In [5]:

```python
import qhea
import benchmark

cost_functions = benchmark.get_tsp_names()[:2]
popsize = 100
generations = 1000
executions = 10
params = [
    qhea.Parameters(
        population_size=popsize,
        generation_count=generations,
        crossover_strategy=qhea.Crossover.Half
    ),
    qhea.Parameters(
        population_size=popsize,
        generation_count=generations,
        crossover_strategy=qhea.Crossover.Nodes
    ),
    qhea.Parameters(
        population_size=popsize,
        generation_count=generations,
        crossover_strategy=qhea.Crossover.Random
    ),

]
names = ['Crossover Half', 'Crossover Nodes', 'Crossover Random',
        ]
benchmark.analyze_and_display(params, executions,[], cost_functions , names)
```

```
Executing parameter 1 of 3 ...
Executing cost function 1 of 2 ...
Finished cost function 1 of 2 136.1337732999964 seconds.
Executing cost function 2 of 2 ...
Finished cost function 2 of 2 288.3258006000033 seconds.
Finished parameter 1 of 3 424.4602150999999 seconds.
Executing parameter 2 of 3 ...
Executing cost function 1 of 2 ...
Finished cost function 1 of 2 147.70010909999837 seconds.
Executing cost function 2 of 2 ...
Finished cost function 2 of 2 313.2090878000017 seconds.
Finished parameter 2 of 3 460.9097236000016 seconds.
Executing parameter 3 of 3 ...
Executing cost function 1 of 2 ...
Finished cost function 1 of 2 150.49074460000702 seconds.
Executing cost function 2 of 2 ...
Finished cost function 2 of 2 308.56698609999876 seconds.
Finished parameter 3 of 3 459.05845039999986 seconds.
================================================================================
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Algorithm was tested with 3 different parameter configurations
For each parameter configuration, the algorithm was tested against these pro
blems:
 ['distances-10-3-100', 'distances-15-1-100']
For each problem, the algorithm was executed 10 times to collect data.
--------------------------------------------------------------------------------
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```

```
----------------------------------------------------------------------------
----------
Tested Parameter Configuration: Crossover Half
Population Size:       100
Generation Count:      1000
Mutation Rate:         0.05
Crossover Rate:        1
Selection Pressure:    1.9
Optimization Rate:     1
Adjust Parameters:     False
Annealing Size:        5
Sub Problems:          [[]]
Init Strategy:         Random
Selection Strategy:    Fittest
Local Optimization:    LocalOptimization.OptimizationNone
Replacement Strategy: Replacement.ParentAndOffSpring


----------------------------------------------------------------------------
----------
Tested Parameter Configuration: Crossover Nodes
Population Size:       100
Generation Count:      1000
Mutation Rate:         0.05
Crossover Rate:        1
Selection Pressure:    1.9
Optimization Rate:     1
Adjust Parameters:     False
Annealing Size:        5
Sub Problems:          [[]]
Init Strategy:         Random
Selection Strategy:    Fittest
Local Optimization:    LocalOptimization.OptimizationNone
Replacement Strategy: Replacement.ParentAndOffSpring


