```
"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=56144

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_5 _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] = 143.32    temp_best_value_gen = 143.32
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 143.32     temp_best_value_gen = 143.32
    No, maintain solution  and obj[gen] = 143.32 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 3.98  3.89  4.83  3.78  4.84  4.31  4.44  8.85  5.06  6.92  2.11  5.07
  4.16  5.96  2.91  9.   12.5  14.   12.   11.  ]
        second level:  [29.  0.  6.  8. 10. 11. 12. 14. 16. 18. 19. 23. 25.  3. 32.  1.  2.  4.
  5.  8.]
        third level:  [2. 3. 5. 4. 3. 5. 6. 7. 5. 7. 2. 4. 2. 2. 2. 5. 2. 9. 4. 2.] ]
    The No. 1  iteration is finished!

Beging the No. 2  iteration:
    obj[gen-1] = 143.32     temp_best_value_gen = 143.32
    No, maintain solution  and obj[gen] = 143.32 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [ 3.98  3.89  4.83  3.78  4.84  4.31  4.44  8.85  5.06  6.92  2.11  5.07
  4.16  5.96  2.91  9.   12.5  14.   12.   11.  ]
        second level:  [29.  0.  6.  8. 10. 11. 12. 14. 16. 18. 19. 23. 25.  3. 32.  1.  2.  4.
  5.  8.]
        third level:  [2. 3. 5. 4. 3. 5. 6. 7. 5. 7. 2. 4. 2. 2. 2. 5. 2. 9. 4. 2.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 143.32     temp_best_value_gen = 143.32
    No, maintain solution  and obj[gen] = 143.32 , and the tolerance_counter = 3
    solution chromosome =
        first level: [ [ 3.98  3.89  4.83  3.78  4.84  4.31  4.44  8.85  5.06  6.92  2.11  5.07
  4.16  5.96  2.91  9.   12.5  14.   12.   11.  ]
        second level:  [29.  0.  6.  8. 10. 11. 12. 14. 16. 18. 19. 23. 25.  3. 32.  1.  2.  4.
  5.  8.]
        third level:  [2. 3. 5. 4. 3. 5. 6. 7. 5. 7. 2. 4. 2. 2. 2. 5. 2. 9. 4. 2.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 143.32     temp_best_value_gen = 143.32
    No, maintain solution  and obj[gen] = 143.32 , and the tolerance_counter = 4
    solution chromosome =
        first level: [ [ 3.98  3.89  4.83  3.78  4.84  4.31  4.44  8.85  5.06  6.92  2.11  5.07
  4.16  5.96  2.91  9.   12.5  14.   12.   11.  ]
        second level:  [29.  0.  6.  8. 10. 11. 12. 14. 16. 18. 19. 23. 25.  3. 32.  1.  2.  4.
  5.  8.]
```

```
        third level:  [2. 3. 5. 4. 3. 5. 6. 7. 5. 7. 2. 4. 2. 2. 2. 5. 2. 9. 4. 2.] ]
    The No. 4  iteration is finished!

Beging the No. 5  iteration:
    obj[gen-1] = 143.32     temp_best_value_gen = 143.32
    No, maintain solution  and obj[gen] = 143.32 , and the tolerance_counter = 5
    solution chromosome =
        first level: [ [ 3.98  3.89  4.83  3.78  4.84  4.31  4.44  8.85  5.06  6.92  2.11  5.07
  4.16  5.96  2.91  9.   12.5  14.   12.   11.  ]
        second level:  [29.  0.  6.  8. 10. 11. 12. 14. 16. 18. 19. 23. 25.  3. 32.  1.  2.  4.
  5.  8.]
        third level:  [2. 3. 5. 4. 3. 5. 6. 7. 5. 7. 2. 4. 2. 2. 2. 5. 2. 9. 4. 2.] ]
    The No. 5  iteration is finished!

Beging the No. 6  iteration:
    obj[gen-1] = 143.32     temp_best_value_gen = 143.32
    No, maintain solution  and obj[gen] = 143.32 , and the tolerance_counter = 6
    solution chromosome =
        first level: [ [ 3.98  3.89  4.83  3.78  4.84  4.31  4.44  8.85  5.06  6.92  2.11  5.07
  4.16  5.96  2.91  9.   12.5  14.   12.   11.  ]
        second level:  [29.  0.  6.  8. 10. 11. 12. 14. 16. 18. 19. 23. 25.  3. 32.  1.  2.  4.
  5.  8.]
        third level:  [2. 3. 5. 4. 3. 5. 6. 7. 5. 7. 2. 4. 2. 2. 2. 5. 2. 9. 4. 2.] ]
    The No. 6  iteration is finished!


--------------------------------------------------------------------------------
The iteration is terminated and then visulize the solution:
    solution chromosome =
        first level: [ [ 3.98  3.89  4.83  3.78  4.84  4.31  4.44  8.85  5.06  6.92  2.11  5.07
  4.16  5.96  2.91  9.   12.5  14.   12.   11.  ]
        second level:  [29.  0.  6.  8. 10. 11. 12. 14. 16. 18. 19. 23. 25.  3. 32.  1.  2.  4.
  5.  8.]
        third level:  [2. 3. 5. 4. 3. 5. 6. 7. 5. 7. 2. 4. 2. 2. 2. 5. 2. 9. 4. 2.] ]
    Objective function values and some other indicators:
        Obj0 = 35.00            Obj1 = 768.22           Obj0 + Obj1 = 803.22
        Total movement of crane: 33.22
        Total waiting time in berth position: 246.00
        Total index of q during berthing: 520.00
    Specific arrangement for each vessel:
        V_id:  0        li: 7.0         xi: 4.0         bow of i: 0.5           tail of i: 7.5          gama_i0: 29.0           gama_i1: 32.0
                duration_time_i: 3.0            demand_i: 120.0         work load_i: 120.0      work load gap_i: 0
        V_id:  1        li: 5.0         xi: 3.9         bow of i: 1.4           tail of i: 6.4          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
        V_id:  2        li: 7.0         xi: 4.8         bow of i: 1.3           tail of i: 8.3          gama_i0: 6.0            gama_i1: 8.0
                duration_time_i: 2.0            demand_i: 120.0         work load_i: 120.0      work load gap_i: 0
        V_id:  3        li: 5.0         xi: 3.8         bow of i: 1.3           tail of i: 6.3          gama_i0: 8.0            gama_i1: 10.0
                duration_time_i: 2.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  4        li: 5.0         xi: 4.8         bow of i: 2.3           tail of i: 7.3          gama_i0: 10.0           gama_i1: 11.0
                duration_time_i: 1.0            demand_i: 60.0          work load_i: 60.0       work load gap_i: 0
        V_id:  5        li: 8.0         xi: 4.3         bow of i: 0.3           tail of i: 8.3          gama_i0: 11.0           gama_i1: 12.0
                duration_time_i: 1.0            demand_i: 100.0         work load_i: 100.0      work load gap_i: 0
        V_id:  6        li: 6.0         xi: 4.4         bow of i: 1.4           tail of i: 7.4          gama_i0: 12.0           gama_i1: 14.0
                duration_time_i: 2.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  7        li: 9.0         xi: 8.8         bow of i: 4.3           tail of i: 13.3         gama_i0: 14.0           gama_i1: 16.
    0           duration_time_i: 2.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  8        li: 6.0         xi: 5.1         bow of i: 2.1           tail of i: 8.1          gama_i0: 16.0           gama_i1: 18.0
                duration_time_i: 2.0            demand_i: 140.0         work load_i: 140.0      work load gap_i: 0
        V_id:  9        li: 8.0         xi: 6.9         bow of i: 2.9           tail of i: 10.9         gama_i0: 18.0           gama_i1: 19.
    0           duration_time_i: 1.0            demand_i: 80.0          work load_i: 80.0       work load gap_i: 0
        V_id:  10       li: 3.0         xi: 2.1         bow of i: 0.6           tail of i: 3.6          gama_i0: 19.0           gama_i1: 23.
    0           duration_time_i: 4.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  11       li: 7.0         xi: 5.1         bow of i: 1.6           tail of i: 8.6          gama_i0: 23.0           gama_i1: 25.
    0           duration_time_i: 2.0            demand_i: 140.0         work load_i: 140.0      work load gap_i: 0
        V_id:  12       li: 5.0         xi: 4.2         bow of i: 1.7           tail of i: 6.7          gama_i0: 25.0           gama_i1: 29.
    0           duration_time_i: 4.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  13       li: 3.0         xi: 6.0         bow of i: 4.5           tail of i: 7.5          gama_i0: 3.0            gama_i1: 6.0
                duration_time_i: 3.0            demand_i: 100.0         work load_i: 100.0      work load gap_i: 0
        V_id:  14       li: 4.0         xi: 2.9         bow of i: 0.9           tail of i: 4.9          gama_i0: 32.0           gama_i1: 36.
    0           duration_time_i: 4.0            demand_i: 140.0         work load_i: 140.0      work load gap_i: 0
        V_id:  15       li: 5.0         xi: 9.0         bow of i: 6.5           tail of i: 11.5         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:  16       li: 6.0         xi: 12.5        bow of i: 9.5           tail of i: 15.5         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:  17       li: 9.0         xi: 14.0        bow of i: 9.5           tail of i: 18.5         gama_i0: 4.0            gama_i1
    : 5.0           duration_time_i: 1.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
        V_id:  18       li: 5.0         xi: 12.0        bow of i: 9.5           tail of i: 14.5         gama_i0: 5.0            gama_i1
    : 6.0           duration_time_i: 1.0            demand_i: 80.0          work load_i: 80.0       work load gap_i: 0
        V_id:  19       li: 3.0         xi: 11.0        bow of i: 9.5           tail of i: 12.5         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

Algorithm finished and the total CPU time: 1378 s
End
```