16.   15.5   5.   13.5  16.   15.5 ]
        second level:  [ 5.  1.  3.  8. 12. 15. 17.  5. 20. 22. 26. 27. 29. 33.  2.  6.  0.  8.
 10. 12.]
        third level:  [2. 3. 2. 2. 3. 4. 3. 7. 3. 2. 6. 7. 2. 2. 3. 6. 6. 2. 4. 3.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 159.60     temp_best_value_gen = 159.60
    No, maintain solution  and obj[gen] = 159.60 , and the tolerance_counter = 3
    solution chromosome =
        first level: [ [ 2.58  7.26  4.63  6.06  3.09  3.27  2.93  8.86  4.8   3.26  8.58  6.81
  2.32  1.84 16.   15.5   5.   13.5  16.   15.5 ]
        second level:  [ 5.  1.  3.  8. 12. 15. 17.  5. 20. 22. 26. 27. 29. 33.  2.  6.  0.  8.
 10. 12.]
        third level:  [2. 3. 2. 2. 3. 4. 3. 7. 3. 2. 6. 7. 2. 2. 3. 6. 6. 2. 4. 3.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 159.60     temp_best_value_gen = 159.60
    No, maintain solution  and obj[gen] = 159.60 , and the tolerance_counter = 4
    solution chromosome =
        first level: [ [ 2.58  7.26  4.63  6.06  3.09  3.27  2.93  8.86  4.8   3.26  8.58  6.81
  2.32  1.84 16.   15.5   5.   13.5  16.   15.5 ]
        second level:  [ 5.  1.  3.  8. 12. 15. 17.  5. 20. 22. 26. 27. 29. 33.  2.  6.  0.  8.
 10. 12.]
```

```
      third level:  [2. 3. 2. 2. 3. 4. 3. 7. 3. 2. 6. 7. 2. 2. 3. 6. 6. 2. 4. 3.] ]
   The No. 4  iteration is finished!

Beging the No. 5  iteration:
   obj[gen-1] = 159.60     temp_best_value_gen = 159.60
   No, maintain solution  and obj[gen] = 159.60 , and the tolerance_counter = 5
   solution chromosome =
      first level: [ [ 2.58  7.26  4.63  6.06  3.09  3.27  2.93  8.86  4.8   3.26  8.58  6.81
 2.32  1.84 16.   15.5   5.   13.5  16.   15.5 ]
      second level:  [ 5.  1.  3.  8. 12. 15. 17.  5. 20. 22. 26. 27. 29. 33.  2.  6.  0.  8.
 10. 12.]
      third level:  [2. 3. 2. 2. 3. 4. 3. 7. 3. 2. 6. 7. 2. 2. 3. 6. 6. 2. 4. 3.] ]
   The No. 5  iteration is finished!

Beging the No. 6  iteration:
   obj[gen-1] = 159.60     temp_best_value_gen = 159.60
   No, maintain solution  and obj[gen] = 159.60 , and the tolerance_counter = 6
   solution chromosome =
      first level: [ [ 2.58  7.26  4.63  6.06  3.09  3.27  2.93  8.86  4.8   3.26  8.58  6.81
 2.32  1.84 16.   15.5   5.   13.5  16.   15.5 ]
      second level:  [ 5.  1.  3.  8. 12. 15. 17.  5. 20. 22. 26. 27. 29. 33.  2.  6.  0.  8.
 10. 12.]
      third level:  [2. 3. 2. 2. 3. 4. 3. 7. 3. 2. 6. 7. 2. 2. 3. 6. 6. 2. 4. 3.] ]
   The No. 6  iteration is finished!


--------------------------------------------------------------------------------
The iteration is terminated and then visulize the solution:
   solution chromosome =
      first level: [ [ 2.58  7.26  4.63  6.06  3.09  3.27  2.93  8.86  4.8   3.26  8.58  6.81
 2.32  1.84 16.   15.5   5.   13.5  16.   15.5 ]
      second level:  [ 5.  1.  3.  8. 12. 15. 17.  5. 20. 22. 26. 27. 29. 33.  2.  6.  0.  8.
 10. 12.]
      third level:  [2. 3. 2. 2. 3. 4. 3. 7. 3. 2. 6. 7. 2. 2. 3. 6. 6. 2. 4. 3.] ]
   Objective function values and some other indicators:
      Obj0 = 35.00          Obj1 = 930.96          Obj0 + Obj1 = 965.96
      Total movement of crane: 50.96
      Total waiting time in berth position: 261.00
      Total index of q during berthing: 617.00
   Specific arrangement for each vessel:
      V_id:  0          li: 3.0          xi: 2.6          bow of i: 1.1          tail of i: 4.1          gama_i0: 5.0          gama_i1: 8.0
                duration_time_i: 3.0          demand_i: 100.0          work load_i: 100.0          work load gap_i: 0
      V_id:  1          li: 9.0          xi: 7.3          bow of i: 2.8          tail of i: 11.8          gama_i0: 1.0          gama_i1: 3.0
                duration_time_i: 2.0          demand_i: 80.0          work load_i: 80.0          work load gap_i: 0
      V_id:  2          li: 5.0          xi: 4.6          bow of i: 2.1          tail of i: 7.1          gama_i0: 3.0          gama_i1: 5.0
                duration_time_i: 2.0          demand_i: 60.0          work load_i: 60.0          work load gap_i: 0
      V_id:  3          li: 7.0          xi: 6.1          bow of i: 2.6          tail of i: 9.6          gama_i0: 8.0          gama_i1: 12.0
                duration_time_i: 4.0          demand_i: 140.0          work load_i: 140.0          work load gap_i: 0
      V_id:  4          li: 4.0          xi: 3.1          bow of i: 1.1          tail of i: 5.1          gama_i0: 12.0          gama_i1: 15.0
                duration_time_i: 3.0          demand_i: 160.0          work load_i: 160.0          work load gap_i: 0
      V_id:  5          li: 4.0          xi: 3.3          bow of i: 1.3          tail of i: 5.3          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:  6          li: 3.0          xi: 2.9          bow of i: 1.4          tail of i: 4.4          gama_i0: 17.0          gama_i1: 20.0
                duration_time_i: 3.0          demand_i: 160.0          work load_i: 160.0          work load gap_i: 0
      V_id:  7          li: 9.0          xi: 8.9          bow of i: 4.4          tail of i: 13.4          gama_i0: 5.0          gama_i1: 6.0
                duration_time_i: 1.0          demand_i: 140.0          work load_i: 140.0          work load gap_i: 0
      V_id:  8          li: 7.0          xi: 4.8          bow of i: 1.3          tail of i: 8.3          gama_i0: 20.0          gama_i1: 22.0
                duration_time_i: 2.0          demand_i: 100.0          work load_i: 100.0          work load gap_i: 0
      V_id:  9          li: 4.0          xi: 3.3          bow of i: 1.3          tail of i: 5.3          gama_i0: 22.0          gama_i1: 26.0
                duration_time_i: 4.0          demand_i: 140.0          work load_i: 140.0          work load gap_i: 0
      V_id:  10          li: 9.0          xi: 8.6          bow of i: 4.1          tail of i: 13.1          gama_i0: 26.0          gama_i1:
   27.0          duration_time_i: 1.0          demand_i: 80.0          work load_i: 80.0          work load gap_i: 0
      V_id:  11          li: 8.0          xi: 6.8          bow of i: 2.8          tail of i: 10.8          gama_i0: 27.0          gama_i1:
   29.0          duration_time_i: 2.0          demand_i: 160.0          work load_i: 160.0          work load gap_i: 0
      V_id:  12          li: 3.0          xi: 2.3          bow of i: 0.8          tail of i: 3.8          gama_i0: 29.0          gama_i1: 33.
   0          duration_time_i: 4.0          demand_i: 140.0          work load_i: 140.0          work load gap_i: 0
      V_id:  13          li: 3.0          xi: 1.8          bow of i: 0.3          tail of i: 3.3          gama_i0: 33.0          gama_i1: 36.
   0          duration_time_i: 3.0          demand_i: 100.0          work load_i: 100.0          work load gap_i: 0
      V_id:  14          li: 8.0          xi: 16.0          bow of i: 12.0          tail of i: 20.0          gama_i0: 2.0          gama_i1
   : 4.0          duration_time_i: 2.0          demand_i: 80.0          work load_i: 80.0          work load gap_i: 0
      V_id:  15          li: 7.0          xi: 15.5          bow of i: 12.0          tail of i: 19.0          gama_i0: 6.0          gama_i1
   : 8.0          duration_time_i: 2.0          demand_i: 160.0          work load_i: 160.0          work load gap_i: 0
      V_id:  16          li: 9.0          xi: 5.0          bow of i: 0.5          tail of i: 9.5          gama_i0: 0.0          gama_i1: 1.0
                duration_time_i: 1.0          demand_i: 60.0          work load_i: 60.0          work load gap_i: 0
      V_id:  17          li: 3.0          xi: 13.5          bow of i: 12.0          tail of i: 15.0          gama_i0: 8.0          gama_i1
   : 10.0          duration_time_i: 2.0          demand_i: 60.0          work load_i: 60.0          work load gap_i: 0
      V_id:  18          li: 8.0          xi: 16.0          bow of i: 12.0          tail of i: 20.0          gama_i0: 10.0          gama_i1
   : 12.0          duration_time_i: 2.0          demand_i: 140.0          work load_i: 140.0          work load gap_i: 0
      V_id:  19          li: 4.0          xi: 15.5          bow of i: 13.5          tail of i: 17.5          gama_i0: 12.0          gama_i1
   : 15.0          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: 1327 s
End
```