----------------------------------------------------------------------------
----------
Tested Parameter Configuration: Crossover Random
Population Size:       100
Generation Count:      1000
Mutation Rate:         0.05
Crossover Rate:        1
Selection Pressure:    1.9
Optimization Rate:     1
Adjust Parameters:     False
Annealing Size:        5
Sub Problems:          [[]]
Init Strategy:         Random
Selection Strategy:    Fittest
Local Optimization:    LocalOptimization.OptimizationNone
Replacement Strategy: Replacement.ParentAndOffSpring
```
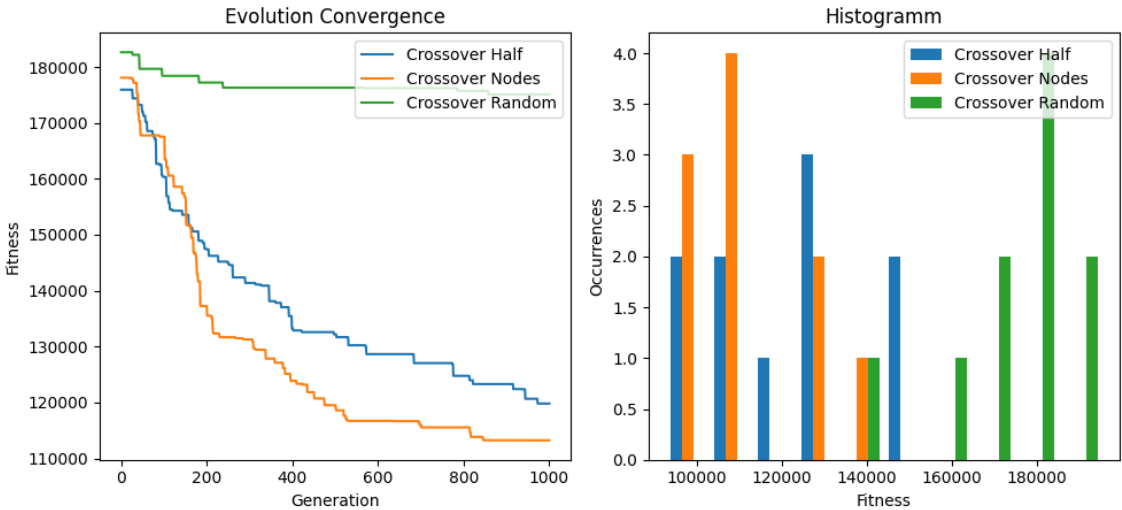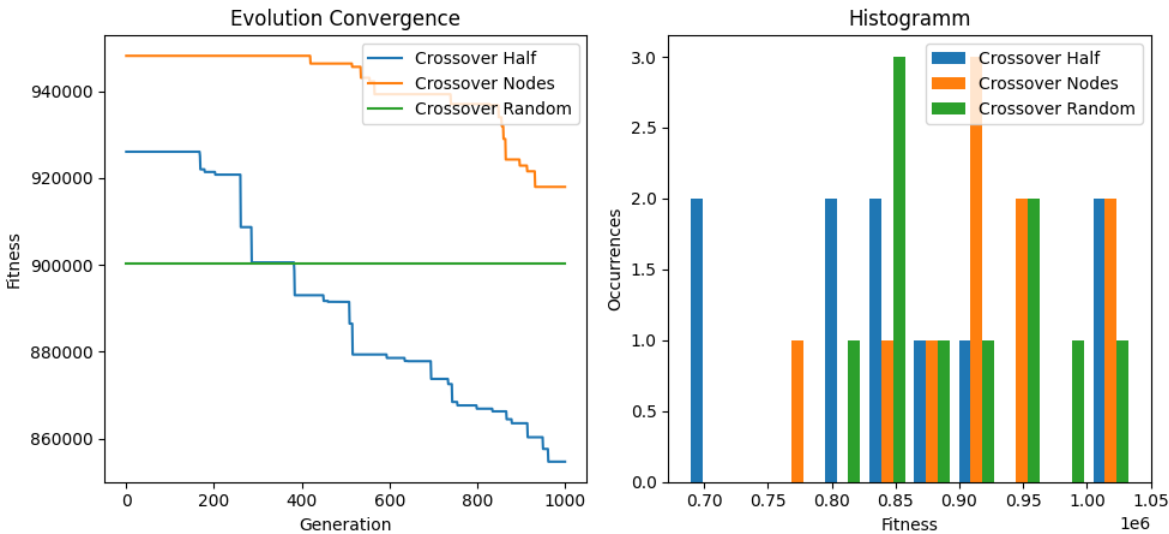
Problem distances-10-3-100



| | Parameters | Accuracy | Average | Best Result | Worst |
|---|---|---|---|---|---|
| 0 | Crossover Half | 0.0 | 119799.7 | 92630.0 | 149829.0 |
| 1 | Crossover Nodes | 0.0 | 113221.9 | 94761.0 | 141339.0 |
| 2 | Crossover Random | 0.0 | 175105.6 | 143408.0 | 195491.0 |

Problem distances-15-1-100



| | Parameters | Accuracy | Average | Best Result | Worst |
|---|---|---|---|---|---|
| 0 | Crossover Half | 0.0 | 854711.8 | 685606.0 | 1036389.0 |
| 1 | Crossover Nodes | 0.0 | 917978.8 | 761695.0 | 1034714.0 |
| 2 | Crossover Random | 0.0 | 900245.1 | 793141.0 | 1019078.0 |

In [ ]: