

Semestrální práce 2

```
%load_ext autoreload
%autoreload 2

The autoreload extension is already loaded. To reload it, use:
%reload_ext autoreload

import concurrent.futures
import time
import pandas as pd
from MWSATInstance import MWSATInstance
from MWSATSolution import MWSATSolution
from simulated_annealing import simulated_annealing
import matplotlib.pyplot as plt
import seaborn as sns
import os
import numpy as np
```

1) Ukázka implementace

Implementace programové reprezentace MWSAT instancí je v souboru MWSATInstance.py. Jsou uchovávány jednodlivé klauzule a proměnné jsou reprezenovány stejně jako ve vstupním souboru. Pro efektivní práci dále třída MWSATInstance uchovává pro každou proměnnou klauzule v kterých je obsažena.

Pojďme se jen rychle podívat na reprezentaci následujícího souboru:

```
c This Formular is generated by mcnf c c horn? no c forced? no c mixed sat? no c
clause length = 3 c c SAT instance uf20-91/uf20-01.cnf p mwcnf 20 91 w 272 39 39
194 1194 178 117 156 39 1 233 311 3111 311 39 39 311 0 c range 100 1500 straight 4 -
18 19 0 3 18 -5 0 -5 -8 -15 0 -20 7 -16 0 10 -13 -7 0 -12 -9 17 0 17 19 5 0 -16 9 15 0 11
-5 -14 0 18 -10 13 0 -3 11 12 0 -6 -17 -8 0 -18 14 10 -19 -15 10 0 12 18 -19 0 -8 4 7 0 -
8 -9 4 0 7 17 -15 0 12 -7 -14 0 -10 -11 8 0 2 -15 -11 0 9 6 1 0 -11 20 -17 0 9 -15 13 0 12
-7 -17 0 -18 -2 20 0 20 12 4 0 19 11 14 0 -16 18 -4 0 -1 -17 -19 0 -13 15 10 0 -12 -14 -
13 0 12 -14 -7 0 -7 16 10 0 6 10 7 0 20 14 -16 0 -19 17 11 0 -7 1 -20 0 -5 12 15 0 -4 -9
-13 0 12 -11 -7 0 -5 19 -8 0 11 6 17 0 20 -14 -15 0 13 -4 10 0 14 7 10 0 -5 9 20 0 10 1 -
19 0 -16 -15 -10 16 3 -11 0 -15 -10 4 0 4 -15 -3 0 -10 -16 11 0 -8 12 -5 0 14 -6 12 0 16
11 0 -13 -5 -10 -7 -21 2 0 1 -20 19 0 -2 -13 -8 0 15 18 4 0 -11 14 9 0 -6 -15 -2 0 5 -12 -
15 0 -6 17 5 0 -13 5 -19 0 20 -11 4 0 9 -17 15 0 -5 19 -18 0 -12 8 -10 0 -18 14 -4 0 15 -
9 13 0 9 -5 -10 10 -19 -14 0 20 9 4 0 -9 -2 19 0 -5 13 -17 0 2 -10 -18 0 -18 3 11 0 7 -9
17 0 -15 -6 -3 0 -2 3 -13 0 12 3 -2 0 -2 -3 17 0 20 -15 -16 0 -5 -17 -19 0 -20 -18 11 0 -
9 1 -5 0 -19 9 17 0 12 -2 17 0 4 -16 -5 0
```

```
# instance_demo = MWSATInstance(os.path.join("data", "wuf20-91", "wuf20-
91-M", "wuf20-01.mwcnf"))
```

```

instance_demo = MWSATInstance(os.path.join("test.mwcnf"))
print("Number of variables: ", instance_demo.num_vars)
print("First clause: ", instance_demo.clauses[0])
print("Clauses for variable 1: ",
      instance_demo.get_clauses_for_var(1))

print("Weight for variable 1: ",
      instance_demo.get_weight_for_variable(1))
print("Weight for variable 2: ",
      instance_demo.get_weight_for_variable(2))
print("Weight for variable 3: ",
      instance_demo.get_weight_for_variable(3))

print("Max-weight: ", instance_demo.max_single_weight)
print("Eval for [1,1,1]: ", instance_demo.evaluate([1,1,1]))
print("Eval for [1,0,1]: ", instance_demo.evaluate([1,0,1]))

print("Satisfied literals in clause 1, variables [1,1,1]: ",
      instance_demo.get_satisfied_vars_in_clause_count(instance_demo.clauses
[0],[1,1,1]))

Number of variables: 3
First clause: (1, -2, 3)
Clauses for variable 1: [(1, -2, 3)]
Weight for variable 1: 272
Weight for variable 2: 39
Weight for variable 3: 39
Max-weight: 272
Eval for [1,1,1]: (350, 1.2867647058823528, True)
Eval for [1,0,1]: (311, 1.1433823529411764, True)
Satisfied literals in clause 1, variables [1,1,1]: 2

solution = MWSATSolution(instance_demo)

print("Clauses: ", solution.instance.clauses)
print("Solution var values: ", solution.variable_values)
print("Solution score: ", solution.current_score)
print("Solution clauses satisfied", solution.clauses_satisfied)
print("-----Solution flip 1-----")
solution.update_variable_and_score(1)
print("Solution var values after: ", solution.variable_values)
print("Solution score after: ", solution.current_score)
print("Solution clauses satisfied after: ",
      solution.clauses_satisfied)

Clauses: [(1, -2, 3)]
Solution var values: [0, 0, 0]
Solution score: 0
Solution clauses satisfied 1
-----Solution flip 1-----

```

```

Solution var values after:  [1, 0, 0]
Solution score after:  272
Solution clauses satisfied after:  1

instance1 = MWSATInstance(os.path.join("data","wuf50-218","wuf50-218-
M","wuf50-02.mwcnf"),penaltyViolation_factor=3)
# result_solution, history_clauses_sat, history_raw_score =
simulated_annealing(instance1,1000,0.05,100,0.01)
result_solution, history =
simulated_annealing(instance1,1000,0.95,100,max_steps_without_improvement=10000,fitness_coefficient=1)
print(result_solution.variable_values)
print(result_solution.clauses_satisfied)
print(result_solution.current_score)

[0, 1, 1, 0, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1,
0, 0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0,
1, 1, 0, 1]
218
24366

```

2) Whitebox fáze

- Cílem této fáze bude nastavit parametry na omezené sadě instancí
- My budeme používat sadu wuf50-218 a z ní první 4 instance

```

from helper import
evaluate_algorithm_performance,plot_algorithm_run,get_solution_dict,
evaluate_param_tuning_no_plot

wuf_50_m_path = os.path.join("data", "wuf50-218", "wuf50-218-M")
wuf_50_n_path = os.path.join("data", "wuf50-218", "wuf50-218-N")
wuf_50_q_path = os.path.join("data", "wuf50-218", "wuf50-218-Q")
wuf_50_r_path = os.path.join("data", "wuf50-218", "wuf50-218-R")
wuf_50_path = os.path.join("data", "wuf50-218")

wuf_20_r_path = os.path.join("data", "wuf20-91", "wuf20-91-R")
wuf_20_n_path = os.path.join("data", "wuf20-91", "wuf20-91-N")
wuf_20_q_path = os.path.join("data", "wuf20-91", "wuf20-91-Q")
wuf_20_m_path = os.path.join("data", "wuf20-91", "wuf20-91-M")
wuf_20_path = os.path.join("data", "wuf20-91")

wuf_75_r_path = os.path.join("data", "wuf75-325", "wuf75-325-R")
wuf_75_m_path = os.path.join("data", "wuf75-325", "wuf75-325-M")
wuf_75_q_path = os.path.join("data", "wuf75-325", "wuf75-325-Q")
wuf_75_n_path = os.path.join("data", "wuf75-325", "wuf75-325-N")
wuf_75_path = os.path.join("data", "wuf75-325")

instance_paths = [os.path.join(wuf_50_r_path,x) for x in

```

```
os.listdir(wuf_50_r_path)[:10]
solutions_wuf_50_r =
get_solution_dict(os.path.join(wuf_50_path, "wuf50-218-R-opt.dat"))
```

Prvním krokem v White box fáze bude nastavení počáteční teploty. Využijeme vzorec z přednášky

$$T_0 = \frac{\delta}{\ln P_0}$$

kde δ je hlouba lokálního optima a P je pravděpodobnost útěku z tohoto optima na počátku. Parametr delta lze spočítat jako průměrnou hloubku lokálních optim a parametr P budeme volit jako hyperparametr.

Pro získání δ mám upravenou verzi algoritmu simulated_annealing, která ukládá hodnoty při zhoršení. Necháme algoritmus běžet s nekonečnou teplotou, tak aby byla explorace prostoru maximální a zjistili jsme průměrnou hloubku lokálních optim.

Pro klaždý druh generování vah budou optima mít různé hodnoty takže je budeme muset měřit zvlášť.

2.1) Baseline konfigurace

- Je potřeba vytvořit si nějakou kombinaci parametrů, který funguje "dobře" na zkoumaných instancích
- Od této konfigurace se potom odpíchneme a budeme ladit jednotlivé parametry samostatně

```
baseline_P0 = 0.9
baseline_cooling_coeff = 0.9
baseline_equilibrium_steps = 3 # Using the new coefficient (6 * 50 = 300)
baseline_max_steps_without_improvement = 300
baseline_fitness_coefficient = 100

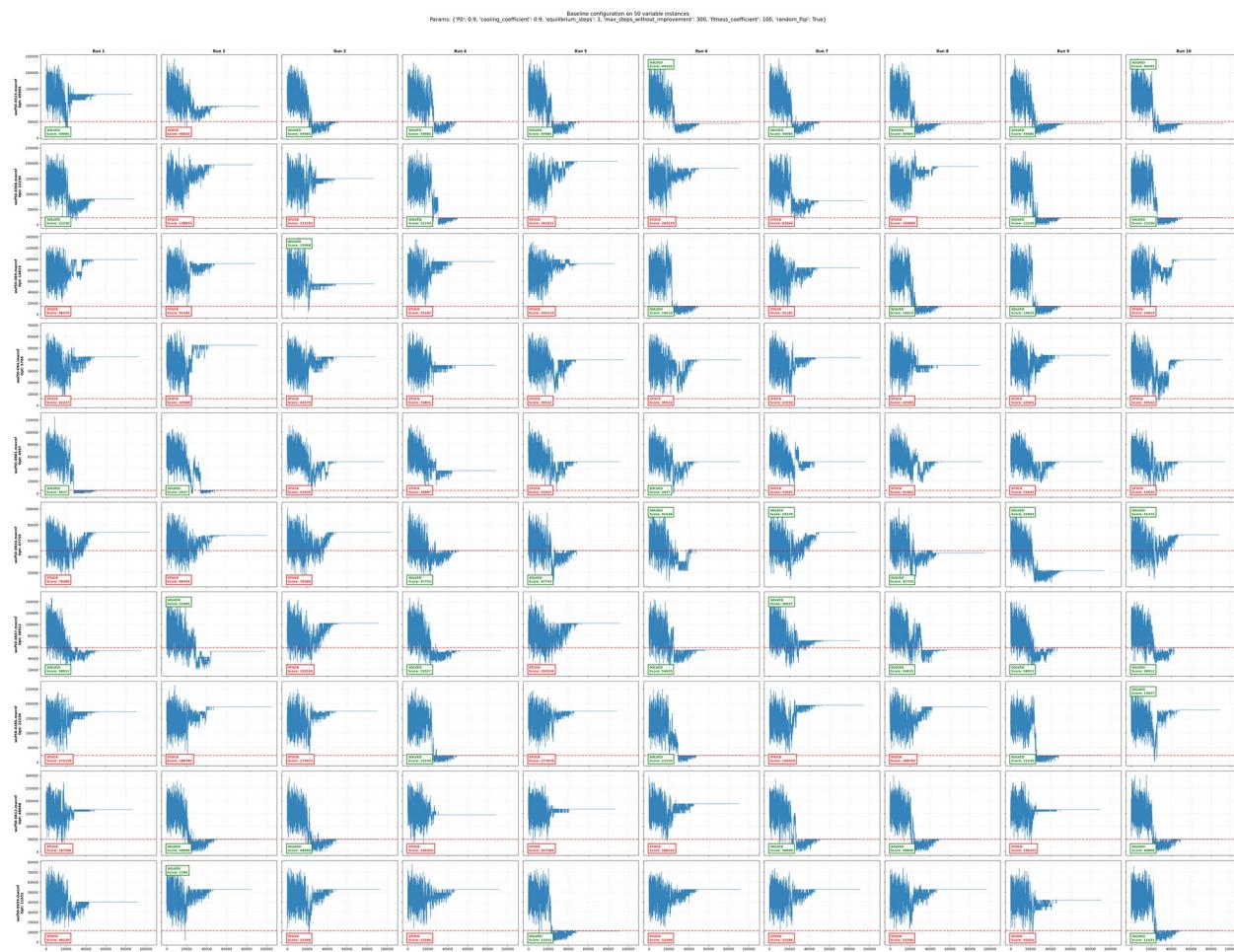
PARAMS = {
    "P0": baseline_P0,
    "cooling_coefficient": baseline_cooling_coeff,
    "equilibrium_steps": baseline_equilibrium_steps,
    "max_steps_without_improvement": baseline_max_steps_without_improvement,
    "fitness_coefficient": baseline_fitness_coefficient,
    "random_flip": True
}
results =
```

```

evaluate_algorithm_performance(instance_paths[:10],solutions_wuf_50_r,
PARAMS,10,"Baseline configuration on 50 variable instances")

--- Starting Baseline configuration on 50 variable instances (100
total runs) ---
Params: {'P0': 0.9, 'cooling_coefficient': 0.9, 'equilibrium_steps': 3, 'max_steps_without_improvement': 300, 'fitness_coefficient': 100, 'random_flip': True}
Processing Instance 1/10: wuf50-0323.mwcnf
Processing Instance 2/10: wuf50-0366.mwcnf
Processing Instance 3/10: wuf50-069.mwcnf
Processing Instance 4/10: wuf50-094.mwcnf
Processing Instance 5/10: wuf50-0861.mwcnf
Processing Instance 6/10: wuf50-0824.mwcnf
Processing Instance 7/10: wuf50-0657.mwcnf
Processing Instance 8/10: wuf50-0286.mwcnf
Processing Instance 9/10: wuf50-0612.mwcnf
Processing Instance 10/10: wuf50-0939.mwcnf

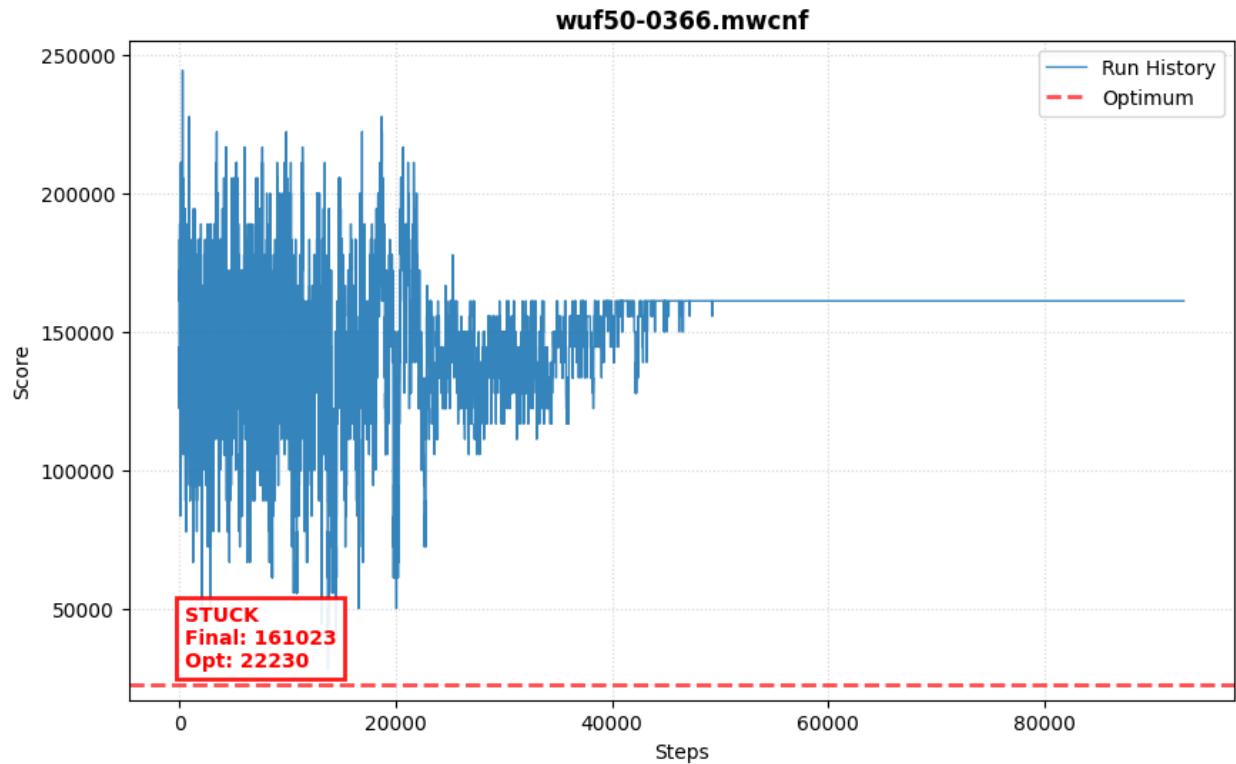
```



Instance of Opt	Avg Steps	Runs	Solved	Optimal	Avg Score	%
wuf50-0323.mwcnf 97.42 %	91690.8	10	9	7	48697.7	
wuf50-0366.mwcnf 100.00 %	89990.4	10	4	4	22230.0	
wuf50-069.mwcnf 93.76 %	88093.8	10	4	3	13703.2	
wuf50-094.mwcnf 0.00 %	91821.6	10	0	0	0.0	
wuf50-0861.mwcnf 100.00 %	92671.8	10	3	3	4937.0	
wuf50-0824.mwcnf 78.84 %	94633.8	10	7	3	37649.3	
wuf50-0657.mwcnf 91.27 %	94372.2	10	8	3	53769.1	
wuf50-0286.mwcnf 91.67 %	93260.4	10	4	3	20379.2	
wuf50-0612.mwcnf 100.00 %	89271.0	10	5	5	48896.0	
wuf50-0939.mwcnf 70.35 %	91233.0	10	3	2	8182.7	

```
instance = MWSATInstance(instance_paths[1])
plot_algorithm_run(instance,solutions_wuf_50_r,PARAMS)

<Axes: title={'center': 'wuf50-0366.mwcnf'}, xlabel='Steps',
ylabel='Score'>
```



Zlepší jinej random flip výkon baseline konfigurace

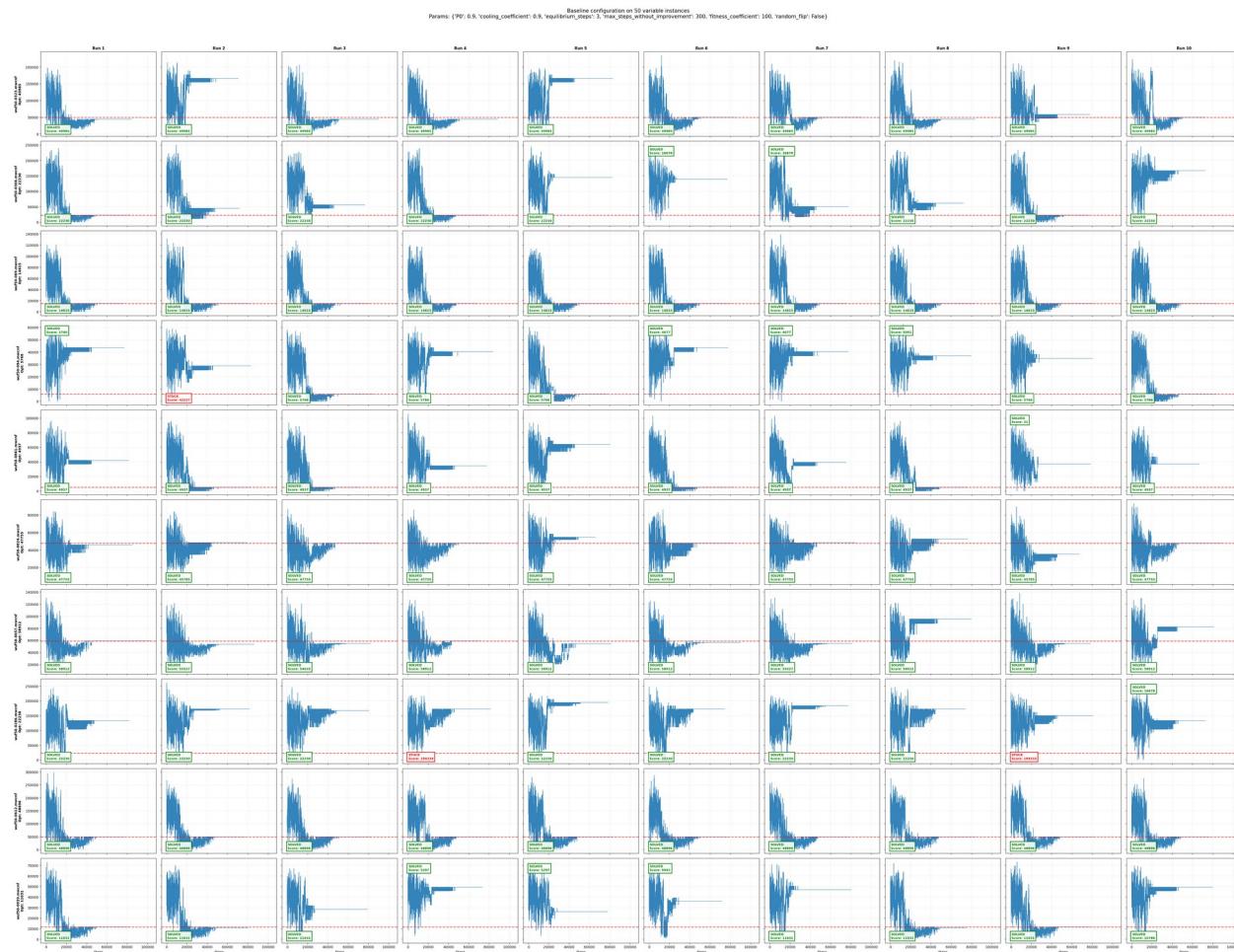
```

PARAMS = {
    "P0": baseline_P0,
    "cooling_coefficient": baseline_cooling_coeff,
    "equilibrium_steps": baseline_equilibrium_steps,
    "max_steps_without_improvement": baseline_max_steps_without_improvement,
    "fitness_coefficient": baseline_fitness_coefficient,
    "random_flip": False
}
results =
evaluate_algorithm_performance(instance_paths[:10], solutions_wuf_50_r,
PARAMS, 10, "Baseline configuration on 50 variable instances")

--- Starting Baseline configuration on 50 variable instances (100
total runs) ---
Params: {'P0': 0.9, 'cooling_coefficient': 0.9, 'equilibrium_steps': 3,
'max_steps_without_improvement': 300, 'fitness_coefficient': 100,
'random_flip': False}
Processing Instance 1/10: wuf50-0323.mwcnf
Processing Instance 2/10: wuf50-0366.mwcnf
Processing Instance 3/10: wuf50-069.mwcnf

```

Processing Instance 4/10: wuf50-094.mwcnf
 Processing Instance 5/10: wuf50-0861.mwcnf
 Processing Instance 6/10: wuf50-0824.mwcnf
 Processing Instance 7/10: wuf50-0657.mwcnf
 Processing Instance 8/10: wuf50-0286.mwcnf
 Processing Instance 9/10: wuf50-0612.mwcnf
 Processing Instance 10/10: wuf50-0939.mwcnf



Instance of Opt	Avg Steps	Runs	Solved	Optimal	Avg Score	%
wuf50-0323.mwcnf	100.00% 82534.8	10	10	10	49985.0	
wuf50-0366.mwcnf	95.00 % 76910.4	10	10	8	21119.6	
wuf50-069.mwcnf		10	10	10	14615.0	

100.00%	79199.4					
wuf50-094.mwcnf	10	9	5	5090.6		
88.29 %	80572.8					
wuf50-0861.mwcnf	10	10	9	4445.4		
90.04 %	77368.2					
wuf50-0824.mwcnf	10	10	8	47361.0		
99.17 %	80115.0					
wuf50-0657.mwcnf	10	10	7	57807.3		
98.12 %	83515.8					
wuf50-0286.mwcnf	10	8	7	21536.0		
96.88 %	78349.2					
wuf50-0612.mwcnf	10	10	10	48896.0		
100.00%	80442.0					
wuf50-0939.mwcnf	10	10	6	10110.8		
86.93 %	77695.2					
=====						
=====						

2.2 Nastavení Fitness coefficient

Nastavení fitness velmi ovlivňuje celý algoritmus, zejména míru toho jak moc jsou přijímány horší řešení.

```
from helper import run_tuning_experiment

base_params = {
    "cooling_coefficient": baseline_cooling_coeff,
    "equilibrium_steps": baseline_equilibrium_steps,
    "max_steps_without_improvement": baseline_max_steps_without_improvement,
    "P0": baseline_P0
}

target_path = instance_paths[0]
filename = os.path.basename(target_path)
key = filename.split(".")[0]
opt_weight = solutions_wuf_50_r.get(key, 0)

run_tuning_experiment(
    base_params=base_params,
    param_name="fitness_coefficient",
    param_values=[10, 50, 100],
    instance_path=target_path,
    optimal_weight=opt_weight,
    n_runs=3
)

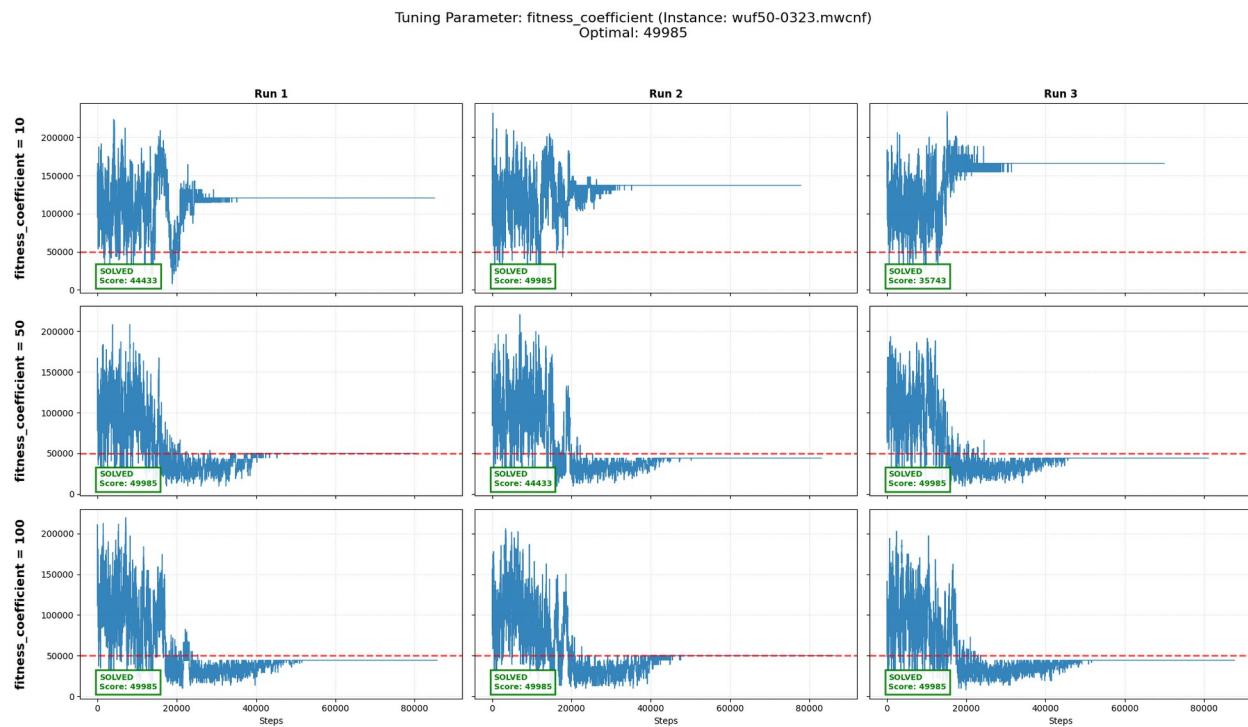
results = evaluate_param_tuning_no_plot(instance_paths[:10],
```

```

solutions_wuf_50_r,base_params,"fitness_coefficient",
[10,20,50,100,150,200])

--- Tuning 'fitness_coefficient' on wuf50-0323.mwcnf (9 total runs)
---
Testing fitness_coefficient = 10...
Testing fitness_coefficient = 50...
Testing fitness_coefficient = 100...

```



```

=====
fitness_coefficient | Runs | Solved | Optimal | Avg Score | % of Opt
| Avg Steps
-----
```

10 77608.0	3	3	1	43387.0	86.80 %	
50 81532.0	3	3	2	48134.3	96.30 %	
100 86546.0	3	3	3	49985.0	100.00%	

```

--- Tuning Parameter: 'fitness_coefficient' (Across 10 instances) ---

```

fitness_coefficient	Runs	Solved	Optimal	Avg % Opt	Avg Steps
10	40	29	14	85.82	78872.4
20	40	35	19	86.75	78970.5
50	40	40	30	95.21	79689.9
100	40	40	32	96.00	78594.4
150	40	39	31	93.97	78692.6
200	40	39	31	97.82	78872.4

best_fitness_coeff_param = 100

2.3) Nastavení P_0

- Jak dlouho budeme explorovat na začátku

```
base_params = {
    "equilibrium_steps": baseline_equilibrium_steps,
    "max_steps_without_improvement":
baseline_max_steps_without_improvement,
    "fitness_coefficient": best_fitness_coeff_param,
    "cooling_coefficient": baseline_cooling_coeff
}

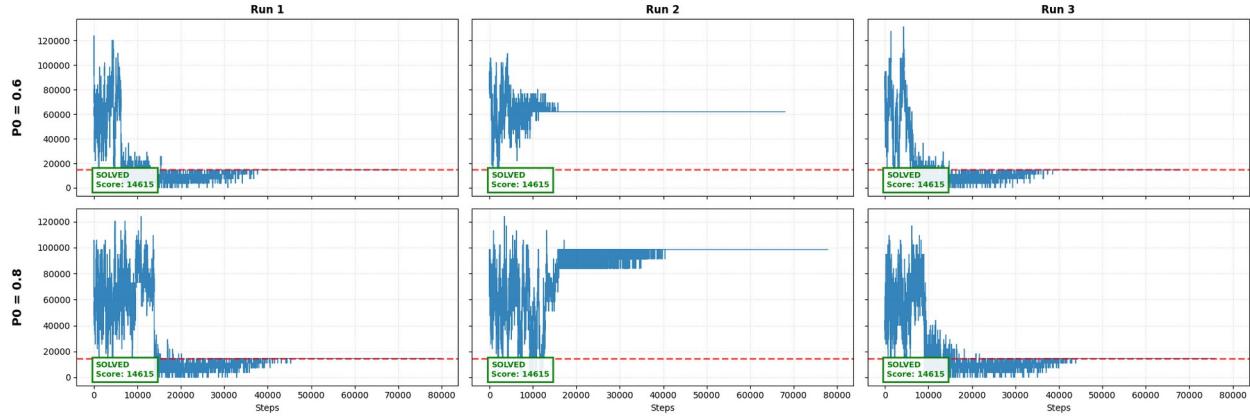
target_path = instance_paths[2]
filename = os.path.basename(target_path)
key = filename.split(".")[0]
opt_weight = solutions_wuf_50_r.get(key, 0)

run_tuning_experiment(
    base_params=base_params,
    param_name="P0",
    param_values=[0.6, 0.8],
    instance_path=target_path,
    optimal_weight=opt_weight,
    n_runs=3
)
```

```
results = evaluate_param_tuning_no_plot(instance_paths[:10],  
solutions_wuf_50_r,base_params,"P0",[0.6,0.7,0.8,0.85,0.9])
```

```
--- Tuning 'P0' on wuf50-069.mwcnf (6 total runs) ---  
Testing P0 = 0.6...  
Testing P0 = 0.8...
```

Tuning Parameter: P0 (Instance: wuf50-069.mwcnf)
Optimal: 14615



```
=====  
=====  
P0 | Runs | Solved | Optimal | Avg Score | % of Opt |  
Avg Steps
```

```
-----  
0.6 | 3 | 3 | 3 | 14615.0 | 100.00% |  
68888.0  
0.8 | 3 | 3 | 3 | 14615.0 | 100.00% |  
77826.0  
=====  
=====
```

```
--- Tuning Parameter: 'P0' (Across 10 instances) ---
```

```
=====  
=====  
P0 | Runs | Solved | Optimal | Avg % Opt | Avg  
Steps
```

```
-----  
0.6 | 40 | 39 | 32 | 93.21 |  
70942.6  
0.7 | 40 | 39 | 31 | 94.95 |  
73149.9  
0.8 | 40 | 39 | 31 | 95.34 |
```

76452.6					
0.85	40	40	31	96.65	
77106.6					
0.9	40	37	34	97.35	
80540.1					

```

best_p0_param = 0.8

PARAMS = base_params.copy()
PARAMS["P0"] = best_p0_param

# Grid to test
cooling_values = [0.95, 0.99, 0.995, 0.999]
# Note: These are coefficients (e.g., 4 means 4*N steps)
steps_values = [1, 3, 4, 6]

# Robustness settings
target_instances = instance_paths[:10] # First 10 instances
n_runs_per_instance = 3 # Runs per instance (Total runs = 10 * 3 = 30 per combo)

print(f"--- Global Grid Search (Total {len(target_instances)} * {n_runs_per_instance} runs per combo) ---")
print(f"Instances: {len(target_instances)}")
print(f"{'Cooling':<8} | {'Steps':<6} | {'Global Success':<15} | {'Global Avg Score':<16} | {'Total Steps':<12}")
print("-" * 80)

# --- Main Loops (Grid Search) ---
for alpha in cooling_values:
    for steps in steps_values:

        # 1. Update Parameters for this Grid Cell
        current_params = PARAMS.copy()
        current_params["cooling_coefficient"] = alpha
        current_params["equilibrium_steps"] = steps # Ensure this key matches your function

        # Aggregators for this specific parameter combination
        total_runs_global = 0
        total_solved_global = 0
        total_score_sum = 0
        total_steps_sum = 0

        # 2. Loop through ALL Target Instances

```

```

for path in target_instances:
    filename = os.path.basename(path)
    # Find optimum for this specific instance
    key = filename.split(".")[0]
    # Use appropriate dictionary (m=medium/hard,
    r=random/easy?)
    # Assuming solutions_wuf_50_m is your main dict
    optimal_weight = solutions_wuf_50_r.get(key, 0)

    instance = MWSATInstance(path)

    # 3. Run Repetitions
    for _ in range(n_runs_per_instance):
        best_state, history = simulated_annealing(instance,
**current_params)

        # Check metrics
        is_valid = (best_state.clauses_satisfied ==
instance.num_clauses)

        # Update sums
        total_runs_global += 1
        total_steps_sum += len(history)

        if is_valid:
            total_solved_global += 1
            total_score_sum += best_state.current_score
        else:
            # Penalize invalid runs with 0 score
            total_score_sum += 0

    # 4. Calculate Global Averages for this Combo
    global_success_rate = (total_solved_global /
total_runs_global) * 100
    global_avg_score = total_score_sum / total_runs_global
    global_avg_steps = total_steps_sum / total_runs_global

    # 5. Print Result Row
    print(f"alpha:<8} | {steps:<6} | {global_success_rate:>13.1f}%
| {global_avg_score:>16.1f} | {int(global_avg_steps):<12}")

--- Global Grid Search (Total 30 runs per combo) ---
Instances: 10
Cooling | Steps | Global Success | Global Avg Score | Total Steps
-----
0.95 | 1 | 83.3% | 25018.9 | 69251
0.95 | 3 | 100.0% | 28343.3 | 82643
0.95 | 4 | 100.0% | 28594.4 | 89002

```

0.95	6	100.0%	28695.7	93391
0.99	1	96.7%	26903.1	90869
0.99	3	96.7%	26948.9	105533
0.99	4	100.0%	28080.3	109872
0.99	6	96.7%	26301.5	100192
0.995	1	100.0%	28630.0	99364
0.995	3	100.0%	27459.6	94830
0.995	4	96.7%	25707.8	99727
0.995	6	93.3%	23443.3	102285
0.999	1	100.0%	28040.0	107437
0.999	3	100.0%	26917.2	103571
0.999	4	100.0%	26610.4	105918
0.999	6	100.0%	27121.2	106253

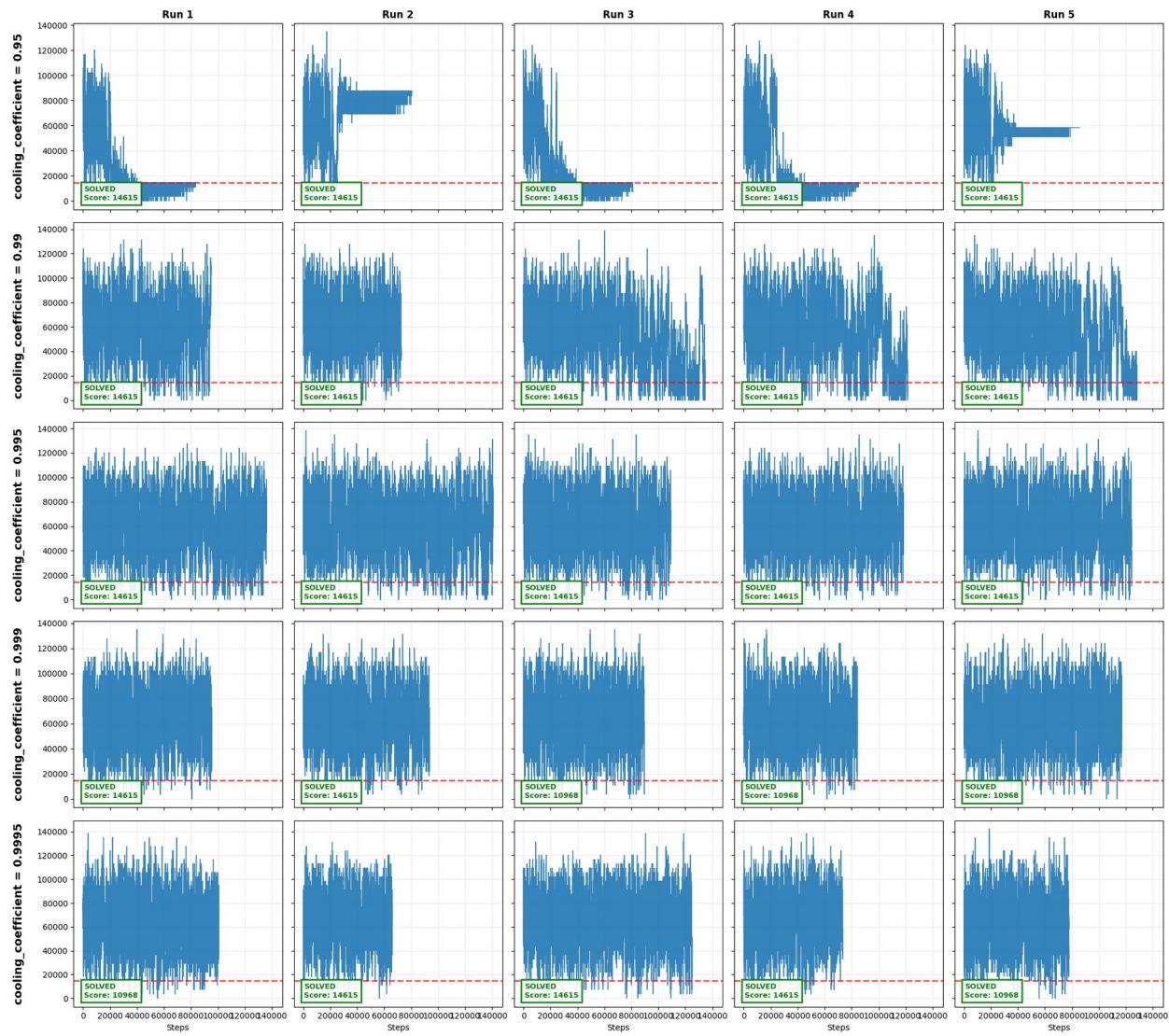
2.4) Nastavení `cooling coefficient`

```
base_params = {
    "equilibrium_steps": baseline_equilibrium_steps,
    "max_steps_without_improvement":
baseline_max_steps_without_improvement,
    "fitness_coefficient": best_fitness_coeff_param,
    "P0": best_p0_param
}

target_path = instance_paths[2]
filename = os.path.basename(target_path)
key = filename.split(".")[0]
opt_weight = solutions_wuf_50_r.get(key, 0)

run_tuning_experiment(
    base_params=base_params,
    param_name="cooling_coefficient",
    param_values=[0.95, 0.99, 0.995, 0.999, 0.9995],
    instance_path=target_path,
    optimal_weight=opt_weight,
    n_runs=5
)
--- Tuning 'cooling_coefficient' on wuf50-069.mwcnf (25 total runs)
---
Testing cooling_coefficient = 0.95...
Testing cooling_coefficient = 0.99...
Testing cooling_coefficient = 0.995...
Testing cooling_coefficient = 0.999...
Testing cooling_coefficient = 0.9995...
```

Tuning Parameter: cooling_coefficient (Instance: wuf50-069.mwcnf)
Optimal: 14615



=====

cooling_coefficient	Runs	Solved	Optimal	Avg Score	% of Opt
0.95	5	5	5	14615.0	100.00%

83188.8					
0.99	5	5	5	14615.0	100.00%
110395.2					
0.995	5	5	5	14615.0	100.00%
125698.8					

0.999		5		5		2		12426.8		85.03 %	
96007.2											
0.9995		5		5		3		13156.2		90.02 %	
88551.6											
<hr/>											
<hr/>											
best_cooling_coeff = 0.95											

2.5) Equilibrium_steps

- je to parametr úzce spjatý s rychlosí chlazení, takže bude dávat smysl ho nastavit hned jako následující

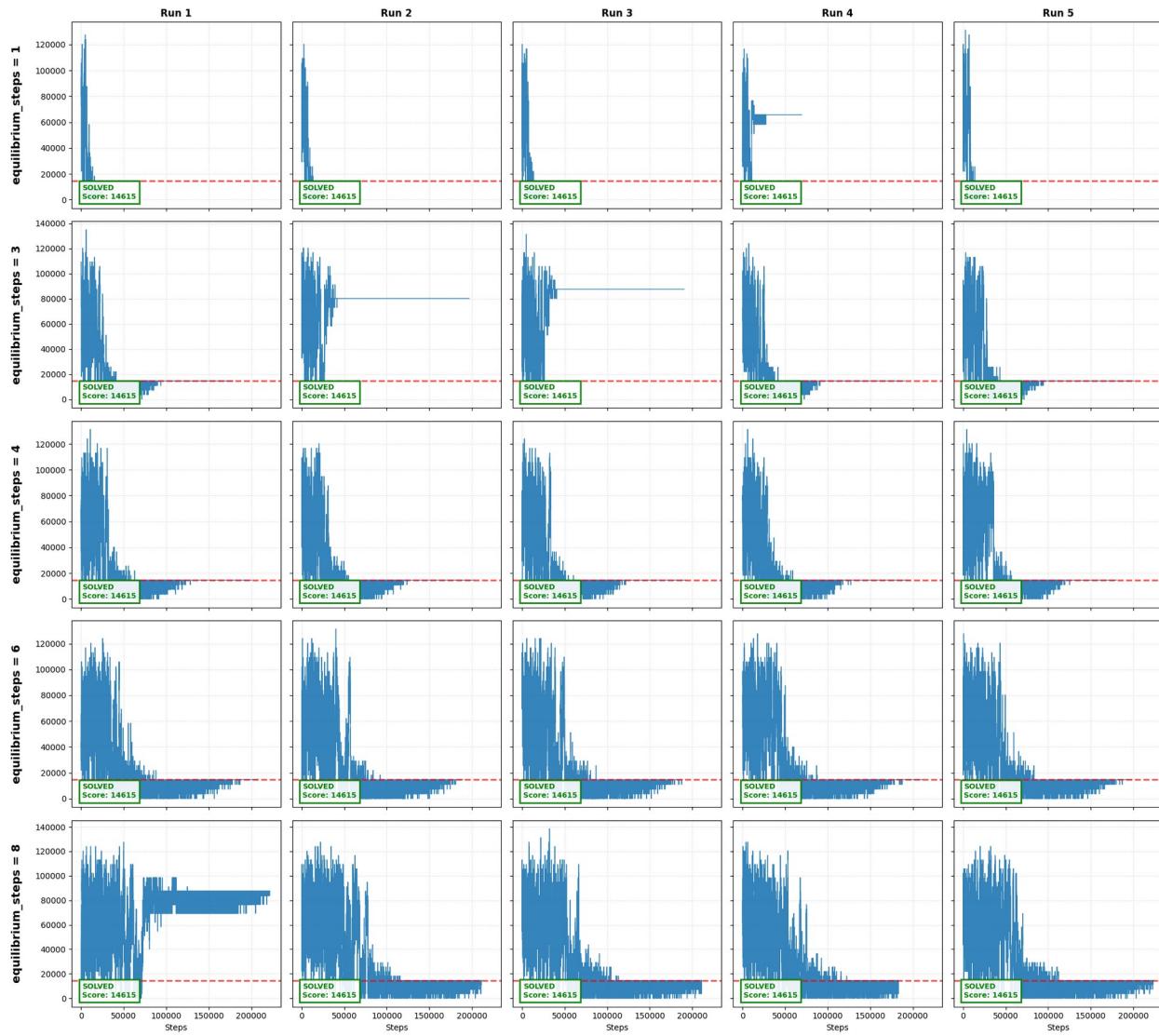
```
base_params = {
    "cooling_coefficient": best_cooling_coeff,
    "max_steps_without_improvement": 800,
    "fitness_coefficient": best_fitness_coeff_param,
    "P0": best_p0_param,
}

target_path = instance_paths[2]
filename = os.path.basename(target_path)
key = filename.split(".")[0]
opt_weight = solutions_wuf_50_r.get(key, 0)

run_tuning_experiment(
    base_params=base_params,
    param_name="equilibrium_steps",
    param_values=[1,3,4,6,8],
    instance_path=target_path,
    optimal_weight=opt_weight,
    n_runs=5
)

--- Tuning 'equilibrium_steps' on wuf50-069.mwcnf (25 total runs) ---
Testing equilibrium_steps = 1...
Testing equilibrium_steps = 3...
Testing equilibrium_steps = 4...
Testing equilibrium_steps = 6...
Testing equilibrium_steps = 8...
```

Tuning Parameter: equilibrium_steps (Instance: wuf50-069.mwcnf)
Optimal: 14615



equilibrium_steps	Runs	Solved	Optimal	Avg Score	% of Opt	Avg Steps
1 69324.0	5	5	5	14615.0	100.00%	
3 191360.4	5	5	5	14615.0	100.00%	
4 194456.0	5	5	5	14615.0	100.00%	

6		5		5		14615.0		100.00%	
199339.2									
8		5		5		14615.0		100.00%	
209977.6									
=====									
=====									
best_equilibrium_steps = 6									
# base_params = {									
# "cooling_coefficient": best_cooling_coeff,									
# "fitness_coefficient": best_fitness_coeff_param,									
# "equilibrium_steps": best_equilibrium_steps,									
# "P0": best_p0_param									
# }									
# results =									
evaluate_algorithm_performance(instance_paths[:2], solutions_wuf_50_r, base_params, 3)									

2.6) max_steps_without_improvement

```
base_params = {
    "cooling_coefficient": best_cooling_coeff,
    "fitness_coefficient": best_fitness_coeff_param,
    "equilibrium_steps": best_equilibrium_steps,
    "P0": best_p0_param
}

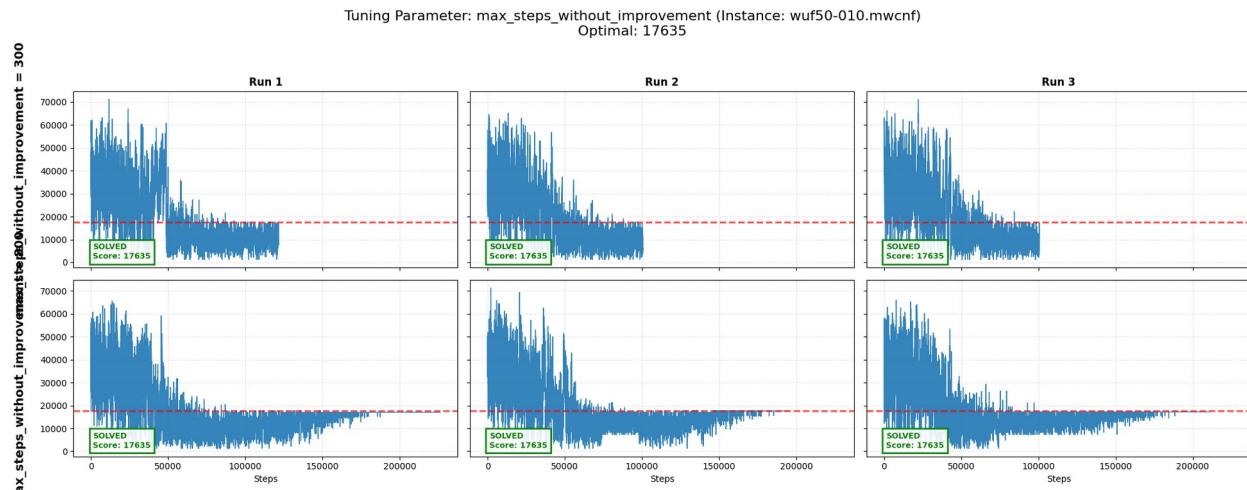
target_path = instance_paths[1]
filename = os.path.basename(target_path)
key = filename.split(".")[0]
opt_weight = solutions_wuf_50_r.get(key, 0)

run_tuning_experiment(
    base_params=base_params,
    param_name="max_steps_without_improvement",
    param_values=[300, 800],
    instance_path=target_path,
    optimal_weight=opt_weight,
    n_runs=3
)

results = evaluate_param_tuning_no_plot(instance_paths[:10],
solutions_wuf_50_r, base_params, "max_steps_without_improvement",
[200, 300, 600, 800, 1200])

--- Tuning 'max_steps_without_improvement' on wuf50-010.mwcnf (6 total
runs) ---
```

```
Testing max_steps_without_improvement = 300...
Testing max_steps_without_improvement = 800...
```



```
=====
=====
```

max_steps_without_improvement	Runs	Solved	Optimal	Avg Score	% of Opt	Avg Steps
-------------------------------	------	--------	---------	-----------	----------	-----------

300	3	3	3	17635.0	100.00%	
107692.0						
800	3	3	3	17635.0	100.00%	
210588.0						

```
=====
=====
```

```
--- Tuning Parameter: 'max_steps_without_improvement' (Across 10 instances) ---
```

```
=====
=====
```

max_steps_without_improvement	Runs	Solved	Optimal	Avg %
-------------------------------	------	--------	---------	-------

200	40	40	38	99.66	
72888.3					
300	40	40	39	100.00	
94928.1					
600	40	40	40	100.00	
158268.0					
800	40	40	39	99.87	
205552.2					

1200		40		40		38		99.69	
290735.7									
=====									
=====									
best_max_steps_without_improvement = 800									
FINAL_CONFIG = {									
"P0": best_p0_param,									
"cooling_coefficient": best_cooling_coeff,									
"equilibrium_steps": best_equilibrium_steps,									
"max_steps_without_improvement":									
best_max_steps_without_improvement,									
"fitness_coefficient": best_fitness_coeff_param									
}									

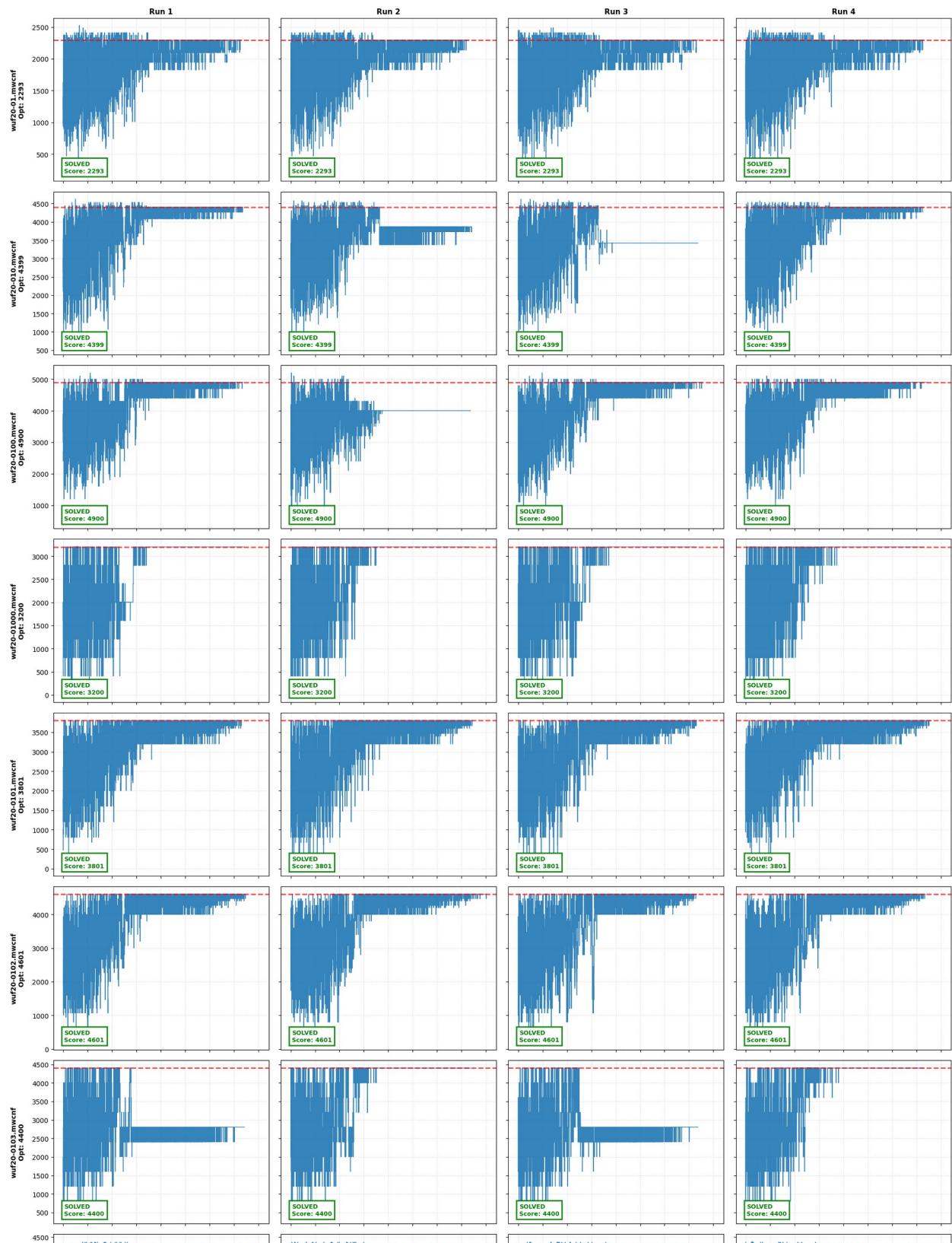
Test na instancích s 20 a 75 proměnnými

```
instance_paths_20 = [os.path.join(wuf_20_m_path,x) for x in
os.listdir(wuf_20_m_path)[:10]]
solutions_wuf_20_m =
get_solution_dict(os.path.join(wuf_20_path,"wuf20-91-M-opt.dat"))

results =
evaluate_algorithm_performance(instance_paths_20,solutions_wuf_20_m,FINAL_CONFIG,4,"Baseline configuration on 20 variable instances")

--- Starting Baseline configuration on 20 variable instances (40 total runs) ---
Params: {'P0': 0.8, 'cooling_coefficient': 0.95, 'equilibrium_steps': 6, 'max_steps_without_improvement': 800, 'fitness_coefficient': 100}
Processing Instance 1/10: wuf20-01.mwcnf
Processing Instance 2/10: wuf20-010.mwcnf
Processing Instance 3/10: wuf20-0100.mwcnf
Processing Instance 4/10: wuf20-01000.mwcnf
Processing Instance 5/10: wuf20-0101.mwcnf
Processing Instance 6/10: wuf20-0102.mwcnf
Processing Instance 7/10: wuf20-0103.mwcnf
Processing Instance 8/10: wuf20-0104.mwcnf
Processing Instance 9/10: wuf20-0105.mwcnf
Processing Instance 10/10: wuf20-0106.mwcnf
```

Baseline configuration on 20 variable instances
Params: {'PO': 0.8, 'cooling_coefficient': 0.95, 'equilibrium_steps': 6, 'max_steps_without_improvement': 800, 'fitness_coefficient': 100}



Instance of Opt	Avg Steps	Runs	Solved	Optimal	Avg Score	%
wuf20-01.mwcnf 100.00% 73300.5		4	4	4	2293.0	
wuf20-010.mwcnf 100.00% 73710.0		4	4	4	4399.0	
wuf20-0100.mwcnf 100.00% 74392.5		4	4	4	4900.0	
wuf20-01000.mwcnf 100.00% 73710.0		4	4	4	3200.0	
wuf20-0101.mwcnf 100.00% 74256.0		4	4	4	3801.0	
wuf20-0102.mwcnf 100.00% 75484.5		4	4	4	4601.0	
wuf20-0103.mwcnf 100.00% 73710.0		4	4	4	4400.0	
wuf20-0104.mwcnf 100.00% 73983.0		4	4	4	4248.0	
wuf20-0105.mwcnf 100.00% 74119.5		4	4	4	3200.0	
wuf20-0106.mwcnf 100.00% 73164.0		4	4	4	3600.0	

75 proměnných

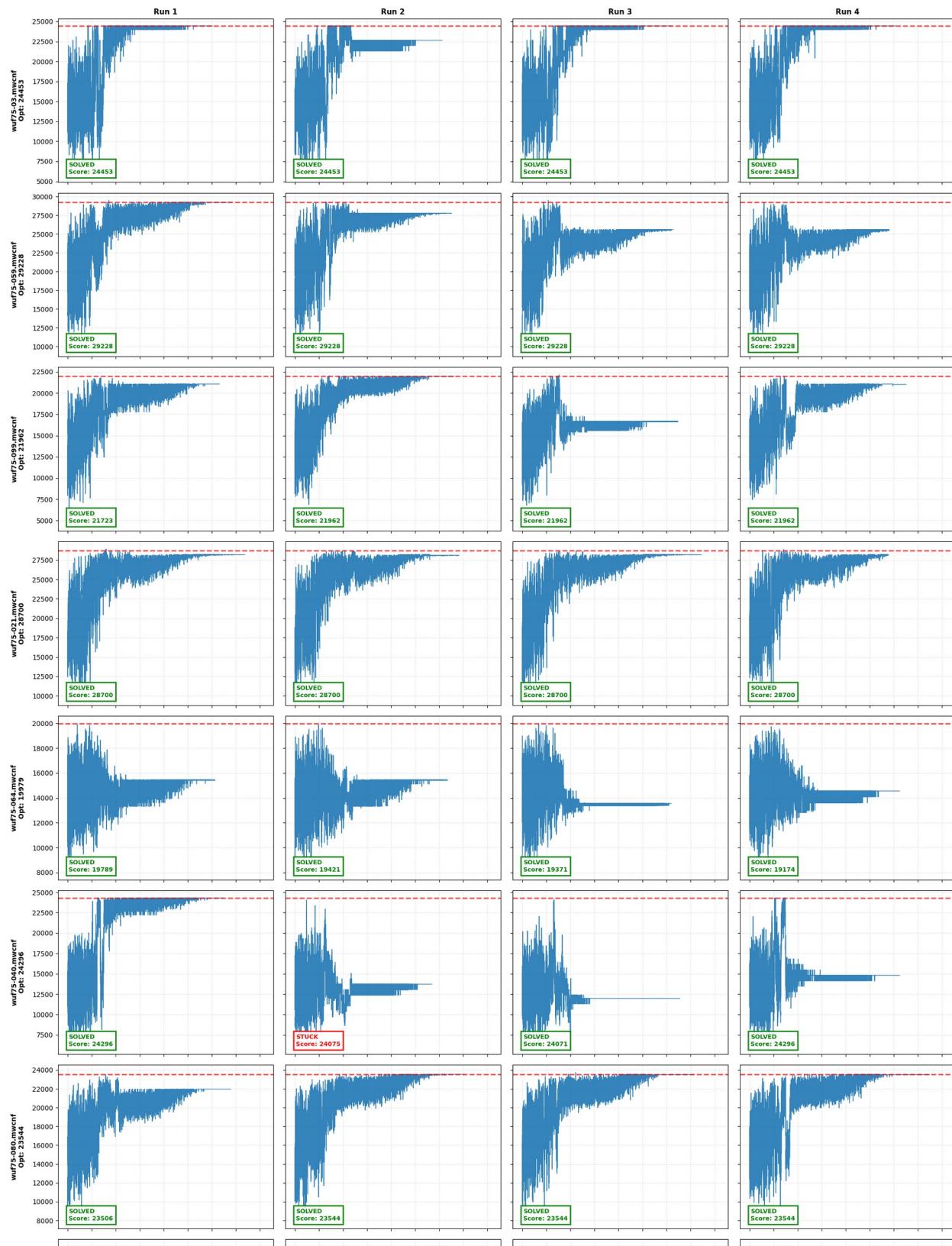
```
instance_paths_75 = [os.path.join(wuf_75_m_path,x) for x in
os.listdir(wuf_75_m_path)[:10]]
solutions_wuf_75_m =
get_solution_dict(os.path.join(wuf_75_path, "wuf75-325-M-opt.dat"))
results =
evaluate_algorithm_performance(instance_paths_75,solutions_wuf_75_m,FI
NAL_CONFIG,4,"Baseline configuration on 75 variable instances")

--- Starting Baseline configuration on 75 variable instances (40 total
runs) ---

Params: {'P0': 0.8, 'cooling_coefficient': 0.95, 'equilibrium_steps': 6,
'max_steps_without_improvement': 800, 'fitness_coefficient': 100}
Processing Instance 1/10: wuf75-03.mwcnf
Processing Instance 2/10: wuf75-059.mwcnf
Processing Instance 3/10: wuf75-099.mwcnf
Processing Instance 4/10: wuf75-021.mwcnf
```

```
Processing Instance 5/10: wuf75-064.mwcnf
Processing Instance 6/10: wuf75-040.mwcnf
Processing Instance 7/10: wuf75-080.mwcnf
Processing Instance 8/10: wuf75-038.mwcnf
Processing Instance 9/10: wuf75-082.mwcnf
Processing Instance 10/10: wuf75-042.mwcnf
```

Baseline configuration on 75 variable instances
Params: {'PO': 0.8, 'cooling_coefficient': 0.95, 'equilibrium_steps': 6, 'max_steps_without_improvement': 800, 'fitness_coefficient': 100}



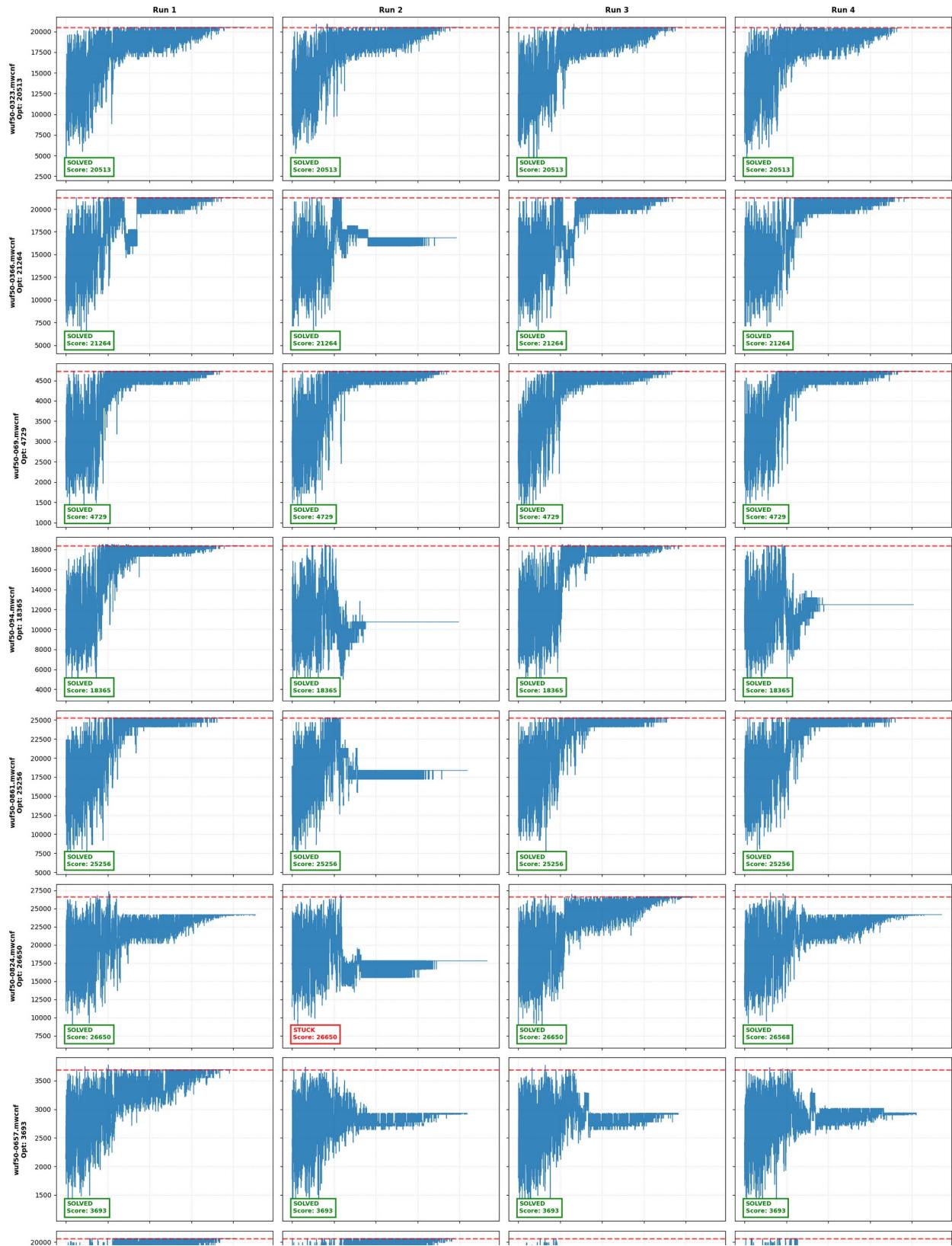
Instance of Opt	Avg Steps	Runs	Solved	Optimal	Avg Score	%
wuf75-03.mwcnf 100.00%	305662.5	4	4	4	24453.0	
wuf75-059.mwcnf 100.00%	317850.0	4	4	4	29228.0	
wuf75-099.mwcnf 99.73 %	324187.5	4	4	3	21902.2	
wuf75-021.mwcnf 100.00%	342712.5	4	4	4	28700.0	
wuf75-064.mwcnf 97.30 %	311512.5	4	4	0	19438.8	
wuf75-040.mwcnf 99.69 %	312000.0	4	3	2	24221.0	
wuf75-080.mwcnf 99.96 %	355875.0	4	4	3	23534.5	
wuf75-038.mwcnf 100.00%	318825.0	4	4	4	25801.0	
wuf75-082.mwcnf 100.00%	337350.0	4	4	4	22393.0	
wuf75-042.mwcnf 100.00%	364162.5	4	4	4	24792.0	

Jiné generování Vah

```
instance_paths_50 = [os.path.join(wuf_50_m_path,x) for x in
os.listdir(wuf_50_m_path)[:10]]
solutions_wuf_50_m =
get_solution_dict(os.path.join(wuf_50_path, "wuf50-218-M-opt.dat"))
results =
evaluate_algorithm_performance(instance_paths_50,solutions_wuf_50_m,FINAL_CONFIG,4,"")
--- Starting (40 total runs) ---
Params: {'P0': 0.8, 'cooling_coefficient': 0.95, 'equilibrium_steps': 6, 'max_steps_without_improvement': 800, 'fitness_coefficient': 100}
Processing Instance 1/10: wuf50-0323.mwcnf
Processing Instance 2/10: wuf50-0366.mwcnf
Processing Instance 3/10: wuf50-069.mwcnf
Processing Instance 4/10: wuf50-094.mwcnf
Processing Instance 5/10: wuf50-0861.mwcnf
```

```
Processing Instance 6/10: wuf50-0824.mwcnf
Processing Instance 7/10: wuf50-0657.mwcnf
Processing Instance 8/10: wuf50-0286.mwcnf
Processing Instance 9/10: wuf50-0612.mwcnf
Processing Instance 10/10: wuf50-0939.mwcnf
```

Params: {'PO': 0.8, 'cooling_coefficient': 0.95, 'equilibrium_steps': 6, 'max_steps_without_improvement': 800, 'fitness_coefficient': 100}



Instance of Opt	Avg Steps	Runs	Solved	Optimal	Avg Score	%
wuf50-0323.mwcnf 100.00%	199143.0	4	4	4	20513.0	
wuf50-0366.mwcnf 100.00%	204048.0	4	4	4	21264.0	
wuf50-069.mwcnf 100.00%	196527.0	4	4	4	4729.0	
wuf50-094.mwcnf 100.00%	201759.0	4	4	4	18365.0	
wuf50-0861.mwcnf 100.00%	203067.0	4	4	4	25256.0	
wuf50-0824.mwcnf 99.90 %	225630.0	4	3	2	26622.7	
wuf50-0657.mwcnf 100.00%	200778.0	4	4	4	3693.0	
wuf50-0286.mwcnf 100.00%	202413.0	4	4	4	20379.0	
wuf50-0612.mwcnf 100.00%	199797.0	4	4	4	13646.0	
wuf50-0939.mwcnf 100.00%	209280.0	4	4	4	15638.0	

```

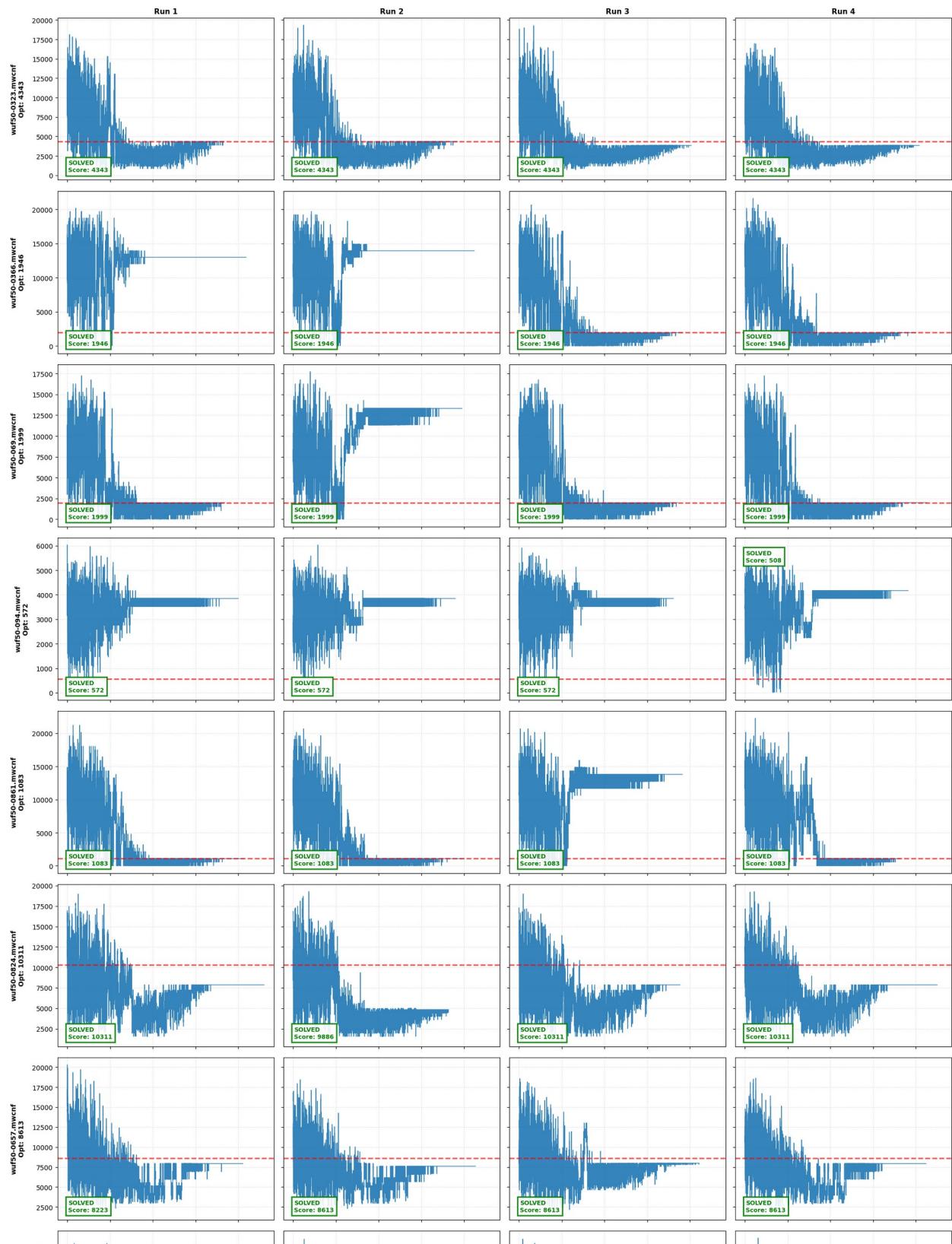
instance_paths_50_q = [os.path.join(wuf_50_q_path,x) for x in
os.listdir(wuf_50_q_path)[:10]]
solutions_wuf_50_q =
get_solution_dict(os.path.join(wuf_50_path,"wuf50-218-Q-opt.dat"))
results =
evaluate_algorithm_performance(instance_paths_50_q,solutions_wuf_50_q,
FINAL_CONFIG,4,"Baseline configuration on 50 variable instances")

--- Starting Baseline configuration on 50 variable instances (40 total
runs) ---
Params: {'P0': 0.8, 'cooling_coefficient': 0.95, 'equilibrium_steps': 6,
'max_steps_without_improvement': 800, 'fitness_coefficient': 100}
Processing Instance 1/10: wuf50-0323.mwcnf
Processing Instance 2/10: wuf50-0366.mwcnf
Processing Instance 3/10: wuf50-069.mwcnf
Processing Instance 4/10: wuf50-094.mwcnf
Processing Instance 5/10: wuf50-0861.mwcnf
Processing Instance 6/10: wuf50-0824.mwcnf
Processing Instance 7/10: wuf50-0657.mwcnf

```

Processing Instance 8/10: wuf50-0286.mwcnf
Processing Instance 9/10: wuf50-0612.mwcnf
Processing Instance 10/10: wuf50-0939.mwcnf

Baseline configuration on 50 variable instances
Params: {'PO': 0.8, 'cooling_coefficient': 0.95, 'equilibrium_steps': 6, 'max_steps_without_improvement': 800, 'fitness_coefficient': 100}



Instance of Opt	Avg Steps	Runs	Solved	Optimal	Avg Score	%
wuf50-0323.mwcnf 100.00%	195219.0	4	4	4	4343.0	
wuf50-0366.mwcnf 100.00%	203067.0	4	4	4	1946.0	
wuf50-069.mwcnf 100.00%	195219.0	4	4	4	1999.0	
wuf50-094.mwcnf 97.20 %	190314.0	4	4	3	556.0	
wuf50-0861.mwcnf 100.00%	194892.0	4	4	4	1083.0	
wuf50-0824.mwcnf 98.97 %	206337.0	4	4	3	10204.8	
wuf50-0657.mwcnf 98.87 %	210261.0	4	4	3	8515.5	
wuf50-0286.mwcnf 100.00%	207645.0	4	4	4	1945.0	
wuf50-0612.mwcnf 100.00%	196527.0	4	4	4	3751.0	
wuf50-0939.mwcnf 100.00%	217455.0	4	4	4	1126.0	

Blackbox Fáze

```

Cell In[28], line 1
^
SyntaxError: invalid syntax

from worker_utils import run_blackbox_parallel

instance_paths = [os.path.join(wuf_20_r_path,x) for x in
os.listdir(wuf_20_r_path)]
solutions = get_solution_dict(os.path.join(wuf_20_path, "wuf20-91-R-
opt.dat"))

df_results = run_blackbox_parallel(

```

```
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=100,
    max_workers=10 # Uses all cores automatically
)
df_results.to_csv("wuf20-91-R")
display(df_results)

--- Starting Black Box Evaluation ---
Instances: 1000
Repeats per Instance: 100
Total Runs: 100000
Parallel Workers: 10
Completed 1/1000 instances...
Completed 2/1000 instances...
Completed 3/1000 instances...
Completed 4/1000 instances...
Completed 5/1000 instances...
Completed 6/1000 instances...
Completed 7/1000 instances...
Completed 8/1000 instances...
Completed 9/1000 instances...
Completed 10/1000 instances...
Completed 11/1000 instances...
Completed 12/1000 instances...
Completed 13/1000 instances...
Completed 14/1000 instances...
Completed 15/1000 instances...
Completed 16/1000 instances...
Completed 17/1000 instances...
Completed 18/1000 instances...
Completed 19/1000 instances...
Completed 20/1000 instances...
Completed 21/1000 instances...
Completed 22/1000 instances...
Completed 23/1000 instances...
Completed 24/1000 instances...
Completed 25/1000 instances...
Completed 26/1000 instances...
Completed 27/1000 instances...
Completed 28/1000 instances...
Completed 29/1000 instances...
Completed 30/1000 instances...
Completed 31/1000 instances...
Completed 32/1000 instances...
Completed 33/1000 instances...
Completed 34/1000 instances...
Completed 35/1000 instances...
Completed 36/1000 instances...
```

Completed 37/1000 instances...
Completed 38/1000 instances...
Completed 39/1000 instances...
Completed 40/1000 instances...
Completed 41/1000 instances...
Completed 42/1000 instances...
Completed 43/1000 instances...
Completed 44/1000 instances...
Completed 45/1000 instances...
Completed 46/1000 instances...
Completed 47/1000 instances...
Completed 48/1000 instances...
Completed 49/1000 instances...
Completed 50/1000 instances...
Completed 51/1000 instances...
Completed 52/1000 instances...
Completed 53/1000 instances...
Completed 54/1000 instances...
Completed 55/1000 instances...
Completed 56/1000 instances...
Completed 57/1000 instances...
Completed 58/1000 instances...
Completed 59/1000 instances...
Completed 60/1000 instances...
Completed 61/1000 instances...
Completed 62/1000 instances...
Completed 63/1000 instances...
Completed 64/1000 instances...
Completed 65/1000 instances...
Completed 66/1000 instances...
Completed 67/1000 instances...
Completed 68/1000 instances...
Completed 69/1000 instances...
Completed 70/1000 instances...
Completed 71/1000 instances...
Completed 72/1000 instances...
Completed 73/1000 instances...
Completed 74/1000 instances...
Completed 75/1000 instances...
Completed 76/1000 instances...
Completed 77/1000 instances...
Completed 78/1000 instances...
Completed 79/1000 instances...
Completed 80/1000 instances...
Completed 81/1000 instances...
Completed 82/1000 instances...
Completed 83/1000 instances...
Completed 84/1000 instances...
Completed 85/1000 instances...

Completed 86/1000 instances...
Completed 87/1000 instances...
Completed 88/1000 instances...
Completed 89/1000 instances...
Completed 90/1000 instances...
Completed 91/1000 instances...
Completed 92/1000 instances...
Completed 93/1000 instances...
Completed 94/1000 instances...
Completed 95/1000 instances...
Completed 96/1000 instances...
Completed 97/1000 instances...
Completed 98/1000 instances...
Completed 99/1000 instances...
Completed 100/1000 instances...
Completed 101/1000 instances...
Completed 102/1000 instances...
Completed 103/1000 instances...
Completed 104/1000 instances...
Completed 105/1000 instances...
Completed 106/1000 instances...
Completed 107/1000 instances...
Completed 108/1000 instances...
Completed 109/1000 instances...
Completed 110/1000 instances...
Completed 111/1000 instances...
Completed 112/1000 instances...
Completed 113/1000 instances...
Completed 114/1000 instances...
Completed 115/1000 instances...
Completed 116/1000 instances...
Completed 117/1000 instances...
Completed 118/1000 instances...
Completed 119/1000 instances...
Completed 120/1000 instances...
Completed 121/1000 instances...
Completed 122/1000 instances...
Completed 123/1000 instances...
Completed 124/1000 instances...
Completed 125/1000 instances...
Completed 126/1000 instances...
Completed 127/1000 instances...
Completed 128/1000 instances...
Completed 129/1000 instances...
Completed 130/1000 instances...
Completed 131/1000 instances...
Completed 132/1000 instances...
Completed 133/1000 instances...
Completed 134/1000 instances...

Completed 135/1000 instances...
Completed 136/1000 instances...
Completed 137/1000 instances...
Completed 138/1000 instances...
Completed 139/1000 instances...
Completed 140/1000 instances...
Completed 141/1000 instances...
Completed 142/1000 instances...
Completed 143/1000 instances...
Completed 144/1000 instances...
Completed 145/1000 instances...
Completed 146/1000 instances...
Completed 147/1000 instances...
Completed 148/1000 instances...
Completed 149/1000 instances...
Completed 150/1000 instances...
Completed 151/1000 instances...
Completed 152/1000 instances...
Completed 153/1000 instances...
Completed 154/1000 instances...
Completed 155/1000 instances...
Completed 156/1000 instances...
Completed 157/1000 instances...
Completed 158/1000 instances...
Completed 159/1000 instances...
Completed 160/1000 instances...
Completed 161/1000 instances...
Completed 162/1000 instances...
Completed 163/1000 instances...
Completed 164/1000 instances...
Completed 165/1000 instances...
Completed 166/1000 instances...
Completed 167/1000 instances...
Completed 168/1000 instances...
Completed 169/1000 instances...
Completed 170/1000 instances...
Completed 171/1000 instances...
Completed 172/1000 instances...
Completed 173/1000 instances...
Completed 174/1000 instances...
Completed 175/1000 instances...
Completed 176/1000 instances...
Completed 177/1000 instances...
Completed 178/1000 instances...
Completed 179/1000 instances...
Completed 180/1000 instances...
Completed 181/1000 instances...
Completed 182/1000 instances...
Completed 183/1000 instances...

Completed 184/1000 instances...
Completed 185/1000 instances...
Completed 186/1000 instances...
Completed 187/1000 instances...
Completed 188/1000 instances...
Completed 189/1000 instances...
Completed 190/1000 instances...
Completed 191/1000 instances...
Completed 192/1000 instances...
Completed 193/1000 instances...
Completed 194/1000 instances...
Completed 195/1000 instances...
Completed 196/1000 instances...
Completed 197/1000 instances...
Completed 198/1000 instances...
Completed 199/1000 instances...
Completed 200/1000 instances...
Completed 201/1000 instances...
Completed 202/1000 instances...
Completed 203/1000 instances...
Completed 204/1000 instances...
Completed 205/1000 instances...
Completed 206/1000 instances...
Completed 207/1000 instances...
Completed 208/1000 instances...
Completed 209/1000 instances...
Completed 210/1000 instances...
Completed 211/1000 instances...
Completed 212/1000 instances...
Completed 213/1000 instances...
Completed 214/1000 instances...
Completed 215/1000 instances...
Completed 216/1000 instances...
Completed 217/1000 instances...
Completed 218/1000 instances...
Completed 219/1000 instances...
Completed 220/1000 instances...
Completed 221/1000 instances...
Completed 222/1000 instances...
Completed 223/1000 instances...
Completed 224/1000 instances...
Completed 225/1000 instances...
Completed 226/1000 instances...
Completed 227/1000 instances...
Completed 228/1000 instances...
Completed 229/1000 instances...
Completed 230/1000 instances...
Completed 231/1000 instances...
Completed 232/1000 instances...

Completed 233/1000 instances...
Completed 234/1000 instances...
Completed 235/1000 instances...
Completed 236/1000 instances...
Completed 237/1000 instances...
Completed 238/1000 instances...
Completed 239/1000 instances...
Completed 240/1000 instances...
Completed 241/1000 instances...
Completed 242/1000 instances...
Completed 243/1000 instances...
Completed 244/1000 instances...
Completed 245/1000 instances...
Completed 246/1000 instances...
Completed 247/1000 instances...
Completed 248/1000 instances...
Completed 249/1000 instances...
Completed 250/1000 instances...
Completed 251/1000 instances...
Completed 252/1000 instances...
Completed 253/1000 instances...
Completed 254/1000 instances...
Completed 255/1000 instances...
Completed 256/1000 instances...
Completed 257/1000 instances...
Completed 258/1000 instances...
Completed 259/1000 instances...
Completed 260/1000 instances...
Completed 261/1000 instances...
Completed 262/1000 instances...
Completed 263/1000 instances...
Completed 264/1000 instances...
Completed 265/1000 instances...
Completed 266/1000 instances...
Completed 267/1000 instances...
Completed 268/1000 instances...
Completed 269/1000 instances...
Completed 270/1000 instances...
Completed 271/1000 instances...
Completed 272/1000 instances...
Completed 273/1000 instances...
Completed 274/1000 instances...
Completed 275/1000 instances...
Completed 276/1000 instances...
Completed 277/1000 instances...
Completed 278/1000 instances...
Completed 279/1000 instances...
Completed 280/1000 instances...
Completed 281/1000 instances...

Completed 282/1000 instances...
Completed 283/1000 instances...
Completed 284/1000 instances...
Completed 285/1000 instances...
Completed 286/1000 instances...
Completed 287/1000 instances...
Completed 288/1000 instances...
Completed 289/1000 instances...
Completed 290/1000 instances...
Completed 291/1000 instances...
Completed 292/1000 instances...
Completed 293/1000 instances...
Completed 294/1000 instances...
Completed 295/1000 instances...
Completed 296/1000 instances...
Completed 297/1000 instances...
Completed 298/1000 instances...
Completed 299/1000 instances...
Completed 300/1000 instances...
Completed 301/1000 instances...
Completed 302/1000 instances...
Completed 303/1000 instances...
Completed 304/1000 instances...
Completed 305/1000 instances...
Completed 306/1000 instances...
Completed 307/1000 instances...
Completed 308/1000 instances...
Completed 309/1000 instances...
Completed 310/1000 instances...
Completed 311/1000 instances...
Completed 312/1000 instances...
Completed 313/1000 instances...
Completed 314/1000 instances...
Completed 315/1000 instances...
Completed 316/1000 instances...
Completed 317/1000 instances...
Completed 318/1000 instances...
Completed 319/1000 instances...
Completed 320/1000 instances...
Completed 321/1000 instances...
Completed 322/1000 instances...
Completed 323/1000 instances...
Completed 324/1000 instances...
Completed 325/1000 instances...
Completed 326/1000 instances...
Completed 327/1000 instances...
Completed 328/1000 instances...
Completed 329/1000 instances...
Completed 330/1000 instances...

Completed 331/1000 instances...
Completed 332/1000 instances...
Completed 333/1000 instances...
Completed 334/1000 instances...
Completed 335/1000 instances...
Completed 336/1000 instances...
Completed 337/1000 instances...
Completed 338/1000 instances...
Completed 339/1000 instances...
Completed 340/1000 instances...
Completed 341/1000 instances...
Completed 342/1000 instances...
Completed 343/1000 instances...
Completed 344/1000 instances...
Completed 345/1000 instances...
Completed 346/1000 instances...
Completed 347/1000 instances...
Completed 348/1000 instances...
Completed 349/1000 instances...
Completed 350/1000 instances...
Completed 351/1000 instances...
Completed 352/1000 instances...
Completed 353/1000 instances...
Completed 354/1000 instances...
Completed 355/1000 instances...
Completed 356/1000 instances...
Completed 357/1000 instances...
Completed 358/1000 instances...
Completed 359/1000 instances...
Completed 360/1000 instances...
Completed 361/1000 instances...
Completed 362/1000 instances...
Completed 363/1000 instances...
Completed 364/1000 instances...
Completed 365/1000 instances...
Completed 366/1000 instances...
Completed 367/1000 instances...
Completed 368/1000 instances...
Completed 369/1000 instances...
Completed 370/1000 instances...
Completed 371/1000 instances...
Completed 372/1000 instances...
Completed 373/1000 instances...
Completed 374/1000 instances...
Completed 375/1000 instances...
Completed 376/1000 instances...
Completed 377/1000 instances...
Completed 378/1000 instances...
Completed 379/1000 instances...

Completed 380/1000 instances...
Completed 381/1000 instances...
Completed 382/1000 instances...
Completed 383/1000 instances...
Completed 384/1000 instances...
Completed 385/1000 instances...
Completed 386/1000 instances...
Completed 387/1000 instances...
Completed 388/1000 instances...
Completed 389/1000 instances...
Completed 390/1000 instances...
Completed 391/1000 instances...
Completed 392/1000 instances...
Completed 393/1000 instances...
Completed 394/1000 instances...
Completed 395/1000 instances...
Completed 396/1000 instances...
Completed 397/1000 instances...
Completed 398/1000 instances...
Completed 399/1000 instances...
Completed 400/1000 instances...
Completed 401/1000 instances...
Completed 402/1000 instances...
Completed 403/1000 instances...
Completed 404/1000 instances...
Completed 405/1000 instances...
Completed 406/1000 instances...
Completed 407/1000 instances...
Completed 408/1000 instances...
Completed 409/1000 instances...
Completed 410/1000 instances...
Completed 411/1000 instances...
Completed 412/1000 instances...
Completed 413/1000 instances...
Completed 414/1000 instances...
Completed 415/1000 instances...
Completed 416/1000 instances...
Completed 417/1000 instances...
Completed 418/1000 instances...
Completed 419/1000 instances...
Completed 420/1000 instances...
Completed 421/1000 instances...
Completed 422/1000 instances...
Completed 423/1000 instances...
Completed 424/1000 instances...
Completed 425/1000 instances...
Completed 426/1000 instances...
Completed 427/1000 instances...
Completed 428/1000 instances...

Completed 429/1000 instances...
Completed 430/1000 instances...
Completed 431/1000 instances...
Completed 432/1000 instances...
Completed 433/1000 instances...
Completed 434/1000 instances...
Completed 435/1000 instances...
Completed 436/1000 instances...
Completed 437/1000 instances...
Completed 438/1000 instances...
Completed 439/1000 instances...
Completed 440/1000 instances...
Completed 441/1000 instances...
Completed 442/1000 instances...
Completed 443/1000 instances...
Completed 444/1000 instances...
Completed 445/1000 instances...
Completed 446/1000 instances...
Completed 447/1000 instances...
Completed 448/1000 instances...
Completed 449/1000 instances...
Completed 450/1000 instances...
Completed 451/1000 instances...
Completed 452/1000 instances...
Completed 453/1000 instances...
Completed 454/1000 instances...
Completed 455/1000 instances...
Completed 456/1000 instances...
Completed 457/1000 instances...
Completed 458/1000 instances...
Completed 459/1000 instances...
Completed 460/1000 instances...
Completed 461/1000 instances...
Completed 462/1000 instances...
Completed 463/1000 instances...
Completed 464/1000 instances...
Completed 465/1000 instances...
Completed 466/1000 instances...
Completed 467/1000 instances...
Completed 468/1000 instances...
Completed 469/1000 instances...
Completed 470/1000 instances...
Completed 471/1000 instances...
Completed 472/1000 instances...
Completed 473/1000 instances...
Completed 474/1000 instances...
Completed 475/1000 instances...
Completed 476/1000 instances...
Completed 477/1000 instances...

Completed 478/1000 instances...
Completed 479/1000 instances...
Completed 480/1000 instances...
Completed 481/1000 instances...
Completed 482/1000 instances...
Completed 483/1000 instances...
Completed 484/1000 instances...
Completed 485/1000 instances...
Completed 486/1000 instances...
Completed 487/1000 instances...
Completed 488/1000 instances...
Completed 489/1000 instances...
Completed 490/1000 instances...
Completed 491/1000 instances...
Completed 492/1000 instances...
Completed 493/1000 instances...
Completed 494/1000 instances...
Completed 495/1000 instances...
Completed 496/1000 instances...
Completed 497/1000 instances...
Completed 498/1000 instances...
Completed 499/1000 instances...
Completed 500/1000 instances...
Completed 501/1000 instances...
Completed 502/1000 instances...
Completed 503/1000 instances...
Completed 504/1000 instances...
Completed 505/1000 instances...
Completed 506/1000 instances...
Completed 507/1000 instances...
Completed 508/1000 instances...
Completed 509/1000 instances...
Completed 510/1000 instances...
Completed 511/1000 instances...
Completed 512/1000 instances...
Completed 513/1000 instances...
Completed 514/1000 instances...
Completed 515/1000 instances...
Completed 516/1000 instances...
Completed 517/1000 instances...
Completed 518/1000 instances...
Completed 519/1000 instances...
Completed 520/1000 instances...
Completed 521/1000 instances...
Completed 522/1000 instances...
Completed 523/1000 instances...
Completed 524/1000 instances...
Completed 525/1000 instances...
Completed 526/1000 instances...
Completed 527/1000 instances...

Completed 528/1000 instances...
Completed 529/1000 instances...
Completed 530/1000 instances...
Completed 531/1000 instances...
Completed 532/1000 instances...
Completed 533/1000 instances...
Completed 534/1000 instances...
Completed 535/1000 instances...
Completed 536/1000 instances...
Completed 537/1000 instances...
Completed 538/1000 instances...
Completed 539/1000 instances...
Completed 540/1000 instances...
Completed 541/1000 instances...
Completed 542/1000 instances...
Completed 543/1000 instances...
Completed 544/1000 instances...
Completed 545/1000 instances...
Completed 546/1000 instances...
Completed 547/1000 instances...
Completed 548/1000 instances...
Completed 549/1000 instances...
Completed 550/1000 instances...
Completed 551/1000 instances...
Completed 552/1000 instances...
Completed 553/1000 instances...
Completed 554/1000 instances...
Completed 555/1000 instances...
Completed 556/1000 instances...
Completed 557/1000 instances...
Completed 558/1000 instances...
Completed 559/1000 instances...
Completed 560/1000 instances...
Completed 561/1000 instances...
Completed 562/1000 instances...
Completed 563/1000 instances...
Completed 564/1000 instances...
Completed 565/1000 instances...
Completed 566/1000 instances...
Completed 567/1000 instances...
Completed 568/1000 instances...
Completed 569/1000 instances...
Completed 570/1000 instances...
Completed 571/1000 instances...
Completed 572/1000 instances...
Completed 573/1000 instances...
Completed 574/1000 instances...
Completed 575/1000 instances...
Completed 576/1000 instances...

Completed 577/1000 instances...
Completed 578/1000 instances...
Completed 579/1000 instances...
Completed 580/1000 instances...
Completed 581/1000 instances...
Completed 582/1000 instances...
Completed 583/1000 instances...
Completed 584/1000 instances...
Completed 585/1000 instances...
Completed 586/1000 instances...
Completed 587/1000 instances...
Completed 588/1000 instances...
Completed 589/1000 instances...
Completed 590/1000 instances...
Completed 591/1000 instances...
Completed 592/1000 instances...
Completed 593/1000 instances...
Completed 594/1000 instances...
Completed 595/1000 instances...
Completed 596/1000 instances...
Completed 597/1000 instances...
Completed 598/1000 instances...
Completed 599/1000 instances...
Completed 600/1000 instances...
Completed 601/1000 instances...
Completed 602/1000 instances...
Completed 603/1000 instances...
Completed 604/1000 instances...
Completed 605/1000 instances...
Completed 606/1000 instances...
Completed 607/1000 instances...
Completed 608/1000 instances...
Completed 609/1000 instances...
Completed 610/1000 instances...
Completed 611/1000 instances...
Completed 612/1000 instances...
Completed 613/1000 instances...
Completed 614/1000 instances...
Completed 615/1000 instances...
Completed 616/1000 instances...
Completed 617/1000 instances...
Completed 618/1000 instances...
Completed 619/1000 instances...
Completed 620/1000 instances...
Completed 621/1000 instances...
Completed 622/1000 instances...
Completed 623/1000 instances...
Completed 624/1000 instances...
Completed 625/1000 instances...

Completed 626/1000 instances...
Completed 627/1000 instances...
Completed 628/1000 instances...
Completed 629/1000 instances...
Completed 630/1000 instances...
Completed 631/1000 instances...
Completed 632/1000 instances...
Completed 633/1000 instances...
Completed 634/1000 instances...
Completed 635/1000 instances...
Completed 636/1000 instances...
Completed 637/1000 instances...
Completed 638/1000 instances...
Completed 639/1000 instances...
Completed 640/1000 instances...
Completed 641/1000 instances...
Completed 642/1000 instances...
Completed 643/1000 instances...
Completed 644/1000 instances...
Completed 645/1000 instances...
Completed 646/1000 instances...
Completed 647/1000 instances...
Completed 648/1000 instances...
Completed 649/1000 instances...
Completed 650/1000 instances...
Completed 651/1000 instances...
Completed 652/1000 instances...
Completed 653/1000 instances...
Completed 654/1000 instances...
Completed 655/1000 instances...
Completed 656/1000 instances...
Completed 657/1000 instances...
Completed 658/1000 instances...
Completed 659/1000 instances...
Completed 660/1000 instances...
Completed 661/1000 instances...
Completed 662/1000 instances...
Completed 663/1000 instances...
Completed 664/1000 instances...
Completed 665/1000 instances...
Completed 666/1000 instances...
Completed 667/1000 instances...
Completed 668/1000 instances...
Completed 669/1000 instances...
Completed 670/1000 instances...
Completed 671/1000 instances...
Completed 672/1000 instances...
Completed 673/1000 instances...
Completed 674/1000 instances...

Completed 675/1000 instances...
Completed 676/1000 instances...
Completed 677/1000 instances...
Completed 678/1000 instances...
Completed 679/1000 instances...
Completed 680/1000 instances...
Completed 681/1000 instances...
Completed 682/1000 instances...
Completed 683/1000 instances...
Completed 684/1000 instances...
Completed 685/1000 instances...
Completed 686/1000 instances...
Completed 687/1000 instances...
Completed 688/1000 instances...
Completed 689/1000 instances...
Completed 690/1000 instances...
Completed 691/1000 instances...
Completed 692/1000 instances...
Completed 693/1000 instances...
Completed 694/1000 instances...
Completed 695/1000 instances...
Completed 696/1000 instances...
Completed 697/1000 instances...
Completed 698/1000 instances...
Completed 699/1000 instances...
Completed 700/1000 instances...
Completed 701/1000 instances...
Completed 702/1000 instances...
Completed 703/1000 instances...
Completed 704/1000 instances...
Completed 705/1000 instances...
Completed 706/1000 instances...
Completed 707/1000 instances...
Completed 708/1000 instances...
Completed 709/1000 instances...
Completed 710/1000 instances...
Completed 711/1000 instances...
Completed 712/1000 instances...
Completed 713/1000 instances...
Completed 714/1000 instances...
Completed 715/1000 instances...
Completed 716/1000 instances...
Completed 717/1000 instances...
Completed 718/1000 instances...
Completed 719/1000 instances...
Completed 720/1000 instances...
Completed 721/1000 instances...
Completed 722/1000 instances...
Completed 723/1000 instances...

Completed 724/1000 instances...
Completed 725/1000 instances...
Completed 726/1000 instances...
Completed 727/1000 instances...
Completed 728/1000 instances...
Completed 729/1000 instances...
Completed 730/1000 instances...
Completed 731/1000 instances...
Completed 732/1000 instances...
Completed 733/1000 instances...
Completed 734/1000 instances...
Completed 735/1000 instances...
Completed 736/1000 instances...
Completed 737/1000 instances...
Completed 738/1000 instances...
Completed 739/1000 instances...
Completed 740/1000 instances...
Completed 741/1000 instances...
Completed 742/1000 instances...
Completed 743/1000 instances...
Completed 744/1000 instances...
Completed 745/1000 instances...
Completed 746/1000 instances...
Completed 747/1000 instances...
Completed 748/1000 instances...
Completed 749/1000 instances...
Completed 750/1000 instances...
Completed 751/1000 instances...
Completed 752/1000 instances...
Completed 753/1000 instances...
Completed 754/1000 instances...
Completed 755/1000 instances...
Completed 756/1000 instances...
Completed 757/1000 instances...
Completed 758/1000 instances...
Completed 759/1000 instances...
Completed 760/1000 instances...
Completed 761/1000 instances...
Completed 762/1000 instances...
Completed 763/1000 instances...
Completed 764/1000 instances...
Completed 765/1000 instances...
Completed 766/1000 instances...
Completed 767/1000 instances...
Completed 768/1000 instances...
Completed 769/1000 instances...
Completed 770/1000 instances...
Completed 771/1000 instances...
Completed 772/1000 instances...

Completed 773/1000 instances...
Completed 774/1000 instances...
Completed 775/1000 instances...
Completed 776/1000 instances...
Completed 777/1000 instances...
Completed 778/1000 instances...
Completed 779/1000 instances...
Completed 780/1000 instances...
Completed 781/1000 instances...
Completed 782/1000 instances...
Completed 783/1000 instances...
Completed 784/1000 instances...
Completed 785/1000 instances...
Completed 786/1000 instances...
Completed 787/1000 instances...
Completed 788/1000 instances...
Completed 789/1000 instances...
Completed 790/1000 instances...
Completed 791/1000 instances...
Completed 792/1000 instances...
Completed 793/1000 instances...
Completed 794/1000 instances...
Completed 795/1000 instances...
Completed 796/1000 instances...
Completed 797/1000 instances...
Completed 798/1000 instances...
Completed 799/1000 instances...
Completed 800/1000 instances...
Completed 801/1000 instances...
Completed 802/1000 instances...
Completed 803/1000 instances...
Completed 804/1000 instances...
Completed 805/1000 instances...
Completed 806/1000 instances...
Completed 807/1000 instances...
Completed 808/1000 instances...
Completed 809/1000 instances...
Completed 810/1000 instances...
Completed 811/1000 instances...
Completed 812/1000 instances...
Completed 813/1000 instances...
Completed 814/1000 instances...
Completed 815/1000 instances...
Completed 816/1000 instances...
Completed 817/1000 instances...
Completed 818/1000 instances...
Completed 819/1000 instances...
Completed 820/1000 instances...
Completed 821/1000 instances...

Completed 822/1000 instances...
Completed 823/1000 instances...
Completed 824/1000 instances...
Completed 825/1000 instances...
Completed 826/1000 instances...
Completed 827/1000 instances...
Completed 828/1000 instances...
Completed 829/1000 instances...
Completed 830/1000 instances...
Completed 831/1000 instances...
Completed 832/1000 instances...
Completed 833/1000 instances...
Completed 834/1000 instances...
Completed 835/1000 instances...
Completed 836/1000 instances...
Completed 837/1000 instances...
Completed 838/1000 instances...
Completed 839/1000 instances...
Completed 840/1000 instances...
Completed 841/1000 instances...
Completed 842/1000 instances...
Completed 843/1000 instances...
Completed 844/1000 instances...
Completed 845/1000 instances...
Completed 846/1000 instances...
Completed 847/1000 instances...
Completed 848/1000 instances...
Completed 849/1000 instances...
Completed 850/1000 instances...
Completed 851/1000 instances...
Completed 852/1000 instances...
Completed 853/1000 instances...
Completed 854/1000 instances...
Completed 855/1000 instances...
Completed 856/1000 instances...
Completed 857/1000 instances...
Completed 858/1000 instances...
Completed 859/1000 instances...
Completed 860/1000 instances...
Completed 861/1000 instances...
Completed 862/1000 instances...
Completed 863/1000 instances...
Completed 864/1000 instances...
Completed 865/1000 instances...
Completed 866/1000 instances...
Completed 867/1000 instances...
Completed 868/1000 instances...
Completed 869/1000 instances...
Completed 870/1000 instances...

Completed 871/1000 instances...
Completed 872/1000 instances...
Completed 873/1000 instances...
Completed 874/1000 instances...
Completed 875/1000 instances...
Completed 876/1000 instances...
Completed 877/1000 instances...
Completed 878/1000 instances...
Completed 879/1000 instances...
Completed 880/1000 instances...
Completed 881/1000 instances...
Completed 882/1000 instances...
Completed 883/1000 instances...
Completed 884/1000 instances...
Completed 885/1000 instances...
Completed 886/1000 instances...
Completed 887/1000 instances...
Completed 888/1000 instances...
Completed 889/1000 instances...
Completed 890/1000 instances...
Completed 891/1000 instances...
Completed 892/1000 instances...
Completed 893/1000 instances...
Completed 894/1000 instances...
Completed 895/1000 instances...
Completed 896/1000 instances...
Completed 897/1000 instances...
Completed 898/1000 instances...
Completed 899/1000 instances...
Completed 900/1000 instances...
Completed 901/1000 instances...
Completed 902/1000 instances...
Completed 903/1000 instances...
Completed 904/1000 instances...
Completed 905/1000 instances...
Completed 906/1000 instances...
Completed 907/1000 instances...
Completed 908/1000 instances...
Completed 909/1000 instances...
Completed 910/1000 instances...
Completed 911/1000 instances...
Completed 912/1000 instances...
Completed 913/1000 instances...
Completed 914/1000 instances...
Completed 915/1000 instances...
Completed 916/1000 instances...
Completed 917/1000 instances...
Completed 918/1000 instances...
Completed 919/1000 instances...

Completed 920/1000 instances...
Completed 921/1000 instances...
Completed 922/1000 instances...
Completed 923/1000 instances...
Completed 924/1000 instances...
Completed 925/1000 instances...
Completed 926/1000 instances...
Completed 927/1000 instances...
Completed 928/1000 instances...
Completed 929/1000 instances...
Completed 930/1000 instances...
Completed 931/1000 instances...
Completed 932/1000 instances...
Completed 933/1000 instances...
Completed 934/1000 instances...
Completed 935/1000 instances...
Completed 936/1000 instances...
Completed 937/1000 instances...
Completed 938/1000 instances...
Completed 939/1000 instances...
Completed 940/1000 instances...
Completed 941/1000 instances...
Completed 942/1000 instances...
Completed 943/1000 instances...
Completed 944/1000 instances...
Completed 945/1000 instances...
Completed 946/1000 instances...
Completed 947/1000 instances...
Completed 948/1000 instances...
Completed 949/1000 instances...
Completed 950/1000 instances...
Completed 951/1000 instances...
Completed 952/1000 instances...
Completed 953/1000 instances...
Completed 954/1000 instances...
Completed 955/1000 instances...
Completed 956/1000 instances...
Completed 957/1000 instances...
Completed 958/1000 instances...
Completed 959/1000 instances...
Completed 960/1000 instances...
Completed 961/1000 instances...
Completed 962/1000 instances...
Completed 963/1000 instances...
Completed 964/1000 instances...
Completed 965/1000 instances...
Completed 966/1000 instances...
Completed 967/1000 instances...
Completed 968/1000 instances...

```

Completed 969/1000 instances...
Completed 970/1000 instances...
Completed 971/1000 instances...
Completed 972/1000 instances...
Completed 973/1000 instances...
Completed 974/1000 instances...
Completed 975/1000 instances...
Completed 976/1000 instances...
Completed 977/1000 instances...
Completed 978/1000 instances...
Completed 979/1000 instances...
Completed 980/1000 instances...
Completed 981/1000 instances...
Completed 982/1000 instances...
Completed 983/1000 instances...
Completed 984/1000 instances...
Completed 985/1000 instances...
Completed 986/1000 instances...
Completed 987/1000 instances...
Completed 988/1000 instances...
Completed 989/1000 instances...
Completed 990/1000 instances...
Completed 991/1000 instances...
Completed 992/1000 instances...
Completed 993/1000 instances...
Completed 994/1000 instances...
Completed 995/1000 instances...
Completed 996/1000 instances...
Completed 997/1000 instances...
Completed 998/1000 instances...
Completed 999/1000 instances...
Completed 1000/1000 instances...
--- Evaluation Complete ---

```

Steps	\	Instance	Is_Valid	Success	Score	Optimum	Rel_Error
0	wuf20-0911.mwcnf		True	True	23689	23689	0.0
73528							
1	wuf20-0911.mwcnf		True	True	23689	23689	0.0
73528							
2	wuf20-0911.mwcnf		True	True	23689	23689	0.0
74256							
3	wuf20-0911.mwcnf		True	True	23689	23689	0.0
73528							
4	wuf20-0911.mwcnf		True	True	23689	23689	0.0
73528							
...
...
99995	wuf20-0572.mwcnf		True	True	3049	3049	0.0
73528							

99996	wuf20-0572.mwcnf	True	True	3049	3049	0.0
75712						
99997	wuf20-0572.mwcnf	True	True	3049	3049	0.0
77168						
99998	wuf20-0572.mwcnf	True	True	3049	3049	0.0
74256						
99999	wuf20-0572.mwcnf	True	True	3049	3049	0.0
73528						

	Time
0	0.383580
1	0.377607
2	0.400077
3	0.378433
4	0.372999
...	...
99995	0.360067
99996	0.417707
99997	0.426511
99998	0.361302
99999	0.351273

[1000000 rows x 8 columns]

```

instance_paths = [os.path.join(wuf_20_m_path,x) for x in
os.listdir(wuf_20_m_path)]
solutions = get_solution_dict(os.path.join(wuf_20_path,"wuf20-91-M-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=100,
    max_workers=12 # Uses all cores automatically
)
df_results.to_csv("wuf20-91-M")
display(df_results)

--- Starting Black Box Evaluation ---
Instances: 1000
Repeats per Instance: 100
Total Runs: 100000
Parallel Workers: 12
Completed 1/1000 instances...
Completed 2/1000 instances...
Completed 3/1000 instances...
Completed 4/1000 instances...
Completed 5/1000 instances...
Completed 6/1000 instances...

```

```
Completed 7/1000 instances...
Completed 8/1000 instances...
Completed 9/1000 instances...
Completed 10/1000 instances...
Completed 11/1000 instances...
Completed 12/1000 instances...
Completed 13/1000 instances...
Completed 14/1000 instances...
Completed 15/1000 instances...
Completed 16/1000 instances...
Completed 17/1000 instances...
Completed 18/1000 instances...
Completed 19/1000 instances...
Completed 20/1000 instances...
Completed 21/1000 instances...
Completed 22/1000 instances...
Completed 23/1000 instances...
Completed 24/1000 instances...
Completed 25/1000 instances...
Completed 26/1000 instances...
Completed 27/1000 instances...
Completed 28/1000 instances...
Completed 29/1000 instances...
Completed 30/1000 instances...
Completed 31/1000 instances...
Completed 32/1000 instances...
Completed 33/1000 instances...
Completed 34/1000 instances...
Completed 35/1000 instances...
Completed 36/1000 instances...
Completed 37/1000 instances...
Completed 38/1000 instances...
Completed 39/1000 instances...
Completed 40/1000 instances...
Completed 41/1000 instances...
Completed 42/1000 instances...
Completed 43/1000 instances...
Completed 44/1000 instances...
Completed 45/1000 instances...
Completed 46/1000 instances...
Completed 47/1000 instances...
Completed 48/1000 instances...
Completed 49/1000 instances...
Completed 50/1000 instances...
Completed 51/1000 instances...
Completed 52/1000 instances...
Completed 53/1000 instances...
Completed 54/1000 instances...
Completed 55/1000 instances...
```

Completed 56/1000 instances...
Completed 57/1000 instances...
Completed 58/1000 instances...
Completed 59/1000 instances...
Completed 60/1000 instances...
Completed 61/1000 instances...
Completed 62/1000 instances...
Completed 63/1000 instances...
Completed 64/1000 instances...
Completed 65/1000 instances...
Completed 66/1000 instances...
Completed 67/1000 instances...
Completed 68/1000 instances...
Completed 69/1000 instances...
Completed 70/1000 instances...
Completed 71/1000 instances...
Completed 72/1000 instances...
Completed 73/1000 instances...
Completed 74/1000 instances...
Completed 75/1000 instances...
Completed 76/1000 instances...
Completed 77/1000 instances...
Completed 78/1000 instances...
Completed 79/1000 instances...
Completed 80/1000 instances...
Completed 81/1000 instances...
Completed 82/1000 instances...
Completed 83/1000 instances...
Completed 84/1000 instances...
Completed 85/1000 instances...
Completed 86/1000 instances...
Completed 87/1000 instances...
Completed 88/1000 instances...
Completed 89/1000 instances...
Completed 90/1000 instances...
Completed 91/1000 instances...
Completed 92/1000 instances...
Completed 93/1000 instances...
Completed 94/1000 instances...
Completed 95/1000 instances...
Completed 96/1000 instances...
Completed 97/1000 instances...
Completed 98/1000 instances...
Completed 99/1000 instances...
Completed 100/1000 instances...
Completed 101/1000 instances...
Completed 102/1000 instances...
Completed 103/1000 instances...
Completed 104/1000 instances...

Completed 105/1000 instances...
Completed 106/1000 instances...
Completed 107/1000 instances...
Completed 108/1000 instances...
Completed 109/1000 instances...
Completed 110/1000 instances...
Completed 111/1000 instances...
Completed 112/1000 instances...
Completed 113/1000 instances...
Completed 114/1000 instances...
Completed 115/1000 instances...
Completed 116/1000 instances...
Completed 117/1000 instances...
Completed 118/1000 instances...
Completed 119/1000 instances...
Completed 120/1000 instances...
Completed 121/1000 instances...
Completed 122/1000 instances...
Completed 123/1000 instances...
Completed 124/1000 instances...
Completed 125/1000 instances...
Completed 126/1000 instances...
Completed 127/1000 instances...
Completed 128/1000 instances...
Completed 129/1000 instances...
Completed 130/1000 instances...
Completed 131/1000 instances...
Completed 132/1000 instances...
Completed 133/1000 instances...
Completed 134/1000 instances...
Completed 135/1000 instances...
Completed 136/1000 instances...
Completed 137/1000 instances...
Completed 138/1000 instances...
Completed 139/1000 instances...
Completed 140/1000 instances...
Completed 141/1000 instances...
Completed 142/1000 instances...
Completed 143/1000 instances...
Completed 144/1000 instances...
Completed 145/1000 instances...
Completed 146/1000 instances...
Completed 147/1000 instances...
Completed 148/1000 instances...
Completed 149/1000 instances...
Completed 150/1000 instances...
Completed 151/1000 instances...
Completed 152/1000 instances...
Completed 153/1000 instances...

Completed 154/1000 instances...
Completed 155/1000 instances...
Completed 156/1000 instances...
Completed 157/1000 instances...
Completed 158/1000 instances...
Completed 159/1000 instances...
Completed 160/1000 instances...
Completed 161/1000 instances...
Completed 162/1000 instances...
Completed 163/1000 instances...
Completed 164/1000 instances...
Completed 165/1000 instances...
Completed 166/1000 instances...
Completed 167/1000 instances...
Completed 168/1000 instances...
Completed 169/1000 instances...
Completed 170/1000 instances...
Completed 171/1000 instances...
Completed 172/1000 instances...
Completed 173/1000 instances...
Completed 174/1000 instances...
Completed 175/1000 instances...
Completed 176/1000 instances...
Completed 177/1000 instances...
Completed 178/1000 instances...
Completed 179/1000 instances...
Completed 180/1000 instances...
Completed 181/1000 instances...
Completed 182/1000 instances...
Completed 183/1000 instances...
Completed 184/1000 instances...
Completed 185/1000 instances...
Completed 186/1000 instances...
Completed 187/1000 instances...
Completed 188/1000 instances...
Completed 189/1000 instances...
Completed 190/1000 instances...
Completed 191/1000 instances...
Completed 192/1000 instances...
Completed 193/1000 instances...
Completed 194/1000 instances...
Completed 195/1000 instances...
Completed 196/1000 instances...
Completed 197/1000 instances...
Completed 198/1000 instances...
Completed 199/1000 instances...
Completed 200/1000 instances...
Completed 201/1000 instances...
Completed 202/1000 instances...

Completed 203/1000 instances...
Completed 204/1000 instances...
Completed 205/1000 instances...
Completed 206/1000 instances...
Completed 207/1000 instances...
Completed 208/1000 instances...
Completed 209/1000 instances...
Completed 210/1000 instances...
Completed 211/1000 instances...
Completed 212/1000 instances...
Completed 213/1000 instances...
Completed 214/1000 instances...
Completed 215/1000 instances...
Completed 216/1000 instances...
Completed 217/1000 instances...
Completed 218/1000 instances...
Completed 219/1000 instances...
Completed 220/1000 instances...
Completed 221/1000 instances...
Completed 222/1000 instances...
Completed 223/1000 instances...
Completed 224/1000 instances...
Completed 225/1000 instances...
Completed 226/1000 instances...
Completed 227/1000 instances...
Completed 228/1000 instances...
Completed 229/1000 instances...
Completed 230/1000 instances...
Completed 231/1000 instances...
Completed 232/1000 instances...
Completed 233/1000 instances...
Completed 234/1000 instances...
Completed 235/1000 instances...
Completed 236/1000 instances...
Completed 237/1000 instances...
Completed 238/1000 instances...
Completed 239/1000 instances...
Completed 240/1000 instances...
Completed 241/1000 instances...
Completed 242/1000 instances...
Completed 243/1000 instances...
Completed 244/1000 instances...
Completed 245/1000 instances...
Completed 246/1000 instances...
Completed 247/1000 instances...
Completed 248/1000 instances...
Completed 249/1000 instances...
Completed 250/1000 instances...
Completed 251/1000 instances...

Completed 252/1000 instances...
Completed 253/1000 instances...
Completed 254/1000 instances...
Completed 255/1000 instances...
Completed 256/1000 instances...
Completed 257/1000 instances...
Completed 258/1000 instances...
Completed 259/1000 instances...
Completed 260/1000 instances...
Completed 261/1000 instances...
Completed 262/1000 instances...
Completed 263/1000 instances...
Completed 264/1000 instances...
Completed 265/1000 instances...
Completed 266/1000 instances...
Completed 267/1000 instances...
Completed 268/1000 instances...
Completed 269/1000 instances...
Completed 270/1000 instances...
Completed 271/1000 instances...
Completed 272/1000 instances...
Completed 273/1000 instances...
Completed 274/1000 instances...
Completed 275/1000 instances...
Completed 276/1000 instances...
Completed 277/1000 instances...
Completed 278/1000 instances...
Completed 279/1000 instances...
Completed 280/1000 instances...
Completed 281/1000 instances...
Completed 282/1000 instances...
Completed 283/1000 instances...
Completed 284/1000 instances...
Completed 285/1000 instances...
Completed 286/1000 instances...
Completed 287/1000 instances...
Completed 288/1000 instances...
Completed 289/1000 instances...
Completed 290/1000 instances...
Completed 291/1000 instances...
Completed 292/1000 instances...
Completed 293/1000 instances...
Completed 294/1000 instances...
Completed 295/1000 instances...
Completed 296/1000 instances...
Completed 297/1000 instances...
Completed 298/1000 instances...
Completed 299/1000 instances...
Completed 300/1000 instances...

Completed 301/1000 instances...
Completed 302/1000 instances...
Completed 303/1000 instances...
Completed 304/1000 instances...
Completed 305/1000 instances...
Completed 306/1000 instances...
Completed 307/1000 instances...
Completed 308/1000 instances...
Completed 309/1000 instances...
Completed 310/1000 instances...
Completed 311/1000 instances...
Completed 312/1000 instances...
Completed 313/1000 instances...
Completed 314/1000 instances...
Completed 315/1000 instances...
Completed 316/1000 instances...
Completed 317/1000 instances...
Completed 318/1000 instances...
Completed 319/1000 instances...
Completed 320/1000 instances...
Completed 321/1000 instances...
Completed 322/1000 instances...
Completed 323/1000 instances...
Completed 324/1000 instances...
Completed 325/1000 instances...
Completed 326/1000 instances...
Completed 327/1000 instances...
Completed 328/1000 instances...
Completed 329/1000 instances...
Completed 330/1000 instances...
Completed 331/1000 instances...
Completed 332/1000 instances...
Completed 333/1000 instances...
Completed 334/1000 instances...
Completed 335/1000 instances...
Completed 336/1000 instances...
Completed 337/1000 instances...
Completed 338/1000 instances...
Completed 339/1000 instances...
Completed 340/1000 instances...
Completed 341/1000 instances...
Completed 342/1000 instances...
Completed 343/1000 instances...
Completed 344/1000 instances...
Completed 345/1000 instances...
Completed 346/1000 instances...
Completed 347/1000 instances...
Completed 348/1000 instances...
Completed 349/1000 instances...

Completed 350/1000 instances...
Completed 351/1000 instances...
Completed 352/1000 instances...
Completed 353/1000 instances...
Completed 354/1000 instances...
Completed 355/1000 instances...
Completed 356/1000 instances...
Completed 357/1000 instances...
Completed 358/1000 instances...
Completed 359/1000 instances...
Completed 360/1000 instances...
Completed 361/1000 instances...
Completed 362/1000 instances...
Completed 363/1000 instances...
Completed 364/1000 instances...
Completed 365/1000 instances...
Completed 366/1000 instances...
Completed 367/1000 instances...
Completed 368/1000 instances...
Completed 369/1000 instances...
Completed 370/1000 instances...
Completed 371/1000 instances...
Completed 372/1000 instances...
Completed 373/1000 instances...
Completed 374/1000 instances...
Completed 375/1000 instances...
Completed 376/1000 instances...
Completed 377/1000 instances...
Completed 378/1000 instances...
Completed 379/1000 instances...
Completed 380/1000 instances...
Completed 381/1000 instances...
Completed 382/1000 instances...
Completed 383/1000 instances...
Completed 384/1000 instances...
Completed 385/1000 instances...
Completed 386/1000 instances...
Completed 387/1000 instances...
Completed 388/1000 instances...
Completed 389/1000 instances...
Completed 390/1000 instances...
Completed 391/1000 instances...
Completed 392/1000 instances...
Completed 393/1000 instances...
Completed 394/1000 instances...
Completed 395/1000 instances...
Completed 396/1000 instances...
Completed 397/1000 instances...
Completed 398/1000 instances...

```
Completed 399/1000 instances...
Completed 400/1000 instances...
Completed 401/1000 instances...
Completed 402/1000 instances...
Completed 403/1000 instances...
Completed 404/1000 instances...
Completed 405/1000 instances...
Completed 406/1000 instances...
Completed 407/1000 instances...
Completed 408/1000 instances...
Completed 409/1000 instances...
Completed 410/1000 instances...
Completed 411/1000 instances...
Completed 412/1000 instances...
Completed 413/1000 instances...
Completed 414/1000 instances...
Completed 415/1000 instances...
Completed 416/1000 instances...
Completed 417/1000 instances...
Completed 418/1000 instances...
Completed 419/1000 instances...
Completed 420/1000 instances...
Completed 421/1000 instances...
Completed 422/1000 instances...
Completed 423/1000 instances...
Completed 424/1000 instances...
Completed 425/1000 instances...
Completed 426/1000 instances...
Completed 427/1000 instances...
Completed 428/1000 instances...
Completed 429/1000 instances...
Completed 430/1000 instances...
Completed 431/1000 instances...
Completed 432/1000 instances...
Completed 433/1000 instances...
Completed 434/1000 instances...
Completed 435/1000 instances...
Completed 436/1000 instances...
Completed 437/1000 instances...
Completed 438/1000 instances...
Completed 439/1000 instances...
Completed 440/1000 instances...
Completed 441/1000 instances...
Completed 442/1000 instances...
Completed 443/1000 instances...
Completed 444/1000 instances...
Completed 445/1000 instances...
Completed 446/1000 instances...
Completed 447/1000 instances...
```

Completed 448/1000 instances...
Completed 449/1000 instances...
Completed 450/1000 instances...
Completed 451/1000 instances...
Completed 452/1000 instances...
Completed 453/1000 instances...
Completed 454/1000 instances...
Completed 455/1000 instances...
Completed 456/1000 instances...
Completed 457/1000 instances...
Completed 458/1000 instances...
Completed 459/1000 instances...
Completed 460/1000 instances...
Completed 461/1000 instances...
Completed 462/1000 instances...
Completed 463/1000 instances...
Completed 464/1000 instances...
Completed 465/1000 instances...
Completed 466/1000 instances...
Completed 467/1000 instances...
Completed 468/1000 instances...
Completed 469/1000 instances...
Completed 470/1000 instances...
Completed 471/1000 instances...
Completed 472/1000 instances...
Completed 473/1000 instances...
Completed 474/1000 instances...
Completed 475/1000 instances...
Completed 476/1000 instances...
Completed 477/1000 instances...
Completed 478/1000 instances...
Completed 479/1000 instances...
Completed 480/1000 instances...
Completed 481/1000 instances...
Completed 482/1000 instances...
Completed 483/1000 instances...
Completed 484/1000 instances...
Completed 485/1000 instances...
Completed 486/1000 instances...
Completed 487/1000 instances...
Completed 488/1000 instances...
Completed 489/1000 instances...
Completed 490/1000 instances...
Completed 491/1000 instances...
Completed 492/1000 instances...
Completed 493/1000 instances...
Completed 494/1000 instances...
Completed 495/1000 instances...
Completed 496/1000 instances...
Completed 497/1000 instances...

Completed 498/1000 instances...
Completed 499/1000 instances...
Completed 500/1000 instances...
Completed 501/1000 instances...
Completed 502/1000 instances...
Completed 503/1000 instances...
Completed 504/1000 instances...
Completed 505/1000 instances...
Completed 506/1000 instances...
Completed 507/1000 instances...
Completed 508/1000 instances...
Completed 509/1000 instances...
Completed 510/1000 instances...
Completed 511/1000 instances...
Completed 512/1000 instances...
Completed 513/1000 instances...
Completed 514/1000 instances...
Completed 515/1000 instances...
Completed 516/1000 instances...
Completed 517/1000 instances...
Completed 518/1000 instances...
Completed 519/1000 instances...
Completed 520/1000 instances...
Completed 521/1000 instances...
Completed 522/1000 instances...
Completed 523/1000 instances...
Completed 524/1000 instances...
Completed 525/1000 instances...
Completed 526/1000 instances...
Completed 527/1000 instances...
Completed 528/1000 instances...
Completed 529/1000 instances...
Completed 530/1000 instances...
Completed 531/1000 instances...
Completed 532/1000 instances...
Completed 533/1000 instances...
Completed 534/1000 instances...
Completed 535/1000 instances...
Completed 536/1000 instances...
Completed 537/1000 instances...
Completed 538/1000 instances...
Completed 539/1000 instances...
Completed 540/1000 instances...
Completed 541/1000 instances...
Completed 542/1000 instances...
Completed 543/1000 instances...
Completed 544/1000 instances...
Completed 545/1000 instances...
Completed 546/1000 instances...

Completed 547/1000 instances...
Completed 548/1000 instances...
Completed 549/1000 instances...
Completed 550/1000 instances...
Completed 551/1000 instances...
Completed 552/1000 instances...
Completed 553/1000 instances...
Completed 554/1000 instances...
Completed 555/1000 instances...
Completed 556/1000 instances...
Completed 557/1000 instances...
Completed 558/1000 instances...
Completed 559/1000 instances...
Completed 560/1000 instances...
Completed 561/1000 instances...
Completed 562/1000 instances...
Completed 563/1000 instances...
Completed 564/1000 instances...
Completed 565/1000 instances...
Completed 566/1000 instances...
Completed 567/1000 instances...
Completed 568/1000 instances...
Completed 569/1000 instances...
Completed 570/1000 instances...
Completed 571/1000 instances...
Completed 572/1000 instances...
Completed 573/1000 instances...
Completed 574/1000 instances...
Completed 575/1000 instances...
Completed 576/1000 instances...
Completed 577/1000 instances...
Completed 578/1000 instances...
Completed 579/1000 instances...
Completed 580/1000 instances...
Completed 581/1000 instances...
Completed 582/1000 instances...
Completed 583/1000 instances...
Completed 584/1000 instances...
Completed 585/1000 instances...
Completed 586/1000 instances...
Completed 587/1000 instances...
Completed 588/1000 instances...
Completed 589/1000 instances...
Completed 590/1000 instances...
Completed 591/1000 instances...
Completed 592/1000 instances...
Completed 593/1000 instances...
Completed 594/1000 instances...
Completed 595/1000 instances...

Completed 596/1000 instances...
Completed 597/1000 instances...
Completed 598/1000 instances...
Completed 599/1000 instances...
Completed 600/1000 instances...
Completed 601/1000 instances...
Completed 602/1000 instances...
Completed 603/1000 instances...
Completed 604/1000 instances...
Completed 605/1000 instances...
Completed 606/1000 instances...
Completed 607/1000 instances...
Completed 608/1000 instances...
Completed 609/1000 instances...
Completed 610/1000 instances...
Completed 611/1000 instances...
Completed 612/1000 instances...
Completed 613/1000 instances...
Completed 614/1000 instances...
Completed 615/1000 instances...
Completed 616/1000 instances...
Completed 617/1000 instances...
Completed 618/1000 instances...
Completed 619/1000 instances...
Completed 620/1000 instances...
Completed 621/1000 instances...
Completed 622/1000 instances...
Completed 623/1000 instances...
Completed 624/1000 instances...
Completed 625/1000 instances...
Completed 626/1000 instances...
Completed 627/1000 instances...
Completed 628/1000 instances...
Completed 629/1000 instances...
Completed 630/1000 instances...
Completed 631/1000 instances...
Completed 632/1000 instances...
Completed 633/1000 instances...
Completed 634/1000 instances...
Completed 635/1000 instances...
Completed 636/1000 instances...
Completed 637/1000 instances...
Completed 638/1000 instances...
Completed 639/1000 instances...
Completed 640/1000 instances...
Completed 641/1000 instances...
Completed 642/1000 instances...
Completed 643/1000 instances...
Completed 644/1000 instances...

Completed 645/1000 instances...
Completed 646/1000 instances...
Completed 647/1000 instances...
Completed 648/1000 instances...
Completed 649/1000 instances...
Completed 650/1000 instances...
Completed 651/1000 instances...
Completed 652/1000 instances...
Completed 653/1000 instances...
Completed 654/1000 instances...
Completed 655/1000 instances...
Completed 656/1000 instances...
Completed 657/1000 instances...
Completed 658/1000 instances...
Completed 659/1000 instances...
Completed 660/1000 instances...
Completed 661/1000 instances...
Completed 662/1000 instances...
Completed 663/1000 instances...
Completed 664/1000 instances...
Completed 665/1000 instances...
Completed 666/1000 instances...
Completed 667/1000 instances...
Completed 668/1000 instances...
Completed 669/1000 instances...
Completed 670/1000 instances...
Completed 671/1000 instances...
Completed 672/1000 instances...
Completed 673/1000 instances...
Completed 674/1000 instances...
Completed 675/1000 instances...
Completed 676/1000 instances...
Completed 677/1000 instances...
Completed 678/1000 instances...
Completed 679/1000 instances...
Completed 680/1000 instances...
Completed 681/1000 instances...
Completed 682/1000 instances...
Completed 683/1000 instances...
Completed 684/1000 instances...
Completed 685/1000 instances...
Completed 686/1000 instances...
Completed 687/1000 instances...
Completed 688/1000 instances...
Completed 689/1000 instances...
Completed 690/1000 instances...
Completed 691/1000 instances...
Completed 692/1000 instances...
Completed 693/1000 instances...

Completed 694/1000 instances...
Completed 695/1000 instances...
Completed 696/1000 instances...
Completed 697/1000 instances...
Completed 698/1000 instances...
Completed 699/1000 instances...
Completed 700/1000 instances...
Completed 701/1000 instances...
Completed 702/1000 instances...
Completed 703/1000 instances...
Completed 704/1000 instances...
Completed 705/1000 instances...
Completed 706/1000 instances...
Completed 707/1000 instances...
Completed 708/1000 instances...
Completed 709/1000 instances...
Completed 710/1000 instances...
Completed 711/1000 instances...
Completed 712/1000 instances...
Completed 713/1000 instances...
Completed 714/1000 instances...
Completed 715/1000 instances...
Completed 716/1000 instances...
Completed 717/1000 instances...
Completed 718/1000 instances...
Completed 719/1000 instances...
Completed 720/1000 instances...
Completed 721/1000 instances...
Completed 722/1000 instances...
Completed 723/1000 instances...
Completed 724/1000 instances...
Completed 725/1000 instances...
Completed 726/1000 instances...
Completed 727/1000 instances...
Completed 728/1000 instances...
Completed 729/1000 instances...
Completed 730/1000 instances...
Completed 731/1000 instances...
Completed 732/1000 instances...
Completed 733/1000 instances...
Completed 734/1000 instances...
Completed 735/1000 instances...
Completed 736/1000 instances...
Completed 737/1000 instances...
Completed 738/1000 instances...
Completed 739/1000 instances...
Completed 740/1000 instances...
Completed 741/1000 instances...
Completed 742/1000 instances...

Completed 743/1000 instances...
Completed 744/1000 instances...
Completed 745/1000 instances...
Completed 746/1000 instances...
Completed 747/1000 instances...
Completed 748/1000 instances...
Completed 749/1000 instances...
Completed 750/1000 instances...
Completed 751/1000 instances...
Completed 752/1000 instances...
Completed 753/1000 instances...
Completed 754/1000 instances...
Completed 755/1000 instances...
Completed 756/1000 instances...
Completed 757/1000 instances...
Completed 758/1000 instances...
Completed 759/1000 instances...
Completed 760/1000 instances...
Completed 761/1000 instances...
Completed 762/1000 instances...
Completed 763/1000 instances...
Completed 764/1000 instances...
Completed 765/1000 instances...
Completed 766/1000 instances...
Completed 767/1000 instances...
Completed 768/1000 instances...
Completed 769/1000 instances...
Completed 770/1000 instances...
Completed 771/1000 instances...
Completed 772/1000 instances...
Completed 773/1000 instances...
Completed 774/1000 instances...
Completed 775/1000 instances...
Completed 776/1000 instances...
Completed 777/1000 instances...
Completed 778/1000 instances...
Completed 779/1000 instances...
Completed 780/1000 instances...
Completed 781/1000 instances...
Completed 782/1000 instances...
Completed 783/1000 instances...
Completed 784/1000 instances...
Completed 785/1000 instances...
Completed 786/1000 instances...
Completed 787/1000 instances...
Completed 788/1000 instances...
Completed 789/1000 instances...
Completed 790/1000 instances...
Completed 791/1000 instances...

Completed 792/1000 instances...
Completed 793/1000 instances...
Completed 794/1000 instances...
Completed 795/1000 instances...
Completed 796/1000 instances...
Completed 797/1000 instances...
Completed 798/1000 instances...
Completed 799/1000 instances...
Completed 800/1000 instances...
Completed 801/1000 instances...
Completed 802/1000 instances...
Completed 803/1000 instances...
Completed 804/1000 instances...
Completed 805/1000 instances...
Completed 806/1000 instances...
Completed 807/1000 instances...
Completed 808/1000 instances...
Completed 809/1000 instances...
Completed 810/1000 instances...
Completed 811/1000 instances...
Completed 812/1000 instances...
Completed 813/1000 instances...
Completed 814/1000 instances...
Completed 815/1000 instances...
Completed 816/1000 instances...
Completed 817/1000 instances...
Completed 818/1000 instances...
Completed 819/1000 instances...
Completed 820/1000 instances...
Completed 821/1000 instances...
Completed 822/1000 instances...
Completed 823/1000 instances...
Completed 824/1000 instances...
Completed 825/1000 instances...
Completed 826/1000 instances...
Completed 827/1000 instances...
Completed 828/1000 instances...
Completed 829/1000 instances...
Completed 830/1000 instances...
Completed 831/1000 instances...
Completed 832/1000 instances...
Completed 833/1000 instances...
Completed 834/1000 instances...
Completed 835/1000 instances...
Completed 836/1000 instances...
Completed 837/1000 instances...
Completed 838/1000 instances...
Completed 839/1000 instances...
Completed 840/1000 instances...

Completed 841/1000 instances...
Completed 842/1000 instances...
Completed 843/1000 instances...
Completed 844/1000 instances...
Completed 845/1000 instances...
Completed 846/1000 instances...
Completed 847/1000 instances...
Completed 848/1000 instances...
Completed 849/1000 instances...
Completed 850/1000 instances...
Completed 851/1000 instances...
Completed 852/1000 instances...
Completed 853/1000 instances...
Completed 854/1000 instances...
Completed 855/1000 instances...
Completed 856/1000 instances...
Completed 857/1000 instances...
Completed 858/1000 instances...
Completed 859/1000 instances...
Completed 860/1000 instances...
Completed 861/1000 instances...
Completed 862/1000 instances...
Completed 863/1000 instances...
Completed 864/1000 instances...
Completed 865/1000 instances...
Completed 866/1000 instances...
Completed 867/1000 instances...
Completed 868/1000 instances...
Completed 869/1000 instances...
Completed 870/1000 instances...
Completed 871/1000 instances...
Completed 872/1000 instances...
Completed 873/1000 instances...
Completed 874/1000 instances...
Completed 875/1000 instances...
Completed 876/1000 instances...
Completed 877/1000 instances...
Completed 878/1000 instances...
Completed 879/1000 instances...
Completed 880/1000 instances...
Completed 881/1000 instances...
Completed 882/1000 instances...
Completed 883/1000 instances...
Completed 884/1000 instances...
Completed 885/1000 instances...
Completed 886/1000 instances...
Completed 887/1000 instances...
Completed 888/1000 instances...
Completed 889/1000 instances...

Completed 890/1000 instances...
Completed 891/1000 instances...
Completed 892/1000 instances...
Completed 893/1000 instances...
Completed 894/1000 instances...
Completed 895/1000 instances...
Completed 896/1000 instances...
Completed 897/1000 instances...
Completed 898/1000 instances...
Completed 899/1000 instances...
Completed 900/1000 instances...
Completed 901/1000 instances...
Completed 902/1000 instances...
Completed 903/1000 instances...
Completed 904/1000 instances...
Completed 905/1000 instances...
Completed 906/1000 instances...
Completed 907/1000 instances...
Completed 908/1000 instances...
Completed 909/1000 instances...
Completed 910/1000 instances...
Completed 911/1000 instances...
Completed 912/1000 instances...
Completed 913/1000 instances...
Completed 914/1000 instances...
Completed 915/1000 instances...
Completed 916/1000 instances...
Completed 917/1000 instances...
Completed 918/1000 instances...
Completed 919/1000 instances...
Completed 920/1000 instances...
Completed 921/1000 instances...
Completed 922/1000 instances...
Completed 923/1000 instances...
Completed 924/1000 instances...
Completed 925/1000 instances...
Completed 926/1000 instances...
Completed 927/1000 instances...
Completed 928/1000 instances...
Completed 929/1000 instances...
Completed 930/1000 instances...
Completed 931/1000 instances...
Completed 932/1000 instances...
Completed 933/1000 instances...
Completed 934/1000 instances...
Completed 935/1000 instances...
Completed 936/1000 instances...
Completed 937/1000 instances...
Completed 938/1000 instances...

Completed 939/1000 instances...
Completed 940/1000 instances...
Completed 941/1000 instances...
Completed 942/1000 instances...
Completed 943/1000 instances...
Completed 944/1000 instances...
Completed 945/1000 instances...
Completed 946/1000 instances...
Completed 947/1000 instances...
Completed 948/1000 instances...
Completed 949/1000 instances...
Completed 950/1000 instances...
Completed 951/1000 instances...
Completed 952/1000 instances...
Completed 953/1000 instances...
Completed 954/1000 instances...
Completed 955/1000 instances...
Completed 956/1000 instances...
Completed 957/1000 instances...
Completed 958/1000 instances...
Completed 959/1000 instances...
Completed 960/1000 instances...
Completed 961/1000 instances...
Completed 962/1000 instances...
Completed 963/1000 instances...
Completed 964/1000 instances...
Completed 965/1000 instances...
Completed 966/1000 instances...
Completed 967/1000 instances...
Completed 968/1000 instances...
Completed 969/1000 instances...
Completed 970/1000 instances...
Completed 971/1000 instances...
Completed 972/1000 instances...
Completed 973/1000 instances...
Completed 974/1000 instances...
Completed 975/1000 instances...
Completed 976/1000 instances...
Completed 977/1000 instances...
Completed 978/1000 instances...
Completed 979/1000 instances...
Completed 980/1000 instances...
Completed 981/1000 instances...
Completed 982/1000 instances...
Completed 983/1000 instances...
Completed 984/1000 instances...
Completed 985/1000 instances...
Completed 986/1000 instances...
Completed 987/1000 instances...

```

Completed 988/1000 instances...
Completed 989/1000 instances...
Completed 990/1000 instances...
Completed 991/1000 instances...
Completed 992/1000 instances...
Completed 993/1000 instances...
Completed 994/1000 instances...
Completed 995/1000 instances...
Completed 996/1000 instances...
Completed 997/1000 instances...
Completed 998/1000 instances...
Completed 999/1000 instances...
Completed 1000/1000 instances...
--- Evaluation Complete ---

```

Steps	Instance	Is_Valid	Success	Score	Optimum	Rel_Error
0	wuf20-0911.mwcnf	True	True	6638	6638	0.0
73528						
1	wuf20-0911.mwcnf	True	True	6638	6638	0.0
73528						
2	wuf20-0911.mwcnf	True	True	6638	6638	0.0
73528						
3	wuf20-0911.mwcnf	True	True	6638	6638	0.0
73528						
4	wuf20-0911.mwcnf	True	True	6638	6638	0.0
73528						
...
...						
99995	wuf20-0572.mwcnf	True	True	3477	3477	0.0
74984						
99996	wuf20-0572.mwcnf	True	True	3477	3477	0.0
73528						
99997	wuf20-0572.mwcnf	True	True	3477	3477	0.0
73528						
99998	wuf20-0572.mwcnf	True	True	3477	3477	0.0
74256						
99999	wuf20-0572.mwcnf	True	True	3477	3477	0.0
75712						

	Time
0	0.394691
1	0.548268
2	0.445367
3	0.449494
4	0.444634
...	...
99995	0.354437
99996	0.398175
99997	0.349683

```
99998  0.347553
99999  0.357235

[100000 rows x 8 columns]

instance_paths = [os.path.join(wuf_20_q_path,x) for x in
os.listdir(wuf_20_q_path)]
solutions = get_solution_dict(os.path.join(wuf_20_path, "wuf20-91-Q-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=100,
    max_workers=12 # Uses all cores automatically
)
df_results.to_csv("wuf20-91-Q")
display(df_results)

--- Starting Black Box Evaluation ---
Instances: 1000
Repeats per Instance: 100
Total Runs: 100000
Parallel Workers: 12
Completed 1/1000 instances...
Completed 2/1000 instances...
Completed 3/1000 instances...
Completed 4/1000 instances...
Completed 5/1000 instances...
Completed 6/1000 instances...
Completed 7/1000 instances...
Completed 8/1000 instances...
Completed 9/1000 instances...
Completed 10/1000 instances...
Completed 11/1000 instances...
Completed 12/1000 instances...
Completed 13/1000 instances...
Completed 14/1000 instances...
Completed 15/1000 instances...
Completed 16/1000 instances...
Completed 17/1000 instances...
Completed 18/1000 instances...
Completed 19/1000 instances...
Completed 20/1000 instances...
Completed 21/1000 instances...
Completed 22/1000 instances...
Completed 23/1000 instances...
Completed 24/1000 instances...
Completed 25/1000 instances...
```

Completed 26/1000 instances...
Completed 27/1000 instances...
Completed 28/1000 instances...
Completed 29/1000 instances...
Completed 30/1000 instances...
Completed 31/1000 instances...
Completed 32/1000 instances...
Completed 33/1000 instances...
Completed 34/1000 instances...
Completed 35/1000 instances...
Completed 36/1000 instances...
Completed 37/1000 instances...
Completed 38/1000 instances...
Completed 39/1000 instances...
Completed 40/1000 instances...
Completed 41/1000 instances...
Completed 42/1000 instances...
Completed 43/1000 instances...
Completed 44/1000 instances...
Completed 45/1000 instances...
Completed 46/1000 instances...
Completed 47/1000 instances...
Completed 48/1000 instances...
Completed 49/1000 instances...
Completed 50/1000 instances...
Completed 51/1000 instances...
Completed 52/1000 instances...
Completed 53/1000 instances...
Completed 54/1000 instances...
Completed 55/1000 instances...
Completed 56/1000 instances...
Completed 57/1000 instances...
Completed 58/1000 instances...
Completed 59/1000 instances...
Completed 60/1000 instances...
Completed 61/1000 instances...
Completed 62/1000 instances...
Completed 63/1000 instances...
Completed 64/1000 instances...
Completed 65/1000 instances...
Completed 66/1000 instances...
Completed 67/1000 instances...
Completed 68/1000 instances...
Completed 69/1000 instances...
Completed 70/1000 instances...
Completed 71/1000 instances...
Completed 72/1000 instances...
Completed 73/1000 instances...
Completed 74/1000 instances...

Completed 75/1000 instances...
Completed 76/1000 instances...
Completed 77/1000 instances...
Completed 78/1000 instances...
Completed 79/1000 instances...
Completed 80/1000 instances...
Completed 81/1000 instances...
Completed 82/1000 instances...
Completed 83/1000 instances...
Completed 84/1000 instances...
Completed 85/1000 instances...
Completed 86/1000 instances...
Completed 87/1000 instances...
Completed 88/1000 instances...
Completed 89/1000 instances...
Completed 90/1000 instances...
Completed 91/1000 instances...
Completed 92/1000 instances...
Completed 93/1000 instances...
Completed 94/1000 instances...
Completed 95/1000 instances...
Completed 96/1000 instances...
Completed 97/1000 instances...
Completed 98/1000 instances...
Completed 99/1000 instances...
Completed 100/1000 instances...
Completed 101/1000 instances...
Completed 102/1000 instances...
Completed 103/1000 instances...
Completed 104/1000 instances...
Completed 105/1000 instances...
Completed 106/1000 instances...
Completed 107/1000 instances...
Completed 108/1000 instances...
Completed 109/1000 instances...
Completed 110/1000 instances...
Completed 111/1000 instances...
Completed 112/1000 instances...
Completed 113/1000 instances...
Completed 114/1000 instances...
Completed 115/1000 instances...
Completed 116/1000 instances...
Completed 117/1000 instances...
Completed 118/1000 instances...
Completed 119/1000 instances...
Completed 120/1000 instances...
Completed 121/1000 instances...
Completed 122/1000 instances...
Completed 123/1000 instances...

Completed 124/1000 instances...
Completed 125/1000 instances...
Completed 126/1000 instances...
Completed 127/1000 instances...
Completed 128/1000 instances...
Completed 129/1000 instances...
Completed 130/1000 instances...
Completed 131/1000 instances...
Completed 132/1000 instances...
Completed 133/1000 instances...
Completed 134/1000 instances...
Completed 135/1000 instances...
Completed 136/1000 instances...
Completed 137/1000 instances...
Completed 138/1000 instances...
Completed 139/1000 instances...
Completed 140/1000 instances...
Completed 141/1000 instances...
Completed 142/1000 instances...
Completed 143/1000 instances...
Completed 144/1000 instances...
Completed 145/1000 instances...
Completed 146/1000 instances...
Completed 147/1000 instances...
Completed 148/1000 instances...
Completed 149/1000 instances...
Completed 150/1000 instances...
Completed 151/1000 instances...
Completed 152/1000 instances...
Completed 153/1000 instances...
Completed 154/1000 instances...
Completed 155/1000 instances...
Completed 156/1000 instances...
Completed 157/1000 instances...
Completed 158/1000 instances...
Completed 159/1000 instances...
Completed 160/1000 instances...
Completed 161/1000 instances...
Completed 162/1000 instances...
Completed 163/1000 instances...
Completed 164/1000 instances...
Completed 165/1000 instances...
Completed 166/1000 instances...
Completed 167/1000 instances...
Completed 168/1000 instances...
Completed 169/1000 instances...
Completed 170/1000 instances...
Completed 171/1000 instances...
Completed 172/1000 instances...

Completed 173/1000 instances...
Completed 174/1000 instances...
Completed 175/1000 instances...
Completed 176/1000 instances...
Completed 177/1000 instances...
Completed 178/1000 instances...
Completed 179/1000 instances...
Completed 180/1000 instances...
Completed 181/1000 instances...
Completed 182/1000 instances...
Completed 183/1000 instances...
Completed 184/1000 instances...
Completed 185/1000 instances...
Completed 186/1000 instances...
Completed 187/1000 instances...
Completed 188/1000 instances...
Completed 189/1000 instances...
Completed 190/1000 instances...
Completed 191/1000 instances...
Completed 192/1000 instances...
Completed 193/1000 instances...
Completed 194/1000 instances...
Completed 195/1000 instances...
Completed 196/1000 instances...
Completed 197/1000 instances...
Completed 198/1000 instances...
Completed 199/1000 instances...
Completed 200/1000 instances...
Completed 201/1000 instances...
Completed 202/1000 instances...
Completed 203/1000 instances...
Completed 204/1000 instances...
Completed 205/1000 instances...
Completed 206/1000 instances...
Completed 207/1000 instances...
Completed 208/1000 instances...
Completed 209/1000 instances...
Completed 210/1000 instances...
Completed 211/1000 instances...
Completed 212/1000 instances...
Completed 213/1000 instances...
Completed 214/1000 instances...
Completed 215/1000 instances...
Completed 216/1000 instances...
Completed 217/1000 instances...
Completed 218/1000 instances...
Completed 219/1000 instances...
Completed 220/1000 instances...
Completed 221/1000 instances...

Completed 222/1000 instances...
Completed 223/1000 instances...
Completed 224/1000 instances...
Completed 225/1000 instances...
Completed 226/1000 instances...
Completed 227/1000 instances...
Completed 228/1000 instances...
Completed 229/1000 instances...
Completed 230/1000 instances...
Completed 231/1000 instances...
Completed 232/1000 instances...
Completed 233/1000 instances...
Completed 234/1000 instances...
Completed 235/1000 instances...
Completed 236/1000 instances...
Completed 237/1000 instances...
Completed 238/1000 instances...
Completed 239/1000 instances...
Completed 240/1000 instances...
Completed 241/1000 instances...
Completed 242/1000 instances...
Completed 243/1000 instances...
Completed 244/1000 instances...
Completed 245/1000 instances...
Completed 246/1000 instances...
Completed 247/1000 instances...
Completed 248/1000 instances...
Completed 249/1000 instances...
Completed 250/1000 instances...
Completed 251/1000 instances...
Completed 252/1000 instances...
Completed 253/1000 instances...
Completed 254/1000 instances...
Completed 255/1000 instances...
Completed 256/1000 instances...
Completed 257/1000 instances...
Completed 258/1000 instances...
Completed 259/1000 instances...
Completed 260/1000 instances...
Completed 261/1000 instances...
Completed 262/1000 instances...
Completed 263/1000 instances...
Completed 264/1000 instances...
Completed 265/1000 instances...
Completed 266/1000 instances...
Completed 267/1000 instances...
Completed 268/1000 instances...
Completed 269/1000 instances...
Completed 270/1000 instances...

Completed 271/1000 instances...
Completed 272/1000 instances...
Completed 273/1000 instances...
Completed 274/1000 instances...
Completed 275/1000 instances...
Completed 276/1000 instances...
Completed 277/1000 instances...
Completed 278/1000 instances...
Completed 279/1000 instances...
Completed 280/1000 instances...
Completed 281/1000 instances...
Completed 282/1000 instances...
Completed 283/1000 instances...
Completed 284/1000 instances...
Completed 285/1000 instances...
Completed 286/1000 instances...
Completed 287/1000 instances...
Completed 288/1000 instances...
Completed 289/1000 instances...
Completed 290/1000 instances...
Completed 291/1000 instances...
Completed 292/1000 instances...
Completed 293/1000 instances...
Completed 294/1000 instances...
Completed 295/1000 instances...
Completed 296/1000 instances...
Completed 297/1000 instances...
Completed 298/1000 instances...
Completed 299/1000 instances...
Completed 300/1000 instances...
Completed 301/1000 instances...
Completed 302/1000 instances...
Completed 303/1000 instances...
Completed 304/1000 instances...
Completed 305/1000 instances...
Completed 306/1000 instances...
Completed 307/1000 instances...
Completed 308/1000 instances...
Completed 309/1000 instances...
Completed 310/1000 instances...
Completed 311/1000 instances...
Completed 312/1000 instances...
Completed 313/1000 instances...
Completed 314/1000 instances...
Completed 315/1000 instances...
Completed 316/1000 instances...
Completed 317/1000 instances...
Completed 318/1000 instances...
Completed 319/1000 instances...

Completed 320/1000 instances...
Completed 321/1000 instances...
Completed 322/1000 instances...
Completed 323/1000 instances...
Completed 324/1000 instances...
Completed 325/1000 instances...
Completed 326/1000 instances...
Completed 327/1000 instances...
Completed 328/1000 instances...
Completed 329/1000 instances...
Completed 330/1000 instances...
Completed 331/1000 instances...
Completed 332/1000 instances...
Completed 333/1000 instances...
Completed 334/1000 instances...
Completed 335/1000 instances...
Completed 336/1000 instances...
Completed 337/1000 instances...
Completed 338/1000 instances...
Completed 339/1000 instances...
Completed 340/1000 instances...
Completed 341/1000 instances...
Completed 342/1000 instances...
Completed 343/1000 instances...
Completed 344/1000 instances...
Completed 345/1000 instances...
Completed 346/1000 instances...
Completed 347/1000 instances...
Completed 348/1000 instances...
Completed 349/1000 instances...
Completed 350/1000 instances...
Completed 351/1000 instances...
Completed 352/1000 instances...
Completed 353/1000 instances...
Completed 354/1000 instances...
Completed 355/1000 instances...
Completed 356/1000 instances...
Completed 357/1000 instances...
Completed 358/1000 instances...
Completed 359/1000 instances...
Completed 360/1000 instances...
Completed 361/1000 instances...
Completed 362/1000 instances...
Completed 363/1000 instances...
Completed 364/1000 instances...
Completed 365/1000 instances...
Completed 366/1000 instances...
Completed 367/1000 instances...
Completed 368/1000 instances...

Completed 369/1000 instances...
Completed 370/1000 instances...
Completed 371/1000 instances...
Completed 372/1000 instances...
Completed 373/1000 instances...
Completed 374/1000 instances...
Completed 375/1000 instances...
Completed 376/1000 instances...
Completed 377/1000 instances...
Completed 378/1000 instances...
Completed 379/1000 instances...
Completed 380/1000 instances...
Completed 381/1000 instances...
Completed 382/1000 instances...
Completed 383/1000 instances...
Completed 384/1000 instances...
Completed 385/1000 instances...
Completed 386/1000 instances...
Completed 387/1000 instances...
Completed 388/1000 instances...
Completed 389/1000 instances...
Completed 390/1000 instances...
Completed 391/1000 instances...
Completed 392/1000 instances...
Completed 393/1000 instances...
Completed 394/1000 instances...
Completed 395/1000 instances...
Completed 396/1000 instances...
Completed 397/1000 instances...
Completed 398/1000 instances...
Completed 399/1000 instances...
Completed 400/1000 instances...
Completed 401/1000 instances...
Completed 402/1000 instances...
Completed 403/1000 instances...
Completed 404/1000 instances...
Completed 405/1000 instances...
Completed 406/1000 instances...
Completed 407/1000 instances...
Completed 408/1000 instances...
Completed 409/1000 instances...
Completed 410/1000 instances...
Completed 411/1000 instances...
Completed 412/1000 instances...
Completed 413/1000 instances...
Completed 414/1000 instances...
Completed 415/1000 instances...
Completed 416/1000 instances...
Completed 417/1000 instances...

Completed 418/1000 instances...
Completed 419/1000 instances...
Completed 420/1000 instances...
Completed 421/1000 instances...
Completed 422/1000 instances...
Completed 423/1000 instances...
Completed 424/1000 instances...
Completed 425/1000 instances...
Completed 426/1000 instances...
Completed 427/1000 instances...
Completed 428/1000 instances...
Completed 429/1000 instances...
Completed 430/1000 instances...
Completed 431/1000 instances...
Completed 432/1000 instances...
Completed 433/1000 instances...
Completed 434/1000 instances...
Completed 435/1000 instances...
Completed 436/1000 instances...
Completed 437/1000 instances...
Completed 438/1000 instances...
Completed 439/1000 instances...
Completed 440/1000 instances...
Completed 441/1000 instances...
Completed 442/1000 instances...
Completed 443/1000 instances...
Completed 444/1000 instances...
Completed 445/1000 instances...
Completed 446/1000 instances...
Completed 447/1000 instances...
Completed 448/1000 instances...
Completed 449/1000 instances...
Completed 450/1000 instances...
Completed 451/1000 instances...
Completed 452/1000 instances...
Completed 453/1000 instances...
Completed 454/1000 instances...
Completed 455/1000 instances...
Completed 456/1000 instances...
Completed 457/1000 instances...
Completed 458/1000 instances...
Completed 459/1000 instances...
Completed 460/1000 instances...
Completed 461/1000 instances...
Completed 462/1000 instances...
Completed 463/1000 instances...
Completed 464/1000 instances...
Completed 465/1000 instances...
Completed 466/1000 instances...

Completed 467/1000 instances...
Completed 468/1000 instances...
Completed 469/1000 instances...
Completed 470/1000 instances...
Completed 471/1000 instances...
Completed 472/1000 instances...
Completed 473/1000 instances...
Completed 474/1000 instances...
Completed 475/1000 instances...
Completed 476/1000 instances...
Completed 477/1000 instances...
Completed 478/1000 instances...
Completed 479/1000 instances...
Completed 480/1000 instances...
Completed 481/1000 instances...
Completed 482/1000 instances...
Completed 483/1000 instances...
Completed 484/1000 instances...
Completed 485/1000 instances...
Completed 486/1000 instances...
Completed 487/1000 instances...
Completed 488/1000 instances...
Completed 489/1000 instances...
Completed 490/1000 instances...
Completed 491/1000 instances...
Completed 492/1000 instances...
Completed 493/1000 instances...
Completed 494/1000 instances...
Completed 495/1000 instances...
Completed 496/1000 instances...
Completed 497/1000 instances...
Completed 498/1000 instances...
Completed 499/1000 instances...
Completed 500/1000 instances...
Completed 501/1000 instances...
Completed 502/1000 instances...
Completed 503/1000 instances...
Completed 504/1000 instances...
Completed 505/1000 instances...
Completed 506/1000 instances...
Completed 507/1000 instances...
Completed 508/1000 instances...
Completed 509/1000 instances...
Completed 510/1000 instances...
Completed 511/1000 instances...
Completed 512/1000 instances...
Completed 513/1000 instances...
Completed 514/1000 instances...
Completed 515/1000 instances...
Completed 516/1000 instances...

Completed 517/1000 instances...
Completed 518/1000 instances...
Completed 519/1000 instances...
Completed 520/1000 instances...
Completed 521/1000 instances...
Completed 522/1000 instances...
Completed 523/1000 instances...
Completed 524/1000 instances...
Completed 525/1000 instances...
Completed 526/1000 instances...
Completed 527/1000 instances...
Completed 528/1000 instances...
Completed 529/1000 instances...
Completed 530/1000 instances...
Completed 531/1000 instances...
Completed 532/1000 instances...
Completed 533/1000 instances...
Completed 534/1000 instances...
Completed 535/1000 instances...
Completed 536/1000 instances...
Completed 537/1000 instances...
Completed 538/1000 instances...
Completed 539/1000 instances...
Completed 540/1000 instances...
Completed 541/1000 instances...
Completed 542/1000 instances...
Completed 543/1000 instances...
Completed 544/1000 instances...
Completed 545/1000 instances...
Completed 546/1000 instances...
Completed 547/1000 instances...
Completed 548/1000 instances...
Completed 549/1000 instances...
Completed 550/1000 instances...
Completed 551/1000 instances...
Completed 552/1000 instances...
Completed 553/1000 instances...
Completed 554/1000 instances...
Completed 555/1000 instances...
Completed 556/1000 instances...
Completed 557/1000 instances...
Completed 558/1000 instances...
Completed 559/1000 instances...
Completed 560/1000 instances...
Completed 561/1000 instances...
Completed 562/1000 instances...
Completed 563/1000 instances...
Completed 564/1000 instances...
Completed 565/1000 instances...

Completed 566/1000 instances...
Completed 567/1000 instances...
Completed 568/1000 instances...
Completed 569/1000 instances...
Completed 570/1000 instances...
Completed 571/1000 instances...
Completed 572/1000 instances...
Completed 573/1000 instances...
Completed 574/1000 instances...
Completed 575/1000 instances...
Completed 576/1000 instances...
Completed 577/1000 instances...
Completed 578/1000 instances...
Completed 579/1000 instances...
Completed 580/1000 instances...
Completed 581/1000 instances...
Completed 582/1000 instances...
Completed 583/1000 instances...
Completed 584/1000 instances...
Completed 585/1000 instances...
Completed 586/1000 instances...
Completed 587/1000 instances...
Completed 588/1000 instances...
Completed 589/1000 instances...
Completed 590/1000 instances...
Completed 591/1000 instances...
Completed 592/1000 instances...
Completed 593/1000 instances...
Completed 594/1000 instances...
Completed 595/1000 instances...
Completed 596/1000 instances...
Completed 597/1000 instances...
Completed 598/1000 instances...
Completed 599/1000 instances...
Completed 600/1000 instances...
Completed 601/1000 instances...
Completed 602/1000 instances...
Completed 603/1000 instances...
Completed 604/1000 instances...
Completed 605/1000 instances...
Completed 606/1000 instances...
Completed 607/1000 instances...
Completed 608/1000 instances...
Completed 609/1000 instances...
Completed 610/1000 instances...
Completed 611/1000 instances...
Completed 612/1000 instances...
Completed 613/1000 instances...
Completed 614/1000 instances...

Completed 615/1000 instances...
Completed 616/1000 instances...
Completed 617/1000 instances...
Completed 618/1000 instances...
Completed 619/1000 instances...
Completed 620/1000 instances...
Completed 621/1000 instances...
Completed 622/1000 instances...
Completed 623/1000 instances...
Completed 624/1000 instances...
Completed 625/1000 instances...
Completed 626/1000 instances...
Completed 627/1000 instances...
Completed 628/1000 instances...
Completed 629/1000 instances...
Completed 630/1000 instances...
Completed 631/1000 instances...
Completed 632/1000 instances...
Completed 633/1000 instances...
Completed 634/1000 instances...
Completed 635/1000 instances...
Completed 636/1000 instances...
Completed 637/1000 instances...
Completed 638/1000 instances...
Completed 639/1000 instances...
Completed 640/1000 instances...
Completed 641/1000 instances...
Completed 642/1000 instances...
Completed 643/1000 instances...
Completed 644/1000 instances...
Completed 645/1000 instances...
Completed 646/1000 instances...
Completed 647/1000 instances...
Completed 648/1000 instances...
Completed 649/1000 instances...
Completed 650/1000 instances...
Completed 651/1000 instances...
Completed 652/1000 instances...
Completed 653/1000 instances...
Completed 654/1000 instances...
Completed 655/1000 instances...
Completed 656/1000 instances...
Completed 657/1000 instances...
Completed 658/1000 instances...
Completed 659/1000 instances...
Completed 660/1000 instances...
Completed 661/1000 instances...
Completed 662/1000 instances...
Completed 663/1000 instances...

Completed 664/1000 instances...
Completed 665/1000 instances...
Completed 666/1000 instances...
Completed 667/1000 instances...
Completed 668/1000 instances...
Completed 669/1000 instances...
Completed 670/1000 instances...
Completed 671/1000 instances...
Completed 672/1000 instances...
Completed 673/1000 instances...
Completed 674/1000 instances...
Completed 675/1000 instances...
Completed 676/1000 instances...
Completed 677/1000 instances...
Completed 678/1000 instances...
Completed 679/1000 instances...
Completed 680/1000 instances...
Completed 681/1000 instances...
Completed 682/1000 instances...
Completed 683/1000 instances...
Completed 684/1000 instances...
Completed 685/1000 instances...
Completed 686/1000 instances...
Completed 687/1000 instances...
Completed 688/1000 instances...
Completed 689/1000 instances...
Completed 690/1000 instances...
Completed 691/1000 instances...
Completed 692/1000 instances...
Completed 693/1000 instances...
Completed 694/1000 instances...
Completed 695/1000 instances...
Completed 696/1000 instances...
Completed 697/1000 instances...
Completed 698/1000 instances...
Completed 699/1000 instances...
Completed 700/1000 instances...
Completed 701/1000 instances...
Completed 702/1000 instances...
Completed 703/1000 instances...
Completed 704/1000 instances...
Completed 705/1000 instances...
Completed 706/1000 instances...
Completed 707/1000 instances...
Completed 708/1000 instances...
Completed 709/1000 instances...
Completed 710/1000 instances...
Completed 711/1000 instances...
Completed 712/1000 instances...

Completed 713/1000 instances...
Completed 714/1000 instances...
Completed 715/1000 instances...
Completed 716/1000 instances...
Completed 717/1000 instances...
Completed 718/1000 instances...
Completed 719/1000 instances...
Completed 720/1000 instances...
Completed 721/1000 instances...
Completed 722/1000 instances...
Completed 723/1000 instances...
Completed 724/1000 instances...
Completed 725/1000 instances...
Completed 726/1000 instances...
Completed 727/1000 instances...
Completed 728/1000 instances...
Completed 729/1000 instances...
Completed 730/1000 instances...
Completed 731/1000 instances...
Completed 732/1000 instances...
Completed 733/1000 instances...
Completed 734/1000 instances...
Completed 735/1000 instances...
Completed 736/1000 instances...
Completed 737/1000 instances...
Completed 738/1000 instances...
Completed 739/1000 instances...
Completed 740/1000 instances...
Completed 741/1000 instances...
Completed 742/1000 instances...
Completed 743/1000 instances...
Completed 744/1000 instances...
Completed 745/1000 instances...
Completed 746/1000 instances...
Completed 747/1000 instances...
Completed 748/1000 instances...
Completed 749/1000 instances...
Completed 750/1000 instances...
Completed 751/1000 instances...
Completed 752/1000 instances...
Completed 753/1000 instances...
Completed 754/1000 instances...
Completed 755/1000 instances...
Completed 756/1000 instances...
Completed 757/1000 instances...
Completed 758/1000 instances...
Completed 759/1000 instances...
Completed 760/1000 instances...
Completed 761/1000 instances...

Completed 762/1000 instances...
Completed 763/1000 instances...
Completed 764/1000 instances...
Completed 765/1000 instances...
Completed 766/1000 instances...
Completed 767/1000 instances...
Completed 768/1000 instances...
Completed 769/1000 instances...
Completed 770/1000 instances...
Completed 771/1000 instances...
Completed 772/1000 instances...
Completed 773/1000 instances...
Completed 774/1000 instances...
Completed 775/1000 instances...
Completed 776/1000 instances...
Completed 777/1000 instances...
Completed 778/1000 instances...
Completed 779/1000 instances...
Completed 780/1000 instances...
Completed 781/1000 instances...
Completed 782/1000 instances...
Completed 783/1000 instances...
Completed 784/1000 instances...
Completed 785/1000 instances...
Completed 786/1000 instances...
Completed 787/1000 instances...
Completed 788/1000 instances...
Completed 789/1000 instances...
Completed 790/1000 instances...
Completed 791/1000 instances...
Completed 792/1000 instances...
Completed 793/1000 instances...
Completed 794/1000 instances...
Completed 795/1000 instances...
Completed 796/1000 instances...
Completed 797/1000 instances...
Completed 798/1000 instances...
Completed 799/1000 instances...
Completed 800/1000 instances...
Completed 801/1000 instances...
Completed 802/1000 instances...
Completed 803/1000 instances...
Completed 804/1000 instances...
Completed 805/1000 instances...
Completed 806/1000 instances...
Completed 807/1000 instances...
Completed 808/1000 instances...
Completed 809/1000 instances...
Completed 810/1000 instances...

Completed 811/1000 instances...
Completed 812/1000 instances...
Completed 813/1000 instances...
Completed 814/1000 instances...
Completed 815/1000 instances...
Completed 816/1000 instances...
Completed 817/1000 instances...
Completed 818/1000 instances...
Completed 819/1000 instances...
Completed 820/1000 instances...
Completed 821/1000 instances...
Completed 822/1000 instances...
Completed 823/1000 instances...
Completed 824/1000 instances...
Completed 825/1000 instances...
Completed 826/1000 instances...
Completed 827/1000 instances...
Completed 828/1000 instances...
Completed 829/1000 instances...
Completed 830/1000 instances...
Completed 831/1000 instances...
Completed 832/1000 instances...
Completed 833/1000 instances...
Completed 834/1000 instances...
Completed 835/1000 instances...
Completed 836/1000 instances...
Completed 837/1000 instances...
Completed 838/1000 instances...
Completed 839/1000 instances...
Completed 840/1000 instances...
Completed 841/1000 instances...
Completed 842/1000 instances...
Completed 843/1000 instances...
Completed 844/1000 instances...
Completed 845/1000 instances...
Completed 846/1000 instances...
Completed 847/1000 instances...
Completed 848/1000 instances...
Completed 849/1000 instances...
Completed 850/1000 instances...
Completed 851/1000 instances...
Completed 852/1000 instances...
Completed 853/1000 instances...
Completed 854/1000 instances...
Completed 855/1000 instances...
Completed 856/1000 instances...
Completed 857/1000 instances...
Completed 858/1000 instances...
Completed 859/1000 instances...

Completed 860/1000 instances...
Completed 861/1000 instances...
Completed 862/1000 instances...
Completed 863/1000 instances...
Completed 864/1000 instances...
Completed 865/1000 instances...
Completed 866/1000 instances...
Completed 867/1000 instances...
Completed 868/1000 instances...
Completed 869/1000 instances...
Completed 870/1000 instances...
Completed 871/1000 instances...
Completed 872/1000 instances...
Completed 873/1000 instances...
Completed 874/1000 instances...
Completed 875/1000 instances...
Completed 876/1000 instances...
Completed 877/1000 instances...
Completed 878/1000 instances...
Completed 879/1000 instances...
Completed 880/1000 instances...
Completed 881/1000 instances...
Completed 882/1000 instances...
Completed 883/1000 instances...
Completed 884/1000 instances...
Completed 885/1000 instances...
Completed 886/1000 instances...
Completed 887/1000 instances...
Completed 888/1000 instances...
Completed 889/1000 instances...
Completed 890/1000 instances...
Completed 891/1000 instances...
Completed 892/1000 instances...
Completed 893/1000 instances...
Completed 894/1000 instances...
Completed 895/1000 instances...
Completed 896/1000 instances...
Completed 897/1000 instances...
Completed 898/1000 instances...
Completed 899/1000 instances...
Completed 900/1000 instances...
Completed 901/1000 instances...
Completed 902/1000 instances...
Completed 903/1000 instances...
Completed 904/1000 instances...
Completed 905/1000 instances...
Completed 906/1000 instances...
Completed 907/1000 instances...
Completed 908/1000 instances...

Completed 909/1000 instances...
Completed 910/1000 instances...
Completed 911/1000 instances...
Completed 912/1000 instances...
Completed 913/1000 instances...
Completed 914/1000 instances...
Completed 915/1000 instances...
Completed 916/1000 instances...
Completed 917/1000 instances...
Completed 918/1000 instances...
Completed 919/1000 instances...
Completed 920/1000 instances...
Completed 921/1000 instances...
Completed 922/1000 instances...
Completed 923/1000 instances...
Completed 924/1000 instances...
Completed 925/1000 instances...
Completed 926/1000 instances...
Completed 927/1000 instances...
Completed 928/1000 instances...
Completed 929/1000 instances...
Completed 930/1000 instances...
Completed 931/1000 instances...
Completed 932/1000 instances...
Completed 933/1000 instances...
Completed 934/1000 instances...
Completed 935/1000 instances...
Completed 936/1000 instances...
Completed 937/1000 instances...
Completed 938/1000 instances...
Completed 939/1000 instances...
Completed 940/1000 instances...
Completed 941/1000 instances...
Completed 942/1000 instances...
Completed 943/1000 instances...
Completed 944/1000 instances...
Completed 945/1000 instances...
Completed 946/1000 instances...
Completed 947/1000 instances...
Completed 948/1000 instances...
Completed 949/1000 instances...
Completed 950/1000 instances...
Completed 951/1000 instances...
Completed 952/1000 instances...
Completed 953/1000 instances...
Completed 954/1000 instances...
Completed 955/1000 instances...
Completed 956/1000 instances...
Completed 957/1000 instances...

```

Completed 958/1000 instances...
Completed 959/1000 instances...
Completed 960/1000 instances...
Completed 961/1000 instances...
Completed 962/1000 instances...
Completed 963/1000 instances...
Completed 964/1000 instances...
Completed 965/1000 instances...
Completed 966/1000 instances...
Completed 967/1000 instances...
Completed 968/1000 instances...
Completed 969/1000 instances...
Completed 970/1000 instances...
Completed 971/1000 instances...
Completed 972/1000 instances...
Completed 973/1000 instances...
Completed 974/1000 instances...
Completed 975/1000 instances...
Completed 976/1000 instances...
Completed 977/1000 instances...
Completed 978/1000 instances...
Completed 979/1000 instances...
Completed 980/1000 instances...
Completed 981/1000 instances...
Completed 982/1000 instances...
Completed 983/1000 instances...
Completed 984/1000 instances...
Completed 985/1000 instances...
Completed 986/1000 instances...
Completed 987/1000 instances...
Completed 988/1000 instances...
Completed 989/1000 instances...
Completed 990/1000 instances...
Completed 991/1000 instances...
Completed 992/1000 instances...
Completed 993/1000 instances...
Completed 994/1000 instances...
Completed 995/1000 instances...
Completed 996/1000 instances...
Completed 997/1000 instances...
Completed 998/1000 instances...
Completed 999/1000 instances...
Completed 1000/1000 instances...
--- Evaluation Complete ---

```

Steps	\	Instance	Is_Valid	Success	Score	Optimum	Rel_Error
0	wuf20-0911.mwcnf		True	True	2247	2247	0.0
73528							
1	wuf20-0911.mwcnf		True	True	2247	2247	0.0

```

74256
2    wuf20-0911.mwcnf    True    True    2247    2247    0.0
75712
3    wuf20-0911.mwcnf    True    True    2247    2247    0.0
73528
4    wuf20-0911.mwcnf    True    True    2247    2247    0.0
73528
...
...
99995  wuf20-0537.mwcnf    True    True    417     417     0.0
73528
99996  wuf20-0537.mwcnf    True    True    417     417     0.0
74984
99997  wuf20-0537.mwcnf    True    True    417     417     0.0
74256
99998  wuf20-0537.mwcnf    True    True    417     417     0.0
74256
99999  wuf20-0537.mwcnf    True    True    417     417     0.0
73528

          Time
0    0.446847
1    0.433554
2    0.460243
3    0.439297
4    0.423190
...
99995  0.334339
99996  0.338266
99997  0.332106
99998  0.348992
99999  0.331954

[100000 rows x 8 columns]

instance_paths = [os.path.join(wuf_20_n_path,x) for x in
os.listdir(wuf_20_n_path)]
solutions = get_solution_dict(os.path.join(wuf_20_path,"wuf20-91-N-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=100,
    max_workers=12 # Uses all cores automatically
)
df_results.to_csv("wuf20-91-N")
display(df_results)

```

```
--- Starting Black Box Evaluation ---
Instances: 1000
Repeats per Instance: 100
Total Runs: 100000
Parallel Workers: 12
Completed 1/1000 instances...
Completed 2/1000 instances...
Completed 3/1000 instances...
Completed 4/1000 instances...
Completed 5/1000 instances...
Completed 6/1000 instances...
Completed 7/1000 instances...
Completed 8/1000 instances...
Completed 9/1000 instances...
Completed 10/1000 instances...
Completed 11/1000 instances...
Completed 12/1000 instances...
Completed 13/1000 instances...
Completed 14/1000 instances...
Completed 15/1000 instances...
Completed 16/1000 instances...
Completed 17/1000 instances...
Completed 18/1000 instances...
Completed 19/1000 instances...
Completed 20/1000 instances...
Completed 21/1000 instances...
Completed 22/1000 instances...
Completed 23/1000 instances...
Completed 24/1000 instances...
Completed 25/1000 instances...
Completed 26/1000 instances...
Completed 27/1000 instances...
Completed 28/1000 instances...
Completed 29/1000 instances...
Completed 30/1000 instances...
Completed 31/1000 instances...
Completed 32/1000 instances...
Completed 33/1000 instances...
Completed 34/1000 instances...
Completed 35/1000 instances...
Completed 36/1000 instances...
Completed 37/1000 instances...
Completed 38/1000 instances...
Completed 39/1000 instances...
Completed 40/1000 instances...
Completed 41/1000 instances...
Completed 42/1000 instances...
Completed 43/1000 instances...
Completed 44/1000 instances...
Completed 45/1000 instances...
```

Completed 46/1000 instances...
Completed 47/1000 instances...
Completed 48/1000 instances...
Completed 49/1000 instances...
Completed 50/1000 instances...
Completed 51/1000 instances...
Completed 52/1000 instances...
Completed 53/1000 instances...
Completed 54/1000 instances...
Completed 55/1000 instances...
Completed 56/1000 instances...
Completed 57/1000 instances...
Completed 58/1000 instances...
Completed 59/1000 instances...
Completed 60/1000 instances...
Completed 61/1000 instances...
Completed 62/1000 instances...
Completed 63/1000 instances...
Completed 64/1000 instances...
Completed 65/1000 instances...
Completed 66/1000 instances...
Completed 67/1000 instances...
Completed 68/1000 instances...
Completed 69/1000 instances...
Completed 70/1000 instances...
Completed 71/1000 instances...
Completed 72/1000 instances...
Completed 73/1000 instances...
Completed 74/1000 instances...
Completed 75/1000 instances...
Completed 76/1000 instances...
Completed 77/1000 instances...
Completed 78/1000 instances...
Completed 79/1000 instances...
Completed 80/1000 instances...
Completed 81/1000 instances...
Completed 82/1000 instances...
Completed 83/1000 instances...
Completed 84/1000 instances...
Completed 85/1000 instances...
Completed 86/1000 instances...
Completed 87/1000 instances...
Completed 88/1000 instances...
Completed 89/1000 instances...
Completed 90/1000 instances...
Completed 91/1000 instances...
Completed 92/1000 instances...
Completed 93/1000 instances...
Completed 94/1000 instances...
Completed 95/1000 instances...

Completed 96/1000 instances...
Completed 97/1000 instances...
Completed 98/1000 instances...
Completed 99/1000 instances...
Completed 100/1000 instances...
Completed 101/1000 instances...
Completed 102/1000 instances...
Completed 103/1000 instances...
Completed 104/1000 instances...
Completed 105/1000 instances...
Completed 106/1000 instances...
Completed 107/1000 instances...
Completed 108/1000 instances...
Completed 109/1000 instances...
Completed 110/1000 instances...
Completed 111/1000 instances...
Completed 112/1000 instances...
Completed 113/1000 instances...
Completed 114/1000 instances...
Completed 115/1000 instances...
Completed 116/1000 instances...
Completed 117/1000 instances...
Completed 118/1000 instances...
Completed 119/1000 instances...
Completed 120/1000 instances...
Completed 121/1000 instances...
Completed 122/1000 instances...
Completed 123/1000 instances...
Completed 124/1000 instances...
Completed 125/1000 instances...
Completed 126/1000 instances...
Completed 127/1000 instances...
Completed 128/1000 instances...
Completed 129/1000 instances...
Completed 130/1000 instances...
Completed 131/1000 instances...
Completed 132/1000 instances...
Completed 133/1000 instances...
Completed 134/1000 instances...
Completed 135/1000 instances...
Completed 136/1000 instances...
Completed 137/1000 instances...
Completed 138/1000 instances...
Completed 139/1000 instances...
Completed 140/1000 instances...
Completed 141/1000 instances...
Completed 142/1000 instances...
Completed 143/1000 instances...
Completed 144/1000 instances...
Completed 145/1000 instances...

Completed 146/1000 instances...
Completed 147/1000 instances...
Completed 148/1000 instances...
Completed 149/1000 instances...
Completed 150/1000 instances...
Completed 151/1000 instances...
Completed 152/1000 instances...
Completed 153/1000 instances...
Completed 154/1000 instances...
Completed 155/1000 instances...
Completed 156/1000 instances...
Completed 157/1000 instances...
Completed 158/1000 instances...
Completed 159/1000 instances...
Completed 160/1000 instances...
Completed 161/1000 instances...
Completed 162/1000 instances...
Completed 163/1000 instances...
Completed 164/1000 instances...
Completed 165/1000 instances...
Completed 166/1000 instances...
Completed 167/1000 instances...
Completed 168/1000 instances...
Completed 169/1000 instances...
Completed 170/1000 instances...
Completed 171/1000 instances...
Completed 172/1000 instances...
Completed 173/1000 instances...
Completed 174/1000 instances...
Completed 175/1000 instances...
Completed 176/1000 instances...
Completed 177/1000 instances...
Completed 178/1000 instances...
Completed 179/1000 instances...
Completed 180/1000 instances...
Completed 181/1000 instances...
Completed 182/1000 instances...
Completed 183/1000 instances...
Completed 184/1000 instances...
Completed 185/1000 instances...
Completed 186/1000 instances...
Completed 187/1000 instances...
Completed 188/1000 instances...
Completed 189/1000 instances...
Completed 190/1000 instances...
Completed 191/1000 instances...
Completed 192/1000 instances...
Completed 193/1000 instances...
Completed 194/1000 instances...
Completed 195/1000 instances...

Completed 196/1000 instances...
Completed 197/1000 instances...
Completed 198/1000 instances...
Completed 199/1000 instances...
Completed 200/1000 instances...
Completed 201/1000 instances...
Completed 202/1000 instances...
Completed 203/1000 instances...
Completed 204/1000 instances...
Completed 205/1000 instances...
Completed 206/1000 instances...
Completed 207/1000 instances...
Completed 208/1000 instances...
Completed 209/1000 instances...
Completed 210/1000 instances...
Completed 211/1000 instances...
Completed 212/1000 instances...
Completed 213/1000 instances...
Completed 214/1000 instances...
Completed 215/1000 instances...
Completed 216/1000 instances...
Completed 217/1000 instances...
Completed 218/1000 instances...
Completed 219/1000 instances...
Completed 220/1000 instances...
Completed 221/1000 instances...
Completed 222/1000 instances...
Completed 223/1000 instances...
Completed 224/1000 instances...
Completed 225/1000 instances...
Completed 226/1000 instances...
Completed 227/1000 instances...
Completed 228/1000 instances...
Completed 229/1000 instances...
Completed 230/1000 instances...
Completed 231/1000 instances...
Completed 232/1000 instances...
Completed 233/1000 instances...
Completed 234/1000 instances...
Completed 235/1000 instances...
Completed 236/1000 instances...
Completed 237/1000 instances...
Completed 238/1000 instances...
Completed 239/1000 instances...
Completed 240/1000 instances...
Completed 241/1000 instances...
Completed 242/1000 instances...
Completed 243/1000 instances...
Completed 244/1000 instances...
Completed 245/1000 instances...

Completed 246/1000 instances...
Completed 247/1000 instances...
Completed 248/1000 instances...
Completed 249/1000 instances...
Completed 250/1000 instances...
Completed 251/1000 instances...
Completed 252/1000 instances...
Completed 253/1000 instances...
Completed 254/1000 instances...
Completed 255/1000 instances...
Completed 256/1000 instances...
Completed 257/1000 instances...
Completed 258/1000 instances...
Completed 259/1000 instances...
Completed 260/1000 instances...
Completed 261/1000 instances...
Completed 262/1000 instances...
Completed 263/1000 instances...
Completed 264/1000 instances...
Completed 265/1000 instances...
Completed 266/1000 instances...
Completed 267/1000 instances...
Completed 268/1000 instances...
Completed 269/1000 instances...
Completed 270/1000 instances...
Completed 271/1000 instances...
Completed 272/1000 instances...
Completed 273/1000 instances...
Completed 274/1000 instances...
Completed 275/1000 instances...
Completed 276/1000 instances...
Completed 277/1000 instances...
Completed 278/1000 instances...
Completed 279/1000 instances...
Completed 280/1000 instances...
Completed 281/1000 instances...
Completed 282/1000 instances...
Completed 283/1000 instances...
Completed 284/1000 instances...
Completed 285/1000 instances...
Completed 286/1000 instances...
Completed 287/1000 instances...
Completed 288/1000 instances...
Completed 289/1000 instances...
Completed 290/1000 instances...
Completed 291/1000 instances...
Completed 292/1000 instances...
Completed 293/1000 instances...
Completed 294/1000 instances...
Completed 295/1000 instances...

Completed 296/1000 instances...
Completed 297/1000 instances...
Completed 298/1000 instances...
Completed 299/1000 instances...
Completed 300/1000 instances...
Completed 301/1000 instances...
Completed 302/1000 instances...
Completed 303/1000 instances...
Completed 304/1000 instances...
Completed 305/1000 instances...
Completed 306/1000 instances...
Completed 307/1000 instances...
Completed 308/1000 instances...
Completed 309/1000 instances...
Completed 310/1000 instances...
Completed 311/1000 instances...
Completed 312/1000 instances...
Completed 313/1000 instances...
Completed 314/1000 instances...
Completed 315/1000 instances...
Completed 316/1000 instances...
Completed 317/1000 instances...
Completed 318/1000 instances...
Completed 319/1000 instances...
Completed 320/1000 instances...
Completed 321/1000 instances...
Completed 322/1000 instances...
Completed 323/1000 instances...
Completed 324/1000 instances...
Completed 325/1000 instances...
Completed 326/1000 instances...
Completed 327/1000 instances...
Completed 328/1000 instances...
Completed 329/1000 instances...
Completed 330/1000 instances...
Completed 331/1000 instances...
Completed 332/1000 instances...
Completed 333/1000 instances...
Completed 334/1000 instances...
Completed 335/1000 instances...
Completed 336/1000 instances...
Completed 337/1000 instances...
Completed 338/1000 instances...
Completed 339/1000 instances...
Completed 340/1000 instances...
Completed 341/1000 instances...
Completed 342/1000 instances...
Completed 343/1000 instances...
Completed 344/1000 instances...
Completed 345/1000 instances...

Completed 346/1000 instances...
Completed 347/1000 instances...
Completed 348/1000 instances...
Completed 349/1000 instances...
Completed 350/1000 instances...
Completed 351/1000 instances...
Completed 352/1000 instances...
Completed 353/1000 instances...
Completed 354/1000 instances...
Completed 355/1000 instances...
Completed 356/1000 instances...
Completed 357/1000 instances...
Completed 358/1000 instances...
Completed 359/1000 instances...
Completed 360/1000 instances...
Completed 361/1000 instances...
Completed 362/1000 instances...
Completed 363/1000 instances...
Completed 364/1000 instances...
Completed 365/1000 instances...
Completed 366/1000 instances...
Completed 367/1000 instances...
Completed 368/1000 instances...
Completed 369/1000 instances...
Completed 370/1000 instances...
Completed 371/1000 instances...
Completed 372/1000 instances...
Completed 373/1000 instances...
Completed 374/1000 instances...
Completed 375/1000 instances...
Completed 376/1000 instances...
Completed 377/1000 instances...
Completed 378/1000 instances...
Completed 379/1000 instances...
Completed 380/1000 instances...
Completed 381/1000 instances...
Completed 382/1000 instances...
Completed 383/1000 instances...
Completed 384/1000 instances...
Completed 385/1000 instances...
Completed 386/1000 instances...
Completed 387/1000 instances...
Completed 388/1000 instances...
Completed 389/1000 instances...
Completed 390/1000 instances...
Completed 391/1000 instances...
Completed 392/1000 instances...
Completed 393/1000 instances...
Completed 394/1000 instances...
Completed 395/1000 instances...

Completed 396/1000 instances...
Completed 397/1000 instances...
Completed 398/1000 instances...
Completed 399/1000 instances...
Completed 400/1000 instances...
Completed 401/1000 instances...
Completed 402/1000 instances...
Completed 403/1000 instances...
Completed 404/1000 instances...
Completed 405/1000 instances...
Completed 406/1000 instances...
Completed 407/1000 instances...
Completed 408/1000 instances...
Completed 409/1000 instances...
Completed 410/1000 instances...
Completed 411/1000 instances...
Completed 412/1000 instances...
Completed 413/1000 instances...
Completed 414/1000 instances...
Completed 415/1000 instances...
Completed 416/1000 instances...
Completed 417/1000 instances...
Completed 418/1000 instances...
Completed 419/1000 instances...
Completed 420/1000 instances...
Completed 421/1000 instances...
Completed 422/1000 instances...
Completed 423/1000 instances...
Completed 424/1000 instances...
Completed 425/1000 instances...
Completed 426/1000 instances...
Completed 427/1000 instances...
Completed 428/1000 instances...
Completed 429/1000 instances...
Completed 430/1000 instances...
Completed 431/1000 instances...
Completed 432/1000 instances...
Completed 433/1000 instances...
Completed 434/1000 instances...
Completed 435/1000 instances...
Completed 436/1000 instances...
Completed 437/1000 instances...
Completed 438/1000 instances...
Completed 439/1000 instances...
Completed 440/1000 instances...
Completed 441/1000 instances...
Completed 442/1000 instances...
Completed 443/1000 instances...
Completed 444/1000 instances...
Completed 445/1000 instances...

Completed 446/1000 instances...
Completed 447/1000 instances...
Completed 448/1000 instances...
Completed 449/1000 instances...
Completed 450/1000 instances...
Completed 451/1000 instances...
Completed 452/1000 instances...
Completed 453/1000 instances...
Completed 454/1000 instances...
Completed 455/1000 instances...
Completed 456/1000 instances...
Completed 457/1000 instances...
Completed 458/1000 instances...
Completed 459/1000 instances...
Completed 460/1000 instances...
Completed 461/1000 instances...
Completed 462/1000 instances...
Completed 463/1000 instances...
Completed 464/1000 instances...
Completed 465/1000 instances...
Completed 466/1000 instances...
Completed 467/1000 instances...
Completed 468/1000 instances...
Completed 469/1000 instances...
Completed 470/1000 instances...
Completed 471/1000 instances...
Completed 472/1000 instances...
Completed 473/1000 instances...
Completed 474/1000 instances...
Completed 475/1000 instances...
Completed 476/1000 instances...
Completed 477/1000 instances...
Completed 478/1000 instances...
Completed 479/1000 instances...
Completed 480/1000 instances...
Completed 481/1000 instances...
Completed 482/1000 instances...
Completed 483/1000 instances...
Completed 484/1000 instances...
Completed 485/1000 instances...
Completed 486/1000 instances...
Completed 487/1000 instances...
Completed 488/1000 instances...
Completed 489/1000 instances...
Completed 490/1000 instances...
Completed 491/1000 instances...
Completed 492/1000 instances...
Completed 493/1000 instances...
Completed 494/1000 instances...
Completed 495/1000 instances...

Completed 496/1000 instances...
Completed 497/1000 instances...
Completed 498/1000 instances...
Completed 499/1000 instances...
Completed 500/1000 instances...
Completed 501/1000 instances...
Completed 502/1000 instances...
Completed 503/1000 instances...
Completed 504/1000 instances...
Completed 505/1000 instances...
Completed 506/1000 instances...
Completed 507/1000 instances...
Completed 508/1000 instances...
Completed 509/1000 instances...
Completed 510/1000 instances...
Completed 511/1000 instances...
Completed 512/1000 instances...
Completed 513/1000 instances...
Completed 514/1000 instances...
Completed 515/1000 instances...
Completed 516/1000 instances...
Completed 517/1000 instances...
Completed 518/1000 instances...
Completed 519/1000 instances...
Completed 520/1000 instances...
Completed 521/1000 instances...
Completed 522/1000 instances...
Completed 523/1000 instances...
Completed 524/1000 instances...
Completed 525/1000 instances...
Completed 526/1000 instances...
Completed 527/1000 instances...
Completed 528/1000 instances...
Completed 529/1000 instances...
Completed 530/1000 instances...
Completed 531/1000 instances...
Completed 532/1000 instances...
Completed 533/1000 instances...
Completed 534/1000 instances...
Completed 535/1000 instances...
Completed 536/1000 instances...
Completed 537/1000 instances...
Completed 538/1000 instances...
Completed 539/1000 instances...
Completed 540/1000 instances...
Completed 541/1000 instances...
Completed 542/1000 instances...
Completed 543/1000 instances...
Completed 544/1000 instances...
Completed 545/1000 instances...

Completed 546/1000 instances...
Completed 547/1000 instances...
Completed 548/1000 instances...
Completed 549/1000 instances...
Completed 550/1000 instances...
Completed 551/1000 instances...
Completed 552/1000 instances...
Completed 553/1000 instances...
Completed 554/1000 instances...
Completed 555/1000 instances...
Completed 556/1000 instances...
Completed 557/1000 instances...
Completed 558/1000 instances...
Completed 559/1000 instances...
Completed 560/1000 instances...
Completed 561/1000 instances...
Completed 562/1000 instances...
Completed 563/1000 instances...
Completed 564/1000 instances...
Completed 565/1000 instances...
Completed 566/1000 instances...
Completed 567/1000 instances...
Completed 568/1000 instances...
Completed 569/1000 instances...
Completed 570/1000 instances...
Completed 571/1000 instances...
Completed 572/1000 instances...
Completed 573/1000 instances...
Completed 574/1000 instances...
Completed 575/1000 instances...
Completed 576/1000 instances...
Completed 577/1000 instances...
Completed 578/1000 instances...
Completed 579/1000 instances...
Completed 580/1000 instances...
Completed 581/1000 instances...
Completed 582/1000 instances...
Completed 583/1000 instances...
Completed 584/1000 instances...
Completed 585/1000 instances...
Completed 586/1000 instances...
Completed 587/1000 instances...
Completed 588/1000 instances...
Completed 589/1000 instances...
Completed 590/1000 instances...
Completed 591/1000 instances...
Completed 592/1000 instances...
Completed 593/1000 instances...
Completed 594/1000 instances...

Completed 595/1000 instances...
Completed 596/1000 instances...
Completed 597/1000 instances...
Completed 598/1000 instances...
Completed 599/1000 instances...
Completed 600/1000 instances...
Completed 601/1000 instances...
Completed 602/1000 instances...
Completed 603/1000 instances...
Completed 604/1000 instances...
Completed 605/1000 instances...
Completed 606/1000 instances...
Completed 607/1000 instances...
Completed 608/1000 instances...
Completed 609/1000 instances...
Completed 610/1000 instances...
Completed 611/1000 instances...
Completed 612/1000 instances...
Completed 613/1000 instances...
Completed 614/1000 instances...
Completed 615/1000 instances...
Completed 616/1000 instances...
Completed 617/1000 instances...
Completed 618/1000 instances...
Completed 619/1000 instances...
Completed 620/1000 instances...
Completed 621/1000 instances...
Completed 622/1000 instances...
Completed 623/1000 instances...
Completed 624/1000 instances...
Completed 625/1000 instances...
Completed 626/1000 instances...
Completed 627/1000 instances...
Completed 628/1000 instances...
Completed 629/1000 instances...
Completed 630/1000 instances...
Completed 631/1000 instances...
Completed 632/1000 instances...
Completed 633/1000 instances...
Completed 634/1000 instances...
Completed 635/1000 instances...
Completed 636/1000 instances...
Completed 637/1000 instances...
Completed 638/1000 instances...
Completed 639/1000 instances...
Completed 640/1000 instances...
Completed 641/1000 instances...
Completed 642/1000 instances...
Completed 643/1000 instances...

Completed 644/1000 instances...
Completed 645/1000 instances...
Completed 646/1000 instances...
Completed 647/1000 instances...
Completed 648/1000 instances...
Completed 649/1000 instances...
Completed 650/1000 instances...
Completed 651/1000 instances...
Completed 652/1000 instances...
Completed 653/1000 instances...
Completed 654/1000 instances...
Completed 655/1000 instances...
Completed 656/1000 instances...
Completed 657/1000 instances...
Completed 658/1000 instances...
Completed 659/1000 instances...
Completed 660/1000 instances...
Completed 661/1000 instances...
Completed 662/1000 instances...
Completed 663/1000 instances...
Completed 664/1000 instances...
Completed 665/1000 instances...
Completed 666/1000 instances...
Completed 667/1000 instances...
Completed 668/1000 instances...
Completed 669/1000 instances...
Completed 670/1000 instances...
Completed 671/1000 instances...
Completed 672/1000 instances...
Completed 673/1000 instances...
Completed 674/1000 instances...
Completed 675/1000 instances...
Completed 676/1000 instances...
Completed 677/1000 instances...
Completed 678/1000 instances...
Completed 679/1000 instances...
Completed 680/1000 instances...
Completed 681/1000 instances...
Completed 682/1000 instances...
Completed 683/1000 instances...
Completed 684/1000 instances...
Completed 685/1000 instances...
Completed 686/1000 instances...
Completed 687/1000 instances...
Completed 688/1000 instances...
Completed 689/1000 instances...
Completed 690/1000 instances...
Completed 691/1000 instances...
Completed 692/1000 instances...

Completed 693/1000 instances...
Completed 694/1000 instances...
Completed 695/1000 instances...
Completed 696/1000 instances...
Completed 697/1000 instances...
Completed 698/1000 instances...
Completed 699/1000 instances...
Completed 700/1000 instances...
Completed 701/1000 instances...
Completed 702/1000 instances...
Completed 703/1000 instances...
Completed 704/1000 instances...
Completed 705/1000 instances...
Completed 706/1000 instances...
Completed 707/1000 instances...
Completed 708/1000 instances...
Completed 709/1000 instances...
Completed 710/1000 instances...
Completed 711/1000 instances...
Completed 712/1000 instances...
Completed 713/1000 instances...
Completed 714/1000 instances...
Completed 715/1000 instances...
Completed 716/1000 instances...
Completed 717/1000 instances...
Completed 718/1000 instances...
Completed 719/1000 instances...
Completed 720/1000 instances...
Completed 721/1000 instances...
Completed 722/1000 instances...
Completed 723/1000 instances...
Completed 724/1000 instances...
Completed 725/1000 instances...
Completed 726/1000 instances...
Completed 727/1000 instances...
Completed 728/1000 instances...
Completed 729/1000 instances...
Completed 730/1000 instances...
Completed 731/1000 instances...
Completed 732/1000 instances...
Completed 733/1000 instances...
Completed 734/1000 instances...
Completed 735/1000 instances...
Completed 736/1000 instances...
Completed 737/1000 instances...
Completed 738/1000 instances...
Completed 739/1000 instances...
Completed 740/1000 instances...
Completed 741/1000 instances...

Completed 742/1000 instances...
Completed 743/1000 instances...
Completed 744/1000 instances...
Completed 745/1000 instances...
Completed 746/1000 instances...
Completed 747/1000 instances...
Completed 748/1000 instances...
Completed 749/1000 instances...
Completed 750/1000 instances...
Completed 751/1000 instances...
Completed 752/1000 instances...
Completed 753/1000 instances...
Completed 754/1000 instances...
Completed 755/1000 instances...
Completed 756/1000 instances...
Completed 757/1000 instances...
Completed 758/1000 instances...
Completed 759/1000 instances...
Completed 760/1000 instances...
Completed 761/1000 instances...
Completed 762/1000 instances...
Completed 763/1000 instances...
Completed 764/1000 instances...
Completed 765/1000 instances...
Completed 766/1000 instances...
Completed 767/1000 instances...
Completed 768/1000 instances...
Completed 769/1000 instances...
Completed 770/1000 instances...
Completed 771/1000 instances...
Completed 772/1000 instances...
Completed 773/1000 instances...
Completed 774/1000 instances...
Completed 775/1000 instances...
Completed 776/1000 instances...
Completed 777/1000 instances...
Completed 778/1000 instances...
Completed 779/1000 instances...
Completed 780/1000 instances...
Completed 781/1000 instances...
Completed 782/1000 instances...
Completed 783/1000 instances...
Completed 784/1000 instances...
Completed 785/1000 instances...
Completed 786/1000 instances...
Completed 787/1000 instances...
Completed 788/1000 instances...
Completed 789/1000 instances...
Completed 790/1000 instances...

Completed 791/1000 instances...
Completed 792/1000 instances...
Completed 793/1000 instances...
Completed 794/1000 instances...
Completed 795/1000 instances...
Completed 796/1000 instances...
Completed 797/1000 instances...
Completed 798/1000 instances...
Completed 799/1000 instances...
Completed 800/1000 instances...
Completed 801/1000 instances...
Completed 802/1000 instances...
Completed 803/1000 instances...
Completed 804/1000 instances...
Completed 805/1000 instances...
Completed 806/1000 instances...
Completed 807/1000 instances...
Completed 808/1000 instances...
Completed 809/1000 instances...
Completed 810/1000 instances...
Completed 811/1000 instances...
Completed 812/1000 instances...
Completed 813/1000 instances...
Completed 814/1000 instances...
Completed 815/1000 instances...
Completed 816/1000 instances...
Completed 817/1000 instances...
Completed 818/1000 instances...
Completed 819/1000 instances...
Completed 820/1000 instances...
Completed 821/1000 instances...
Completed 822/1000 instances...
Completed 823/1000 instances...
Completed 824/1000 instances...
Completed 825/1000 instances...
Completed 826/1000 instances...
Completed 827/1000 instances...
Completed 828/1000 instances...
Completed 829/1000 instances...
Completed 830/1000 instances...
Completed 831/1000 instances...
Completed 832/1000 instances...
Completed 833/1000 instances...
Completed 834/1000 instances...
Completed 835/1000 instances...
Completed 836/1000 instances...
Completed 837/1000 instances...
Completed 838/1000 instances...
Completed 839/1000 instances...

Completed 840/1000 instances...
Completed 841/1000 instances...
Completed 842/1000 instances...
Completed 843/1000 instances...
Completed 844/1000 instances...
Completed 845/1000 instances...
Completed 846/1000 instances...
Completed 847/1000 instances...
Completed 848/1000 instances...
Completed 849/1000 instances...
Completed 850/1000 instances...
Completed 851/1000 instances...
Completed 852/1000 instances...
Completed 853/1000 instances...
Completed 854/1000 instances...
Completed 855/1000 instances...
Completed 856/1000 instances...
Completed 857/1000 instances...
Completed 858/1000 instances...
Completed 859/1000 instances...
Completed 860/1000 instances...
Completed 861/1000 instances...
Completed 862/1000 instances...
Completed 863/1000 instances...
Completed 864/1000 instances...
Completed 865/1000 instances...
Completed 866/1000 instances...
Completed 867/1000 instances...
Completed 868/1000 instances...
Completed 869/1000 instances...
Completed 870/1000 instances...
Completed 871/1000 instances...
Completed 872/1000 instances...
Completed 873/1000 instances...
Completed 874/1000 instances...
Completed 875/1000 instances...
Completed 876/1000 instances...
Completed 877/1000 instances...
Completed 878/1000 instances...
Completed 879/1000 instances...
Completed 880/1000 instances...
Completed 881/1000 instances...
Completed 882/1000 instances...
Completed 883/1000 instances...
Completed 884/1000 instances...
Completed 885/1000 instances...
Completed 886/1000 instances...
Completed 887/1000 instances...
Completed 888/1000 instances...

Completed 889/1000 instances...
Completed 890/1000 instances...
Completed 891/1000 instances...
Completed 892/1000 instances...
Completed 893/1000 instances...
Completed 894/1000 instances...
Completed 895/1000 instances...
Completed 896/1000 instances...
Completed 897/1000 instances...
Completed 898/1000 instances...
Completed 899/1000 instances...
Completed 900/1000 instances...
Completed 901/1000 instances...
Completed 902/1000 instances...
Completed 903/1000 instances...
Completed 904/1000 instances...
Completed 905/1000 instances...
Completed 906/1000 instances...
Completed 907/1000 instances...
Completed 908/1000 instances...
Completed 909/1000 instances...
Completed 910/1000 instances...
Completed 911/1000 instances...
Completed 912/1000 instances...
Completed 913/1000 instances...
Completed 914/1000 instances...
Completed 915/1000 instances...
Completed 916/1000 instances...
Completed 917/1000 instances...
Completed 918/1000 instances...
Completed 919/1000 instances...
Completed 920/1000 instances...
Completed 921/1000 instances...
Completed 922/1000 instances...
Completed 923/1000 instances...
Completed 924/1000 instances...
Completed 925/1000 instances...
Completed 926/1000 instances...
Completed 927/1000 instances...
Completed 928/1000 instances...
Completed 929/1000 instances...
Completed 930/1000 instances...
Completed 931/1000 instances...
Completed 932/1000 instances...
Completed 933/1000 instances...
Completed 934/1000 instances...
Completed 935/1000 instances...
Completed 936/1000 instances...
Completed 937/1000 instances...

Completed 938/1000 instances...
Completed 939/1000 instances...
Completed 940/1000 instances...
Completed 941/1000 instances...
Completed 942/1000 instances...
Completed 943/1000 instances...
Completed 944/1000 instances...
Completed 945/1000 instances...
Completed 946/1000 instances...
Completed 947/1000 instances...
Completed 948/1000 instances...
Completed 949/1000 instances...
Completed 950/1000 instances...
Completed 951/1000 instances...
Completed 952/1000 instances...
Completed 953/1000 instances...
Completed 954/1000 instances...
Completed 955/1000 instances...
Completed 956/1000 instances...
Completed 957/1000 instances...
Completed 958/1000 instances...
Completed 959/1000 instances...
Completed 960/1000 instances...
Completed 961/1000 instances...
Completed 962/1000 instances...
Completed 963/1000 instances...
Completed 964/1000 instances...
Completed 965/1000 instances...
Completed 966/1000 instances...
Completed 967/1000 instances...
Completed 968/1000 instances...
Completed 969/1000 instances...
Completed 970/1000 instances...
Completed 971/1000 instances...
Completed 972/1000 instances...
Completed 973/1000 instances...
Completed 974/1000 instances...
Completed 975/1000 instances...
Completed 976/1000 instances...
Completed 977/1000 instances...
Completed 978/1000 instances...
Completed 979/1000 instances...
Completed 980/1000 instances...
Completed 981/1000 instances...
Completed 982/1000 instances...
Completed 983/1000 instances...
Completed 984/1000 instances...
Completed 985/1000 instances...
Completed 986/1000 instances...

```

Completed 987/1000 instances...
Completed 988/1000 instances...
Completed 989/1000 instances...
Completed 990/1000 instances...
Completed 991/1000 instances...
Completed 992/1000 instances...
Completed 993/1000 instances...
Completed 994/1000 instances...
Completed 995/1000 instances...
Completed 996/1000 instances...
Completed 997/1000 instances...
Completed 998/1000 instances...
Completed 999/1000 instances...
Completed 1000/1000 instances...
--- Evaluation Complete ---

```

Steps	\	Instance	Is_Valid	Success	Score	Optimum	Rel_Error
0	wuf20-0911.mwcnf		True	True	52276	52276	0.0
73528							
1	wuf20-0911.mwcnf		True	True	52276	52276	0.0
73528							
2	wuf20-0911.mwcnf		True	True	52276	52276	0.0
73528							
3	wuf20-0911.mwcnf		True	True	52276	52276	0.0
73528							
4	wuf20-0911.mwcnf		True	True	52276	52276	0.0
73528							
...
...
99995	wuf20-0537.mwcnf		True	True	18167	18167	0.0
73528							
99996	wuf20-0537.mwcnf		True	True	18167	18167	0.0
73528							
99997	wuf20-0537.mwcnf		True	True	18167	18167	0.0
74256							
99998	wuf20-0537.mwcnf		True	True	18167	18167	0.0
74256							
99999	wuf20-0537.mwcnf		True	True	18167	18167	0.0
74256							

	Time
0	0.433480
1	0.471480
2	0.432558
3	0.435537
4	0.414869
...	...
99995	0.331277
99996	0.332314

```
99997  0.333755
99998  0.333068
99999  0.332929

[100000 rows x 8 columns]

instance_paths = [os.path.join(wuf_50_n_path,x) for x in
os.listdir(wuf_50_n_path)]
solutions = get_solution_dict(os.path.join(wuf_50_path, "wuf50-218-N-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=100,
    max_workers=12 # Uses all cores automatically
)
df_results.to_csv("wuf-50-218-N")
display(df_results)

--- Starting Black Box Evaluation ---
Instances: 1000
Repeats per Instance: 100
Total Runs: 100000
Parallel Workers: 12
Completed 1/1000 instances...
Completed 2/1000 instances...
Completed 3/1000 instances...
Completed 4/1000 instances...
Completed 5/1000 instances...
Completed 6/1000 instances...
Completed 7/1000 instances...
Completed 8/1000 instances...
Completed 9/1000 instances...
Completed 10/1000 instances...
Completed 11/1000 instances...
Completed 12/1000 instances...
Completed 13/1000 instances...
Completed 14/1000 instances...
Completed 15/1000 instances...
Completed 16/1000 instances...
Completed 17/1000 instances...
Completed 18/1000 instances...
Completed 19/1000 instances...
Completed 20/1000 instances...
Completed 21/1000 instances...
Completed 22/1000 instances...
Completed 23/1000 instances...
Completed 24/1000 instances...
```

Completed 25/1000 instances...
Completed 26/1000 instances...
Completed 27/1000 instances...
Completed 28/1000 instances...
Completed 29/1000 instances...
Completed 30/1000 instances...
Completed 31/1000 instances...
Completed 32/1000 instances...
Completed 33/1000 instances...
Completed 34/1000 instances...
Completed 35/1000 instances...
Completed 36/1000 instances...
Completed 37/1000 instances...
Completed 38/1000 instances...
Completed 39/1000 instances...
Completed 40/1000 instances...
Completed 41/1000 instances...
Completed 42/1000 instances...
Completed 43/1000 instances...
Completed 44/1000 instances...
Completed 45/1000 instances...
Completed 46/1000 instances...
Completed 47/1000 instances...
Completed 48/1000 instances...
Completed 49/1000 instances...
Completed 50/1000 instances...
Completed 51/1000 instances...
Completed 52/1000 instances...
Completed 53/1000 instances...
Completed 54/1000 instances...
Completed 55/1000 instances...
Completed 56/1000 instances...
Completed 57/1000 instances...
Completed 58/1000 instances...
Completed 59/1000 instances...
Completed 60/1000 instances...
Completed 61/1000 instances...
Completed 62/1000 instances...
Completed 63/1000 instances...
Completed 64/1000 instances...
Completed 65/1000 instances...
Completed 66/1000 instances...
Completed 67/1000 instances...
Completed 68/1000 instances...
Completed 69/1000 instances...
Completed 70/1000 instances...
Completed 71/1000 instances...
Completed 72/1000 instances...
Completed 73/1000 instances...

```
Completed 74/1000 instances...
Completed 75/1000 instances...
Completed 76/1000 instances...
Completed 77/1000 instances...
Completed 78/1000 instances...
Completed 79/1000 instances...
Completed 80/1000 instances...
Completed 81/1000 instances...
Completed 82/1000 instances...
Completed 83/1000 instances...
Completed 84/1000 instances...
Completed 85/1000 instances...
Completed 86/1000 instances...
Completed 87/1000 instances...
Completed 88/1000 instances...
Completed 89/1000 instances...
Completed 90/1000 instances...
Completed 91/1000 instances...
Completed 92/1000 instances...
Completed 93/1000 instances...
Completed 94/1000 instances...
Completed 95/1000 instances...
Completed 96/1000 instances...
Completed 97/1000 instances...
Completed 98/1000 instances...
Completed 99/1000 instances...
Completed 100/1000 instances...
Completed 101/1000 instances...
Completed 102/1000 instances...
Completed 103/1000 instances...
Completed 104/1000 instances...
Completed 105/1000 instances...
Completed 106/1000 instances...
Completed 107/1000 instances...
Completed 108/1000 instances...
Completed 109/1000 instances...
Completed 110/1000 instances...
Completed 111/1000 instances...
Completed 112/1000 instances...
Completed 113/1000 instances...
Completed 114/1000 instances...
Completed 115/1000 instances...
Completed 116/1000 instances...
Completed 117/1000 instances...
Completed 118/1000 instances...
Completed 119/1000 instances...
Completed 120/1000 instances...
Completed 121/1000 instances...
Completed 122/1000 instances...
```

Completed 123/1000 instances...
Completed 124/1000 instances...
Completed 125/1000 instances...
Completed 126/1000 instances...
Completed 127/1000 instances...
Completed 128/1000 instances...
Completed 129/1000 instances...
Completed 130/1000 instances...
Completed 131/1000 instances...
Completed 132/1000 instances...
Completed 133/1000 instances...
Completed 134/1000 instances...
Completed 135/1000 instances...
Completed 136/1000 instances...
Completed 137/1000 instances...
Completed 138/1000 instances...
Completed 139/1000 instances...
Completed 140/1000 instances...
Completed 141/1000 instances...
Completed 142/1000 instances...
Completed 143/1000 instances...
Completed 144/1000 instances...
Completed 145/1000 instances...
Completed 146/1000 instances...
Completed 147/1000 instances...
Completed 148/1000 instances...
Completed 149/1000 instances...
Completed 150/1000 instances...
Completed 151/1000 instances...
Completed 152/1000 instances...
Completed 153/1000 instances...
Completed 154/1000 instances...
Completed 155/1000 instances...
Completed 156/1000 instances...
Completed 157/1000 instances...
Completed 158/1000 instances...
Completed 159/1000 instances...
Completed 160/1000 instances...
Completed 161/1000 instances...
Completed 162/1000 instances...
Completed 163/1000 instances...
Completed 164/1000 instances...
Completed 165/1000 instances...
Completed 166/1000 instances...
Completed 167/1000 instances...
Completed 168/1000 instances...
Completed 169/1000 instances...
Completed 170/1000 instances...
Completed 171/1000 instances...

Completed 172/1000 instances...
Completed 173/1000 instances...
Completed 174/1000 instances...
Completed 175/1000 instances...
Completed 176/1000 instances...
Completed 177/1000 instances...
Completed 178/1000 instances...
Completed 179/1000 instances...
Completed 180/1000 instances...
Completed 181/1000 instances...
Completed 182/1000 instances...
Completed 183/1000 instances...
Completed 184/1000 instances...
Completed 185/1000 instances...
Completed 186/1000 instances...
Completed 187/1000 instances...
Completed 188/1000 instances...
Completed 189/1000 instances...
Completed 190/1000 instances...
Completed 191/1000 instances...
Completed 192/1000 instances...
Completed 193/1000 instances...
Completed 194/1000 instances...
Completed 195/1000 instances...
Completed 196/1000 instances...
Completed 197/1000 instances...
Completed 198/1000 instances...
Completed 199/1000 instances...
Completed 200/1000 instances...
Completed 201/1000 instances...
Completed 202/1000 instances...
Completed 203/1000 instances...
Completed 204/1000 instances...
Completed 205/1000 instances...
Completed 206/1000 instances...
Completed 207/1000 instances...
Completed 208/1000 instances...
Completed 209/1000 instances...
Completed 210/1000 instances...
Completed 211/1000 instances...
Completed 212/1000 instances...
Completed 213/1000 instances...
Completed 214/1000 instances...
Completed 215/1000 instances...
Completed 216/1000 instances...
Completed 217/1000 instances...
Completed 218/1000 instances...
Completed 219/1000 instances...
Completed 220/1000 instances...

Completed 221/1000 instances...
Completed 222/1000 instances...
Completed 223/1000 instances...
Completed 224/1000 instances...
Completed 225/1000 instances...
Completed 226/1000 instances...
Completed 227/1000 instances...
Completed 228/1000 instances...
Completed 229/1000 instances...
Completed 230/1000 instances...
Completed 231/1000 instances...
Completed 232/1000 instances...
Completed 233/1000 instances...
Completed 234/1000 instances...
Completed 235/1000 instances...
Completed 236/1000 instances...
Completed 237/1000 instances...
Completed 238/1000 instances...
Completed 239/1000 instances...
Completed 240/1000 instances...
Completed 241/1000 instances...
Completed 242/1000 instances...
Completed 243/1000 instances...
Completed 244/1000 instances...
Completed 245/1000 instances...
Completed 246/1000 instances...
Completed 247/1000 instances...
Completed 248/1000 instances...
Completed 249/1000 instances...
Completed 250/1000 instances...
Completed 251/1000 instances...
Completed 252/1000 instances...
Completed 253/1000 instances...
Completed 254/1000 instances...
Completed 255/1000 instances...
Completed 256/1000 instances...
Completed 257/1000 instances...
Completed 258/1000 instances...
Completed 259/1000 instances...
Completed 260/1000 instances...
Completed 261/1000 instances...
Completed 262/1000 instances...
Completed 263/1000 instances...
Completed 264/1000 instances...
Completed 265/1000 instances...
Completed 266/1000 instances...
Completed 267/1000 instances...
Completed 268/1000 instances...
Completed 269/1000 instances...

Completed 270/1000 instances...
Completed 271/1000 instances...
Completed 272/1000 instances...
Completed 273/1000 instances...
Completed 274/1000 instances...
Completed 275/1000 instances...
Completed 276/1000 instances...
Completed 277/1000 instances...
Completed 278/1000 instances...
Completed 279/1000 instances...
Completed 280/1000 instances...
Completed 281/1000 instances...
Completed 282/1000 instances...
Completed 283/1000 instances...
Completed 284/1000 instances...
Completed 285/1000 instances...
Completed 286/1000 instances...
Completed 287/1000 instances...
Completed 288/1000 instances...
Completed 289/1000 instances...
Completed 290/1000 instances...
Completed 291/1000 instances...
Completed 292/1000 instances...
Completed 293/1000 instances...
Completed 294/1000 instances...
Completed 295/1000 instances...
Completed 296/1000 instances...
Completed 297/1000 instances...
Completed 298/1000 instances...
Completed 299/1000 instances...
Completed 300/1000 instances...
Completed 301/1000 instances...
Completed 302/1000 instances...
Completed 303/1000 instances...
Completed 304/1000 instances...
Completed 305/1000 instances...
Completed 306/1000 instances...
Completed 307/1000 instances...
Completed 308/1000 instances...
Completed 309/1000 instances...
Completed 310/1000 instances...
Completed 311/1000 instances...
Completed 312/1000 instances...
Completed 313/1000 instances...
Completed 314/1000 instances...
Completed 315/1000 instances...
Completed 316/1000 instances...
Completed 317/1000 instances...
Completed 318/1000 instances...

Completed 319/1000 instances...
Completed 320/1000 instances...
Completed 321/1000 instances...
Completed 322/1000 instances...
Completed 323/1000 instances...
Completed 324/1000 instances...
Completed 325/1000 instances...
Completed 326/1000 instances...
Completed 327/1000 instances...
Completed 328/1000 instances...
Completed 329/1000 instances...
Completed 330/1000 instances...
Completed 331/1000 instances...
Completed 332/1000 instances...
Completed 333/1000 instances...
Completed 334/1000 instances...
Completed 335/1000 instances...
Completed 336/1000 instances...
Completed 337/1000 instances...
Completed 338/1000 instances...
Completed 339/1000 instances...
Completed 340/1000 instances...
Completed 341/1000 instances...
Completed 342/1000 instances...
Completed 343/1000 instances...
Completed 344/1000 instances...
Completed 345/1000 instances...
Completed 346/1000 instances...
Completed 347/1000 instances...
Completed 348/1000 instances...
Completed 349/1000 instances...
Completed 350/1000 instances...
Completed 351/1000 instances...
Completed 352/1000 instances...
Completed 353/1000 instances...
Completed 354/1000 instances...
Completed 355/1000 instances...
Completed 356/1000 instances...
Completed 357/1000 instances...
Completed 358/1000 instances...
Completed 359/1000 instances...
Completed 360/1000 instances...
Completed 361/1000 instances...
Completed 362/1000 instances...
Completed 363/1000 instances...
Completed 364/1000 instances...
Completed 365/1000 instances...
Completed 366/1000 instances...
Completed 367/1000 instances...

Completed 368/1000 instances...
Completed 369/1000 instances...
Completed 370/1000 instances...
Completed 371/1000 instances...
Completed 372/1000 instances...
Completed 373/1000 instances...
Completed 374/1000 instances...
Completed 375/1000 instances...
Completed 376/1000 instances...
Completed 377/1000 instances...
Completed 378/1000 instances...
Completed 379/1000 instances...
Completed 380/1000 instances...
Completed 381/1000 instances...
Completed 382/1000 instances...
Completed 383/1000 instances...
Completed 384/1000 instances...
Completed 385/1000 instances...
Completed 386/1000 instances...
Completed 387/1000 instances...
Completed 388/1000 instances...
Completed 389/1000 instances...
Completed 390/1000 instances...
Completed 391/1000 instances...
Completed 392/1000 instances...
Completed 393/1000 instances...
Completed 394/1000 instances...
Completed 395/1000 instances...
Completed 396/1000 instances...
Completed 397/1000 instances...
Completed 398/1000 instances...
Completed 399/1000 instances...
Completed 400/1000 instances...
Completed 401/1000 instances...
Completed 402/1000 instances...
Completed 403/1000 instances...
Completed 404/1000 instances...
Completed 405/1000 instances...
Completed 406/1000 instances...
Completed 407/1000 instances...
Completed 408/1000 instances...
Completed 409/1000 instances...
Completed 410/1000 instances...
Completed 411/1000 instances...
Completed 412/1000 instances...
Completed 413/1000 instances...
Completed 414/1000 instances...
Completed 415/1000 instances...
Completed 416/1000 instances...

Completed 417/1000 instances...
Completed 418/1000 instances...
Completed 419/1000 instances...
Completed 420/1000 instances...
Completed 421/1000 instances...
Completed 422/1000 instances...
Completed 423/1000 instances...
Completed 424/1000 instances...
Completed 425/1000 instances...
Completed 426/1000 instances...
Completed 427/1000 instances...
Completed 428/1000 instances...
Completed 429/1000 instances...
Completed 430/1000 instances...
Completed 431/1000 instances...
Completed 432/1000 instances...
Completed 433/1000 instances...
Completed 434/1000 instances...
Completed 435/1000 instances...
Completed 436/1000 instances...
Completed 437/1000 instances...
Completed 438/1000 instances...
Completed 439/1000 instances...
Completed 440/1000 instances...
Completed 441/1000 instances...
Completed 442/1000 instances...
Completed 443/1000 instances...
Completed 444/1000 instances...
Completed 445/1000 instances...
Completed 446/1000 instances...
Completed 447/1000 instances...
Completed 448/1000 instances...
Completed 449/1000 instances...
Completed 450/1000 instances...
Completed 451/1000 instances...
Completed 452/1000 instances...
Completed 453/1000 instances...
Completed 454/1000 instances...
Completed 455/1000 instances...
Completed 456/1000 instances...
Completed 457/1000 instances...
Completed 458/1000 instances...
Completed 459/1000 instances...
Completed 460/1000 instances...
Completed 461/1000 instances...
Completed 462/1000 instances...
Completed 463/1000 instances...
Completed 464/1000 instances...
Completed 465/1000 instances...

Completed 466/1000 instances...
Completed 467/1000 instances...
Completed 468/1000 instances...
Completed 469/1000 instances...
Completed 470/1000 instances...
Completed 471/1000 instances...
Completed 472/1000 instances...
Completed 473/1000 instances...
Completed 474/1000 instances...
Completed 475/1000 instances...
Completed 476/1000 instances...
Completed 477/1000 instances...
Completed 478/1000 instances...
Completed 479/1000 instances...
Completed 480/1000 instances...
Completed 481/1000 instances...
Completed 482/1000 instances...
Completed 483/1000 instances...
Completed 484/1000 instances...
Completed 485/1000 instances...
Completed 486/1000 instances...
Completed 487/1000 instances...
Completed 488/1000 instances...
Completed 489/1000 instances...
Completed 490/1000 instances...
Completed 491/1000 instances...
Completed 492/1000 instances...
Completed 493/1000 instances...
Completed 494/1000 instances...
Completed 495/1000 instances...
Completed 496/1000 instances...
Completed 497/1000 instances...
Completed 498/1000 instances...
Completed 499/1000 instances...
Completed 500/1000 instances...
Completed 501/1000 instances...
Completed 502/1000 instances...
Completed 503/1000 instances...
Completed 504/1000 instances...
Completed 505/1000 instances...
Completed 506/1000 instances...
Completed 507/1000 instances...
Completed 508/1000 instances...
Completed 509/1000 instances...
Completed 510/1000 instances...
Completed 511/1000 instances...
Completed 512/1000 instances...
Completed 513/1000 instances...
Completed 514/1000 instances...
Completed 515/1000 instances...

Completed 516/1000 instances...
Completed 517/1000 instances...
Completed 518/1000 instances...
Completed 519/1000 instances...
Completed 520/1000 instances...
Completed 521/1000 instances...
Completed 522/1000 instances...
Completed 523/1000 instances...
Completed 524/1000 instances...
Completed 525/1000 instances...
Completed 526/1000 instances...
Completed 527/1000 instances...
Completed 528/1000 instances...
Completed 529/1000 instances...
Completed 530/1000 instances...
Completed 531/1000 instances...
Completed 532/1000 instances...
Completed 533/1000 instances...
Completed 534/1000 instances...
Completed 535/1000 instances...
Completed 536/1000 instances...
Completed 537/1000 instances...
Completed 538/1000 instances...
Completed 539/1000 instances...
Completed 540/1000 instances...
Completed 541/1000 instances...
Completed 542/1000 instances...
Completed 543/1000 instances...
Completed 544/1000 instances...
Completed 545/1000 instances...
Completed 546/1000 instances...
Completed 547/1000 instances...
Completed 548/1000 instances...
Completed 549/1000 instances...
Completed 550/1000 instances...
Completed 551/1000 instances...
Completed 552/1000 instances...
Completed 553/1000 instances...
Completed 554/1000 instances...
Completed 555/1000 instances...
Completed 556/1000 instances...
Completed 557/1000 instances...
Completed 558/1000 instances...
Completed 559/1000 instances...
Completed 560/1000 instances...
Completed 561/1000 instances...
Completed 562/1000 instances...
Completed 563/1000 instances...
Completed 564/1000 instances...

Completed 565/1000 instances...
Completed 566/1000 instances...
Completed 567/1000 instances...
Completed 568/1000 instances...
Completed 569/1000 instances...
Completed 570/1000 instances...
Completed 571/1000 instances...
Completed 572/1000 instances...
Completed 573/1000 instances...
Completed 574/1000 instances...
Completed 575/1000 instances...
Completed 576/1000 instances...
Completed 577/1000 instances...
Completed 578/1000 instances...
Completed 579/1000 instances...
Completed 580/1000 instances...
Completed 581/1000 instances...
Completed 582/1000 instances...
Completed 583/1000 instances...
Completed 584/1000 instances...
Completed 585/1000 instances...
Completed 586/1000 instances...
Completed 587/1000 instances...
Completed 588/1000 instances...
Completed 589/1000 instances...
Completed 590/1000 instances...
Completed 591/1000 instances...
Completed 592/1000 instances...
Completed 593/1000 instances...
Completed 594/1000 instances...
Completed 595/1000 instances...
Completed 596/1000 instances...
Completed 597/1000 instances...
Completed 598/1000 instances...
Completed 599/1000 instances...
Completed 600/1000 instances...
Completed 601/1000 instances...
Completed 602/1000 instances...
Completed 603/1000 instances...
Completed 604/1000 instances...
Completed 605/1000 instances...
Completed 606/1000 instances...
Completed 607/1000 instances...
Completed 608/1000 instances...
Completed 609/1000 instances...
Completed 610/1000 instances...
Completed 611/1000 instances...
Completed 612/1000 instances...
Completed 613/1000 instances...

Completed 614/1000 instances...
Completed 615/1000 instances...
Completed 616/1000 instances...
Completed 617/1000 instances...
Completed 618/1000 instances...
Completed 619/1000 instances...
Completed 620/1000 instances...
Completed 621/1000 instances...
Completed 622/1000 instances...
Completed 623/1000 instances...
Completed 624/1000 instances...
Completed 625/1000 instances...
Completed 626/1000 instances...
Completed 627/1000 instances...
Completed 628/1000 instances...
Completed 629/1000 instances...
Completed 630/1000 instances...
Completed 631/1000 instances...
Completed 632/1000 instances...
Completed 633/1000 instances...
Completed 634/1000 instances...
Completed 635/1000 instances...
Completed 636/1000 instances...
Completed 637/1000 instances...
Completed 638/1000 instances...
Completed 639/1000 instances...
Completed 640/1000 instances...
Completed 641/1000 instances...
Completed 642/1000 instances...
Completed 643/1000 instances...
Completed 644/1000 instances...
Completed 645/1000 instances...
Completed 646/1000 instances...
Completed 647/1000 instances...
Completed 648/1000 instances...
Completed 649/1000 instances...
Completed 650/1000 instances...
Completed 651/1000 instances...
Completed 652/1000 instances...
Completed 653/1000 instances...
Completed 654/1000 instances...
Completed 655/1000 instances...
Completed 656/1000 instances...
Completed 657/1000 instances...
Completed 658/1000 instances...
Completed 659/1000 instances...
Completed 660/1000 instances...
Completed 661/1000 instances...
Completed 662/1000 instances...

Completed 663/1000 instances...
Completed 664/1000 instances...
Completed 665/1000 instances...
Completed 666/1000 instances...
Completed 667/1000 instances...
Completed 668/1000 instances...
Completed 669/1000 instances...
Completed 670/1000 instances...
Completed 671/1000 instances...
Completed 672/1000 instances...
Completed 673/1000 instances...
Completed 674/1000 instances...
Completed 675/1000 instances...
Completed 676/1000 instances...
Completed 677/1000 instances...
Completed 678/1000 instances...
Completed 679/1000 instances...
Completed 680/1000 instances...
Completed 681/1000 instances...
Completed 682/1000 instances...
Completed 683/1000 instances...
Completed 684/1000 instances...
Completed 685/1000 instances...
Completed 686/1000 instances...
Completed 687/1000 instances...
Completed 688/1000 instances...
Completed 689/1000 instances...
Completed 690/1000 instances...
Completed 691/1000 instances...
Completed 692/1000 instances...
Completed 693/1000 instances...
Completed 694/1000 instances...
Completed 695/1000 instances...
Completed 696/1000 instances...
Completed 697/1000 instances...
Completed 698/1000 instances...
Completed 699/1000 instances...
Completed 700/1000 instances...
Completed 701/1000 instances...
Completed 702/1000 instances...
Completed 703/1000 instances...
Completed 704/1000 instances...
Completed 705/1000 instances...
Completed 706/1000 instances...
Completed 707/1000 instances...
Completed 708/1000 instances...
Completed 709/1000 instances...
Completed 710/1000 instances...
Completed 711/1000 instances...

Completed 712/1000 instances...
Completed 713/1000 instances...
Completed 714/1000 instances...
Completed 715/1000 instances...
Completed 716/1000 instances...
Completed 717/1000 instances...
Completed 718/1000 instances...
Completed 719/1000 instances...
Completed 720/1000 instances...
Completed 721/1000 instances...
Completed 722/1000 instances...
Completed 723/1000 instances...
Completed 724/1000 instances...
Completed 725/1000 instances...
Completed 726/1000 instances...
Completed 727/1000 instances...
Completed 728/1000 instances...
Completed 729/1000 instances...
Completed 730/1000 instances...
Completed 731/1000 instances...
Completed 732/1000 instances...
Completed 733/1000 instances...
Completed 734/1000 instances...
Completed 735/1000 instances...
Completed 736/1000 instances...
Completed 737/1000 instances...
Completed 738/1000 instances...
Completed 739/1000 instances...
Completed 740/1000 instances...
Completed 741/1000 instances...
Completed 742/1000 instances...
Completed 743/1000 instances...
Completed 744/1000 instances...
Completed 745/1000 instances...
Completed 746/1000 instances...
Completed 747/1000 instances...
Completed 748/1000 instances...
Completed 749/1000 instances...
Completed 750/1000 instances...
Completed 751/1000 instances...
Completed 752/1000 instances...
Completed 753/1000 instances...
Completed 754/1000 instances...
Completed 755/1000 instances...
Completed 756/1000 instances...
Completed 757/1000 instances...
Completed 758/1000 instances...
Completed 759/1000 instances...
Completed 760/1000 instances...

Completed 761/1000 instances...
Completed 762/1000 instances...
Completed 763/1000 instances...
Completed 764/1000 instances...
Completed 765/1000 instances...
Completed 766/1000 instances...
Completed 767/1000 instances...
Completed 768/1000 instances...
Completed 769/1000 instances...
Completed 770/1000 instances...
Completed 771/1000 instances...
Completed 772/1000 instances...
Completed 773/1000 instances...
Completed 774/1000 instances...
Completed 775/1000 instances...
Completed 776/1000 instances...
Completed 777/1000 instances...
Completed 778/1000 instances...
Completed 779/1000 instances...
Completed 780/1000 instances...
Completed 781/1000 instances...
Completed 782/1000 instances...
Completed 783/1000 instances...
Completed 784/1000 instances...
Completed 785/1000 instances...
Completed 786/1000 instances...
Completed 787/1000 instances...
Completed 788/1000 instances...
Completed 789/1000 instances...
Completed 790/1000 instances...
Completed 791/1000 instances...
Completed 792/1000 instances...
Completed 793/1000 instances...
Completed 794/1000 instances...
Completed 795/1000 instances...
Completed 796/1000 instances...
Completed 797/1000 instances...
Completed 798/1000 instances...
Completed 799/1000 instances...
Completed 800/1000 instances...
Completed 801/1000 instances...
Completed 802/1000 instances...
Completed 803/1000 instances...
Completed 804/1000 instances...
Completed 805/1000 instances...
Completed 806/1000 instances...
Completed 807/1000 instances...
Completed 808/1000 instances...
Completed 809/1000 instances...

Completed 810/1000 instances...
Completed 811/1000 instances...
Completed 812/1000 instances...
Completed 813/1000 instances...
Completed 814/1000 instances...
Completed 815/1000 instances...
Completed 816/1000 instances...
Completed 817/1000 instances...
Completed 818/1000 instances...
Completed 819/1000 instances...
Completed 820/1000 instances...
Completed 821/1000 instances...
Completed 822/1000 instances...
Completed 823/1000 instances...
Completed 824/1000 instances...
Completed 825/1000 instances...
Completed 826/1000 instances...
Completed 827/1000 instances...
Completed 828/1000 instances...
Completed 829/1000 instances...
Completed 830/1000 instances...
Completed 831/1000 instances...
Completed 832/1000 instances...
Completed 833/1000 instances...
Completed 834/1000 instances...
Completed 835/1000 instances...
Completed 836/1000 instances...
Completed 837/1000 instances...
Completed 838/1000 instances...
Completed 839/1000 instances...
Completed 840/1000 instances...
Completed 841/1000 instances...
Completed 842/1000 instances...
Completed 843/1000 instances...
Completed 844/1000 instances...
Completed 845/1000 instances...
Completed 846/1000 instances...
Completed 847/1000 instances...
Completed 848/1000 instances...
Completed 849/1000 instances...
Completed 850/1000 instances...
Completed 851/1000 instances...
Completed 852/1000 instances...
Completed 853/1000 instances...
Completed 854/1000 instances...
Completed 855/1000 instances...
Completed 856/1000 instances...
Completed 857/1000 instances...
Completed 858/1000 instances...

Completed 859/1000 instances...
Completed 860/1000 instances...
Completed 861/1000 instances...
Completed 862/1000 instances...
Completed 863/1000 instances...
Completed 864/1000 instances...
Completed 865/1000 instances...
Completed 866/1000 instances...
Completed 867/1000 instances...
Completed 868/1000 instances...
Completed 869/1000 instances...
Completed 870/1000 instances...
Completed 871/1000 instances...
Completed 872/1000 instances...
Completed 873/1000 instances...
Completed 874/1000 instances...
Completed 875/1000 instances...
Completed 876/1000 instances...
Completed 877/1000 instances...
Completed 878/1000 instances...
Completed 879/1000 instances...
Completed 880/1000 instances...
Completed 881/1000 instances...
Completed 882/1000 instances...
Completed 883/1000 instances...
Completed 884/1000 instances...
Completed 885/1000 instances...
Completed 886/1000 instances...
Completed 887/1000 instances...
Completed 888/1000 instances...
Completed 889/1000 instances...
Completed 890/1000 instances...
Completed 891/1000 instances...
Completed 892/1000 instances...
Completed 893/1000 instances...
Completed 894/1000 instances...
Completed 895/1000 instances...
Completed 896/1000 instances...
Completed 897/1000 instances...
Completed 898/1000 instances...
Completed 899/1000 instances...
Completed 900/1000 instances...
Completed 901/1000 instances...
Completed 902/1000 instances...
Completed 903/1000 instances...
Completed 904/1000 instances...
Completed 905/1000 instances...
Completed 906/1000 instances...
Completed 907/1000 instances...

Completed 908/1000 instances...
Completed 909/1000 instances...
Completed 910/1000 instances...
Completed 911/1000 instances...
Completed 912/1000 instances...
Completed 913/1000 instances...
Completed 914/1000 instances...
Completed 915/1000 instances...
Completed 916/1000 instances...
Completed 917/1000 instances...
Completed 918/1000 instances...
Completed 919/1000 instances...
Completed 920/1000 instances...
Completed 921/1000 instances...
Completed 922/1000 instances...
Completed 923/1000 instances...
Completed 924/1000 instances...
Completed 925/1000 instances...
Completed 926/1000 instances...
Completed 927/1000 instances...
Completed 928/1000 instances...
Completed 929/1000 instances...
Completed 930/1000 instances...
Completed 931/1000 instances...
Completed 932/1000 instances...
Completed 933/1000 instances...
Completed 934/1000 instances...
Completed 935/1000 instances...
Completed 936/1000 instances...
Completed 937/1000 instances...
Completed 938/1000 instances...
Completed 939/1000 instances...
Completed 940/1000 instances...
Completed 941/1000 instances...
Completed 942/1000 instances...
Completed 943/1000 instances...
Completed 944/1000 instances...
Completed 945/1000 instances...
Completed 946/1000 instances...
Completed 947/1000 instances...
Completed 948/1000 instances...
Completed 949/1000 instances...
Completed 950/1000 instances...
Completed 951/1000 instances...
Completed 952/1000 instances...
Completed 953/1000 instances...
Completed 954/1000 instances...
Completed 955/1000 instances...
Completed 956/1000 instances...

```
Completed 957/1000 instances...
Completed 958/1000 instances...
Completed 959/1000 instances...
Completed 960/1000 instances...
Completed 961/1000 instances...
Completed 962/1000 instances...
Completed 963/1000 instances...
Completed 964/1000 instances...
Completed 965/1000 instances...
Completed 966/1000 instances...
Completed 967/1000 instances...
Completed 968/1000 instances...
Completed 969/1000 instances...
Completed 970/1000 instances...
Completed 971/1000 instances...
Completed 972/1000 instances...
Completed 973/1000 instances...
Completed 974/1000 instances...
Completed 975/1000 instances...
Completed 976/1000 instances...
Completed 977/1000 instances...
Completed 978/1000 instances...
Completed 979/1000 instances...
Completed 980/1000 instances...
Completed 981/1000 instances...
Completed 982/1000 instances...
Completed 983/1000 instances...
Completed 984/1000 instances...
Completed 985/1000 instances...
Completed 986/1000 instances...
Completed 987/1000 instances...
Completed 988/1000 instances...
Completed 989/1000 instances...
Completed 990/1000 instances...
Completed 991/1000 instances...
Completed 992/1000 instances...
Completed 993/1000 instances...
Completed 994/1000 instances...
Completed 995/1000 instances...
Completed 996/1000 instances...
Completed 997/1000 instances...
Completed 998/1000 instances...
Completed 999/1000 instances...
Completed 1000/1000 instances...
--- Evaluation Complete ---
```

	Instance	Is_Valid	Success	Score	Optimum	Rel_Error
0	wuf50-0556.mwcnf	True	True	256073	256073	0.0

1	wuf50-0556.mwcnf	True	True	256073	256073	0.0
2	wuf50-0556.mwcnf	True	True	256073	256073	0.0
3	wuf50-0556.mwcnf	True	True	256073	256073	0.0
4	wuf50-0556.mwcnf	True	True	256073	256073	0.0
...
99995	wuf50-0277.mwcnf	True	True	259292	259292	0.0
99996	wuf50-0277.mwcnf	True	True	259292	259292	0.0
99997	wuf50-0277.mwcnf	True	True	259292	259292	0.0
99998	wuf50-0277.mwcnf	True	True	259292	259292	0.0
99999	wuf50-0277.mwcnf	True	True	259292	259292	0.0

	Steps	Time
0	176144	1.183171
1	186608	1.143567
2	202304	1.302799
3	184864	1.212153
4	176144	1.074071
...
99995	197072	0.941950
99996	214512	1.034257
99997	207536	0.978449
99998	224976	1.062096
99999	186608	0.861523

[100000 rows x 8 columns]

```
instance_paths = [os.path.join(wuf_50_r_path,x) for x in
os.listdir(wuf_50_r_path)]
solutions = get_solution_dict(os.path.join(wuf_50_path,"wuf50-218-R-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=100,
    max_workers=12 # Uses all cores automatically
)
df_results.to_csv("wuf-50-218-R")
```

```
--- Starting Black Box Evaluation ---
Instances: 1000
Repeats per Instance: 100
Total Runs: 100000
Parallel Workers: 12
Completed 1/1000 instances...
Completed 2/1000 instances...
Completed 3/1000 instances...
Completed 4/1000 instances...
Completed 5/1000 instances...
Completed 6/1000 instances...
Completed 7/1000 instances...
Completed 8/1000 instances...
Completed 9/1000 instances...
Completed 10/1000 instances...
Completed 11/1000 instances...
Completed 12/1000 instances...
Completed 13/1000 instances...
Completed 14/1000 instances...
Completed 15/1000 instances...
Completed 16/1000 instances...
Completed 17/1000 instances...
Completed 18/1000 instances...
Completed 19/1000 instances...
Completed 20/1000 instances...
Completed 21/1000 instances...
Completed 22/1000 instances...
Completed 23/1000 instances...
Completed 24/1000 instances...
Completed 25/1000 instances...
Completed 26/1000 instances...
Completed 27/1000 instances...
Completed 28/1000 instances...
Completed 29/1000 instances...
Completed 30/1000 instances...
Completed 31/1000 instances...
Completed 32/1000 instances...
Completed 33/1000 instances...
Completed 34/1000 instances...
Completed 35/1000 instances...
Completed 36/1000 instances...
Completed 37/1000 instances...
Completed 38/1000 instances...
Completed 39/1000 instances...
Completed 40/1000 instances...
Completed 41/1000 instances...
Completed 42/1000 instances...
Completed 43/1000 instances...
Completed 44/1000 instances...
Completed 45/1000 instances...
```

Completed 46/1000 instances...
Completed 47/1000 instances...
Completed 48/1000 instances...
Completed 49/1000 instances...
Completed 50/1000 instances...
Completed 51/1000 instances...
Completed 52/1000 instances...
Completed 53/1000 instances...
Completed 54/1000 instances...
Completed 55/1000 instances...
Completed 56/1000 instances...
Completed 57/1000 instances...
Completed 58/1000 instances...
Completed 59/1000 instances...
Completed 60/1000 instances...
Completed 61/1000 instances...
Completed 62/1000 instances...
Completed 63/1000 instances...
Completed 64/1000 instances...
Completed 65/1000 instances...
Completed 66/1000 instances...
Completed 67/1000 instances...
Completed 68/1000 instances...
Completed 69/1000 instances...
Completed 70/1000 instances...
Completed 71/1000 instances...
Completed 72/1000 instances...
Completed 73/1000 instances...
Completed 74/1000 instances...
Completed 75/1000 instances...
Completed 76/1000 instances...
Completed 77/1000 instances...
Completed 78/1000 instances...
Completed 79/1000 instances...
Completed 80/1000 instances...
Completed 81/1000 instances...
Completed 82/1000 instances...
Completed 83/1000 instances...
Completed 84/1000 instances...
Completed 85/1000 instances...
Completed 86/1000 instances...
Completed 87/1000 instances...
Completed 88/1000 instances...
Completed 89/1000 instances...
Completed 90/1000 instances...
Completed 91/1000 instances...
Completed 92/1000 instances...
Completed 93/1000 instances...
Completed 94/1000 instances...
Completed 95/1000 instances...

Completed 96/1000 instances...
Completed 97/1000 instances...
Completed 98/1000 instances...
Completed 99/1000 instances...
Completed 100/1000 instances...
Completed 101/1000 instances...
Completed 102/1000 instances...
Completed 103/1000 instances...
Completed 104/1000 instances...
Completed 105/1000 instances...
Completed 106/1000 instances...
Completed 107/1000 instances...
Completed 108/1000 instances...
Completed 109/1000 instances...
Completed 110/1000 instances...
Completed 111/1000 instances...
Completed 112/1000 instances...
Completed 113/1000 instances...
Completed 114/1000 instances...
Completed 115/1000 instances...
Completed 116/1000 instances...
Completed 117/1000 instances...
Completed 118/1000 instances...
Completed 119/1000 instances...
Completed 120/1000 instances...
Completed 121/1000 instances...
Completed 122/1000 instances...
Completed 123/1000 instances...
Completed 124/1000 instances...
Completed 125/1000 instances...
Completed 126/1000 instances...
Completed 127/1000 instances...
Completed 128/1000 instances...
Completed 129/1000 instances...
Completed 130/1000 instances...
Completed 131/1000 instances...
Completed 132/1000 instances...
Completed 133/1000 instances...
Completed 134/1000 instances...
Completed 135/1000 instances...
Completed 136/1000 instances...
Completed 137/1000 instances...
Completed 138/1000 instances...
Completed 139/1000 instances...
Completed 140/1000 instances...
Completed 141/1000 instances...
Completed 142/1000 instances...
Completed 143/1000 instances...
Completed 144/1000 instances...
Completed 145/1000 instances...

Completed 146/1000 instances...
Completed 147/1000 instances...
Completed 148/1000 instances...
Completed 149/1000 instances...
Completed 150/1000 instances...
Completed 151/1000 instances...
Completed 152/1000 instances...
Completed 153/1000 instances...
Completed 154/1000 instances...
Completed 155/1000 instances...
Completed 156/1000 instances...
Completed 157/1000 instances...
Completed 158/1000 instances...
Completed 159/1000 instances...
Completed 160/1000 instances...
Completed 161/1000 instances...
Completed 162/1000 instances...
Completed 163/1000 instances...
Completed 164/1000 instances...
Completed 165/1000 instances...
Completed 166/1000 instances...
Completed 167/1000 instances...
Completed 168/1000 instances...
Completed 169/1000 instances...
Completed 170/1000 instances...
Completed 171/1000 instances...
Completed 172/1000 instances...
Completed 173/1000 instances...
Completed 174/1000 instances...
Completed 175/1000 instances...
Completed 176/1000 instances...
Completed 177/1000 instances...
Completed 178/1000 instances...
Completed 179/1000 instances...
Completed 180/1000 instances...
Completed 181/1000 instances...
Completed 182/1000 instances...
Completed 183/1000 instances...
Completed 184/1000 instances...
Completed 185/1000 instances...
Completed 186/1000 instances...
Completed 187/1000 instances...
Completed 188/1000 instances...
Completed 189/1000 instances...
Completed 190/1000 instances...
Completed 191/1000 instances...
Completed 192/1000 instances...
Completed 193/1000 instances...
Completed 194/1000 instances...
Completed 195/1000 instances...

Completed 196/1000 instances...
Completed 197/1000 instances...
Completed 198/1000 instances...
Completed 199/1000 instances...
Completed 200/1000 instances...
Completed 201/1000 instances...
Completed 202/1000 instances...
Completed 203/1000 instances...
Completed 204/1000 instances...
Completed 205/1000 instances...
Completed 206/1000 instances...
Completed 207/1000 instances...
Completed 208/1000 instances...
Completed 209/1000 instances...
Completed 210/1000 instances...
Completed 211/1000 instances...
Completed 212/1000 instances...
Completed 213/1000 instances...
Completed 214/1000 instances...
Completed 215/1000 instances...
Completed 216/1000 instances...
Completed 217/1000 instances...
Completed 218/1000 instances...
Completed 219/1000 instances...
Completed 220/1000 instances...
Completed 221/1000 instances...
Completed 222/1000 instances...
Completed 223/1000 instances...
Completed 224/1000 instances...
Completed 225/1000 instances...
Completed 226/1000 instances...
Completed 227/1000 instances...
Completed 228/1000 instances...
Completed 229/1000 instances...
Completed 230/1000 instances...
Completed 231/1000 instances...
Completed 232/1000 instances...
Completed 233/1000 instances...
Completed 234/1000 instances...
Completed 235/1000 instances...
Completed 236/1000 instances...
Completed 237/1000 instances...
Completed 238/1000 instances...
Completed 239/1000 instances...
Completed 240/1000 instances...
Completed 241/1000 instances...
Completed 242/1000 instances...
Completed 243/1000 instances...
Completed 244/1000 instances...
Completed 245/1000 instances...

Completed 246/1000 instances...
Completed 247/1000 instances...
Completed 248/1000 instances...
Completed 249/1000 instances...
Completed 250/1000 instances...
Completed 251/1000 instances...
Completed 252/1000 instances...
Completed 253/1000 instances...
Completed 254/1000 instances...
Completed 255/1000 instances...
Completed 256/1000 instances...
Completed 257/1000 instances...
Completed 258/1000 instances...
Completed 259/1000 instances...
Completed 260/1000 instances...
Completed 261/1000 instances...
Completed 262/1000 instances...
Completed 263/1000 instances...
Completed 264/1000 instances...
Completed 265/1000 instances...
Completed 266/1000 instances...
Completed 267/1000 instances...
Completed 268/1000 instances...
Completed 269/1000 instances...
Completed 270/1000 instances...
Completed 271/1000 instances...
Completed 272/1000 instances...
Completed 273/1000 instances...
Completed 274/1000 instances...
Completed 275/1000 instances...
Completed 276/1000 instances...
Completed 277/1000 instances...
Completed 278/1000 instances...
Completed 279/1000 instances...
Completed 280/1000 instances...
Completed 281/1000 instances...
Completed 282/1000 instances...
Completed 283/1000 instances...
Completed 284/1000 instances...
Completed 285/1000 instances...
Completed 286/1000 instances...
Completed 287/1000 instances...
Completed 288/1000 instances...
Completed 289/1000 instances...
Completed 290/1000 instances...
Completed 291/1000 instances...
Completed 292/1000 instances...
Completed 293/1000 instances...
Completed 294/1000 instances...
Completed 295/1000 instances...

Completed 296/1000 instances...
Completed 297/1000 instances...
Completed 298/1000 instances...
Completed 299/1000 instances...
Completed 300/1000 instances...
Completed 301/1000 instances...
Completed 302/1000 instances...
Completed 303/1000 instances...
Completed 304/1000 instances...
Completed 305/1000 instances...
Completed 306/1000 instances...
Completed 307/1000 instances...
Completed 308/1000 instances...
Completed 309/1000 instances...
Completed 310/1000 instances...
Completed 311/1000 instances...
Completed 312/1000 instances...
Completed 313/1000 instances...
Completed 314/1000 instances...
Completed 315/1000 instances...
Completed 316/1000 instances...
Completed 317/1000 instances...
Completed 318/1000 instances...
Completed 319/1000 instances...
Completed 320/1000 instances...
Completed 321/1000 instances...
Completed 322/1000 instances...
Completed 323/1000 instances...
Completed 324/1000 instances...
Completed 325/1000 instances...
Completed 326/1000 instances...
Completed 327/1000 instances...
Completed 328/1000 instances...
Completed 329/1000 instances...
Completed 330/1000 instances...
Completed 331/1000 instances...
Completed 332/1000 instances...
Completed 333/1000 instances...
Completed 334/1000 instances...
Completed 335/1000 instances...
Completed 336/1000 instances...
Completed 337/1000 instances...
Completed 338/1000 instances...
Completed 339/1000 instances...
Completed 340/1000 instances...
Completed 341/1000 instances...
Completed 342/1000 instances...
Completed 343/1000 instances...
Completed 344/1000 instances...
Completed 345/1000 instances...

Completed 346/1000 instances...
Completed 347/1000 instances...
Completed 348/1000 instances...
Completed 349/1000 instances...
Completed 350/1000 instances...
Completed 351/1000 instances...
Completed 352/1000 instances...
Completed 353/1000 instances...
Completed 354/1000 instances...
Completed 355/1000 instances...
Completed 356/1000 instances...
Completed 357/1000 instances...
Completed 358/1000 instances...
Completed 359/1000 instances...
Completed 360/1000 instances...
Completed 361/1000 instances...
Completed 362/1000 instances...
Completed 363/1000 instances...
Completed 364/1000 instances...
Completed 365/1000 instances...
Completed 366/1000 instances...
Completed 367/1000 instances...
Completed 368/1000 instances...
Completed 369/1000 instances...
Completed 370/1000 instances...
Completed 371/1000 instances...
Completed 372/1000 instances...
Completed 373/1000 instances...
Completed 374/1000 instances...
Completed 375/1000 instances...
Completed 376/1000 instances...
Completed 377/1000 instances...
Completed 378/1000 instances...
Completed 379/1000 instances...
Completed 380/1000 instances...
Completed 381/1000 instances...
Completed 382/1000 instances...
Completed 383/1000 instances...
Completed 384/1000 instances...
Completed 385/1000 instances...
Completed 386/1000 instances...
Completed 387/1000 instances...
Completed 388/1000 instances...
Completed 389/1000 instances...
Completed 390/1000 instances...
Completed 391/1000 instances...
Completed 392/1000 instances...
Completed 393/1000 instances...
Completed 394/1000 instances...
Completed 395/1000 instances...

Completed 396/1000 instances...
Completed 397/1000 instances...
Completed 398/1000 instances...
Completed 399/1000 instances...
Completed 400/1000 instances...
Completed 401/1000 instances...
Completed 402/1000 instances...
Completed 403/1000 instances...
Completed 404/1000 instances...
Completed 405/1000 instances...
Completed 406/1000 instances...
Completed 407/1000 instances...
Completed 408/1000 instances...
Completed 409/1000 instances...
Completed 410/1000 instances...
Completed 411/1000 instances...
Completed 412/1000 instances...
Completed 413/1000 instances...
Completed 414/1000 instances...
Completed 415/1000 instances...
Completed 416/1000 instances...
Completed 417/1000 instances...
Completed 418/1000 instances...
Completed 419/1000 instances...
Completed 420/1000 instances...
Completed 421/1000 instances...
Completed 422/1000 instances...
Completed 423/1000 instances...
Completed 424/1000 instances...
Completed 425/1000 instances...
Completed 426/1000 instances...
Completed 427/1000 instances...
Completed 428/1000 instances...
Completed 429/1000 instances...
Completed 430/1000 instances...
Completed 431/1000 instances...
Completed 432/1000 instances...
Completed 433/1000 instances...
Completed 434/1000 instances...
Completed 435/1000 instances...
Completed 436/1000 instances...
Completed 437/1000 instances...
Completed 438/1000 instances...
Completed 439/1000 instances...
Completed 440/1000 instances...
Completed 441/1000 instances...
Completed 442/1000 instances...
Completed 443/1000 instances...
Completed 444/1000 instances...
Completed 445/1000 instances...

Completed 446/1000 instances...
Completed 447/1000 instances...
Completed 448/1000 instances...
Completed 449/1000 instances...
Completed 450/1000 instances...
Completed 451/1000 instances...
Completed 452/1000 instances...
Completed 453/1000 instances...
Completed 454/1000 instances...
Completed 455/1000 instances...
Completed 456/1000 instances...
Completed 457/1000 instances...
Completed 458/1000 instances...
Completed 459/1000 instances...
Completed 460/1000 instances...
Completed 461/1000 instances...
Completed 462/1000 instances...
Completed 463/1000 instances...
Completed 464/1000 instances...
Completed 465/1000 instances...
Completed 466/1000 instances...
Completed 467/1000 instances...
Completed 468/1000 instances...
Completed 469/1000 instances...
Completed 470/1000 instances...
Completed 471/1000 instances...
Completed 472/1000 instances...
Completed 473/1000 instances...
Completed 474/1000 instances...
Completed 475/1000 instances...
Completed 476/1000 instances...
Completed 477/1000 instances...
Completed 478/1000 instances...
Completed 479/1000 instances...
Completed 480/1000 instances...
Completed 481/1000 instances...
Completed 482/1000 instances...
Completed 483/1000 instances...
Completed 484/1000 instances...
Completed 485/1000 instances...
Completed 486/1000 instances...
Completed 487/1000 instances...
Completed 488/1000 instances...
Completed 489/1000 instances...
Completed 490/1000 instances...
Completed 491/1000 instances...
Completed 492/1000 instances...
Completed 493/1000 instances...
Completed 494/1000 instances...
Completed 495/1000 instances...

Completed 496/1000 instances...
Completed 497/1000 instances...
Completed 498/1000 instances...
Completed 499/1000 instances...
Completed 500/1000 instances...
Completed 501/1000 instances...
Completed 502/1000 instances...
Completed 503/1000 instances...
Completed 504/1000 instances...
Completed 505/1000 instances...
Completed 506/1000 instances...
Completed 507/1000 instances...
Completed 508/1000 instances...
Completed 509/1000 instances...
Completed 510/1000 instances...
Completed 511/1000 instances...
Completed 512/1000 instances...
Completed 513/1000 instances...
Completed 514/1000 instances...
Completed 515/1000 instances...
Completed 516/1000 instances...
Completed 517/1000 instances...
Completed 518/1000 instances...
Completed 519/1000 instances...
Completed 520/1000 instances...
Completed 521/1000 instances...
Completed 522/1000 instances...
Completed 523/1000 instances...
Completed 524/1000 instances...
Completed 525/1000 instances...
Completed 526/1000 instances...
Completed 527/1000 instances...
Completed 528/1000 instances...
Completed 529/1000 instances...
Completed 530/1000 instances...
Completed 531/1000 instances...
Completed 532/1000 instances...
Completed 533/1000 instances...
Completed 534/1000 instances...
Completed 535/1000 instances...
Completed 536/1000 instances...
Completed 537/1000 instances...
Completed 538/1000 instances...
Completed 539/1000 instances...
Completed 540/1000 instances...
Completed 541/1000 instances...
Completed 542/1000 instances...
Completed 543/1000 instances...
Completed 544/1000 instances...
Completed 545/1000 instances...

Completed 546/1000 instances...
Completed 547/1000 instances...
Completed 548/1000 instances...
Completed 549/1000 instances...
Completed 550/1000 instances...
Completed 551/1000 instances...
Completed 552/1000 instances...
Completed 553/1000 instances...
Completed 554/1000 instances...
Completed 555/1000 instances...
Completed 556/1000 instances...
Completed 557/1000 instances...
Completed 558/1000 instances...
Completed 559/1000 instances...
Completed 560/1000 instances...
Completed 561/1000 instances...
Completed 562/1000 instances...
Completed 563/1000 instances...
Completed 564/1000 instances...
Completed 565/1000 instances...
Completed 566/1000 instances...
Completed 567/1000 instances...
Completed 568/1000 instances...
Completed 569/1000 instances...
Completed 570/1000 instances...
Completed 571/1000 instances...
Completed 572/1000 instances...
Completed 573/1000 instances...
Completed 574/1000 instances...
Completed 575/1000 instances...
Completed 576/1000 instances...
Completed 577/1000 instances...
Completed 578/1000 instances...
Completed 579/1000 instances...
Completed 580/1000 instances...
Completed 581/1000 instances...
Completed 582/1000 instances...
Completed 583/1000 instances...
Completed 584/1000 instances...
Completed 585/1000 instances...
Completed 586/1000 instances...
Completed 587/1000 instances...
Completed 588/1000 instances...
Completed 589/1000 instances...
Completed 590/1000 instances...
Completed 591/1000 instances...
Completed 592/1000 instances...
Completed 593/1000 instances...
Completed 594/1000 instances...

Completed 595/1000 instances...
Completed 596/1000 instances...
Completed 597/1000 instances...
Completed 598/1000 instances...
Completed 599/1000 instances...
Completed 600/1000 instances...
Completed 601/1000 instances...
Completed 602/1000 instances...
Completed 603/1000 instances...
Completed 604/1000 instances...
Completed 605/1000 instances...
Completed 606/1000 instances...
Completed 607/1000 instances...
Completed 608/1000 instances...
Completed 609/1000 instances...
Completed 610/1000 instances...
Completed 611/1000 instances...
Completed 612/1000 instances...
Completed 613/1000 instances...
Completed 614/1000 instances...
Completed 615/1000 instances...
Completed 616/1000 instances...
Completed 617/1000 instances...
Completed 618/1000 instances...
Completed 619/1000 instances...
Completed 620/1000 instances...
Completed 621/1000 instances...
Completed 622/1000 instances...
Completed 623/1000 instances...
Completed 624/1000 instances...
Completed 625/1000 instances...
Completed 626/1000 instances...
Completed 627/1000 instances...
Completed 628/1000 instances...
Completed 629/1000 instances...
Completed 630/1000 instances...
Completed 631/1000 instances...
Completed 632/1000 instances...
Completed 633/1000 instances...
Completed 634/1000 instances...
Completed 635/1000 instances...
Completed 636/1000 instances...
Completed 637/1000 instances...
Completed 638/1000 instances...
Completed 639/1000 instances...
Completed 640/1000 instances...
Completed 641/1000 instances...
Completed 642/1000 instances...
Completed 643/1000 instances...

Completed 644/1000 instances...
Completed 645/1000 instances...
Completed 646/1000 instances...
Completed 647/1000 instances...
Completed 648/1000 instances...
Completed 649/1000 instances...
Completed 650/1000 instances...
Completed 651/1000 instances...
Completed 652/1000 instances...
Completed 653/1000 instances...
Completed 654/1000 instances...
Completed 655/1000 instances...
Completed 656/1000 instances...
Completed 657/1000 instances...
Completed 658/1000 instances...
Completed 659/1000 instances...
Completed 660/1000 instances...
Completed 661/1000 instances...
Completed 662/1000 instances...
Completed 663/1000 instances...
Completed 664/1000 instances...
Completed 665/1000 instances...
Completed 666/1000 instances...
Completed 667/1000 instances...
Completed 668/1000 instances...
Completed 669/1000 instances...
Completed 670/1000 instances...
Completed 671/1000 instances...
Completed 672/1000 instances...
Completed 673/1000 instances...
Completed 674/1000 instances...
Completed 675/1000 instances...
Completed 676/1000 instances...
Completed 677/1000 instances...
Completed 678/1000 instances...
Completed 679/1000 instances...
Completed 680/1000 instances...
Completed 681/1000 instances...
Completed 682/1000 instances...
Completed 683/1000 instances...
Completed 684/1000 instances...
Completed 685/1000 instances...
Completed 686/1000 instances...
Completed 687/1000 instances...
Completed 688/1000 instances...
Completed 689/1000 instances...
Completed 690/1000 instances...
Completed 691/1000 instances...
Completed 692/1000 instances...

Completed 693/1000 instances...
Completed 694/1000 instances...
Completed 695/1000 instances...
Completed 696/1000 instances...
Completed 697/1000 instances...
Completed 698/1000 instances...
Completed 699/1000 instances...
Completed 700/1000 instances...
Completed 701/1000 instances...
Completed 702/1000 instances...
Completed 703/1000 instances...
Completed 704/1000 instances...
Completed 705/1000 instances...
Completed 706/1000 instances...
Completed 707/1000 instances...
Completed 708/1000 instances...
Completed 709/1000 instances...
Completed 710/1000 instances...
Completed 711/1000 instances...
Completed 712/1000 instances...
Completed 713/1000 instances...
Completed 714/1000 instances...
Completed 715/1000 instances...
Completed 716/1000 instances...
Completed 717/1000 instances...
Completed 718/1000 instances...
Completed 719/1000 instances...
Completed 720/1000 instances...
Completed 721/1000 instances...
Completed 722/1000 instances...
Completed 723/1000 instances...
Completed 724/1000 instances...
Completed 725/1000 instances...
Completed 726/1000 instances...
Completed 727/1000 instances...
Completed 728/1000 instances...
Completed 729/1000 instances...
Completed 730/1000 instances...
Completed 731/1000 instances...
Completed 732/1000 instances...
Completed 733/1000 instances...
Completed 734/1000 instances...
Completed 735/1000 instances...
Completed 736/1000 instances...
Completed 737/1000 instances...
Completed 738/1000 instances...
Completed 739/1000 instances...
Completed 740/1000 instances...
Completed 741/1000 instances...

Completed 742/1000 instances...
Completed 743/1000 instances...
Completed 744/1000 instances...
Completed 745/1000 instances...
Completed 746/1000 instances...
Completed 747/1000 instances...
Completed 748/1000 instances...
Completed 749/1000 instances...
Completed 750/1000 instances...
Completed 751/1000 instances...
Completed 752/1000 instances...
Completed 753/1000 instances...
Completed 754/1000 instances...
Completed 755/1000 instances...
Completed 756/1000 instances...
Completed 757/1000 instances...
Completed 758/1000 instances...
Completed 759/1000 instances...
Completed 760/1000 instances...
Completed 761/1000 instances...
Completed 762/1000 instances...
Completed 763/1000 instances...
Completed 764/1000 instances...
Completed 765/1000 instances...
Completed 766/1000 instances...
Completed 767/1000 instances...
Completed 768/1000 instances...
Completed 769/1000 instances...
Completed 770/1000 instances...
Completed 771/1000 instances...
Completed 772/1000 instances...
Completed 773/1000 instances...
Completed 774/1000 instances...
Completed 775/1000 instances...
Completed 776/1000 instances...
Completed 777/1000 instances...
Completed 778/1000 instances...
Completed 779/1000 instances...
Completed 780/1000 instances...
Completed 781/1000 instances...
Completed 782/1000 instances...
Completed 783/1000 instances...
Completed 784/1000 instances...
Completed 785/1000 instances...
Completed 786/1000 instances...
Completed 787/1000 instances...
Completed 788/1000 instances...
Completed 789/1000 instances...
Completed 790/1000 instances...

Completed 791/1000 instances...
Completed 792/1000 instances...
Completed 793/1000 instances...
Completed 794/1000 instances...
Completed 795/1000 instances...
Completed 796/1000 instances...
Completed 797/1000 instances...
Completed 798/1000 instances...
Completed 799/1000 instances...
Completed 800/1000 instances...
Completed 801/1000 instances...
Completed 802/1000 instances...
Completed 803/1000 instances...
Completed 804/1000 instances...
Completed 805/1000 instances...
Completed 806/1000 instances...
Completed 807/1000 instances...
Completed 808/1000 instances...
Completed 809/1000 instances...
Completed 810/1000 instances...
Completed 811/1000 instances...
Completed 812/1000 instances...
Completed 813/1000 instances...
Completed 814/1000 instances...
Completed 815/1000 instances...
Completed 816/1000 instances...
Completed 817/1000 instances...
Completed 818/1000 instances...
Completed 819/1000 instances...
Completed 820/1000 instances...
Completed 821/1000 instances...
Completed 822/1000 instances...
Completed 823/1000 instances...
Completed 824/1000 instances...
Completed 825/1000 instances...
Completed 826/1000 instances...
Completed 827/1000 instances...
Completed 828/1000 instances...
Completed 829/1000 instances...
Completed 830/1000 instances...
Completed 831/1000 instances...
Completed 832/1000 instances...
Completed 833/1000 instances...
Completed 834/1000 instances...
Completed 835/1000 instances...
Completed 836/1000 instances...
Completed 837/1000 instances...
Completed 838/1000 instances...
Completed 839/1000 instances...

Completed 840/1000 instances...
Completed 841/1000 instances...
Completed 842/1000 instances...
Completed 843/1000 instances...
Completed 844/1000 instances...
Completed 845/1000 instances...
Completed 846/1000 instances...
Completed 847/1000 instances...
Completed 848/1000 instances...
Completed 849/1000 instances...
Completed 850/1000 instances...
Completed 851/1000 instances...
Completed 852/1000 instances...
Completed 853/1000 instances...
Completed 854/1000 instances...
Completed 855/1000 instances...
Completed 856/1000 instances...
Completed 857/1000 instances...
Completed 858/1000 instances...
Completed 859/1000 instances...
Completed 860/1000 instances...
Completed 861/1000 instances...
Completed 862/1000 instances...
Completed 863/1000 instances...
Completed 864/1000 instances...
Completed 865/1000 instances...
Completed 866/1000 instances...
Completed 867/1000 instances...
Completed 868/1000 instances...
Completed 869/1000 instances...
Completed 870/1000 instances...
Completed 871/1000 instances...
Completed 872/1000 instances...
Completed 873/1000 instances...
Completed 874/1000 instances...
Completed 875/1000 instances...
Completed 876/1000 instances...
Completed 877/1000 instances...
Completed 878/1000 instances...
Completed 879/1000 instances...
Completed 880/1000 instances...
Completed 881/1000 instances...
Completed 882/1000 instances...
Completed 883/1000 instances...
Completed 884/1000 instances...
Completed 885/1000 instances...
Completed 886/1000 instances...
Completed 887/1000 instances...
Completed 888/1000 instances...

Completed 889/1000 instances...
Completed 890/1000 instances...
Completed 891/1000 instances...
Completed 892/1000 instances...
Completed 893/1000 instances...
Completed 894/1000 instances...
Completed 895/1000 instances...
Completed 896/1000 instances...
Completed 897/1000 instances...
Completed 898/1000 instances...
Completed 899/1000 instances...
Completed 900/1000 instances...
Completed 901/1000 instances...
Completed 902/1000 instances...
Completed 903/1000 instances...
Completed 904/1000 instances...
Completed 905/1000 instances...
Completed 906/1000 instances...
Completed 907/1000 instances...
Completed 908/1000 instances...
Completed 909/1000 instances...
Completed 910/1000 instances...
Completed 911/1000 instances...
Completed 912/1000 instances...
Completed 913/1000 instances...
Completed 914/1000 instances...
Completed 915/1000 instances...
Completed 916/1000 instances...
Completed 917/1000 instances...
Completed 918/1000 instances...
Completed 919/1000 instances...
Completed 920/1000 instances...
Completed 921/1000 instances...
Completed 922/1000 instances...
Completed 923/1000 instances...
Completed 924/1000 instances...
Completed 925/1000 instances...
Completed 926/1000 instances...
Completed 927/1000 instances...
Completed 928/1000 instances...
Completed 929/1000 instances...
Completed 930/1000 instances...
Completed 931/1000 instances...
Completed 932/1000 instances...
Completed 933/1000 instances...
Completed 934/1000 instances...
Completed 935/1000 instances...
Completed 936/1000 instances...
Completed 937/1000 instances...

Completed 938/1000 instances...
Completed 939/1000 instances...
Completed 940/1000 instances...
Completed 941/1000 instances...
Completed 942/1000 instances...
Completed 943/1000 instances...
Completed 944/1000 instances...
Completed 945/1000 instances...
Completed 946/1000 instances...
Completed 947/1000 instances...
Completed 948/1000 instances...
Completed 949/1000 instances...
Completed 950/1000 instances...
Completed 951/1000 instances...
Completed 952/1000 instances...
Completed 953/1000 instances...
Completed 954/1000 instances...
Completed 955/1000 instances...
Completed 956/1000 instances...
Completed 957/1000 instances...
Completed 958/1000 instances...
Completed 959/1000 instances...
Completed 960/1000 instances...
Completed 961/1000 instances...
Completed 962/1000 instances...
Completed 963/1000 instances...
Completed 964/1000 instances...
Completed 965/1000 instances...
Completed 966/1000 instances...
Completed 967/1000 instances...
Completed 968/1000 instances...
Completed 969/1000 instances...
Completed 970/1000 instances...
Completed 971/1000 instances...
Completed 972/1000 instances...
Completed 973/1000 instances...
Completed 974/1000 instances...
Completed 975/1000 instances...
Completed 976/1000 instances...
Completed 977/1000 instances...
Completed 978/1000 instances...
Completed 979/1000 instances...
Completed 980/1000 instances...
Completed 981/1000 instances...
Completed 982/1000 instances...
Completed 983/1000 instances...
Completed 984/1000 instances...
Completed 985/1000 instances...
Completed 986/1000 instances...

```
Completed 987/1000 instances...
Completed 988/1000 instances...
Completed 989/1000 instances...
Completed 990/1000 instances...
Completed 991/1000 instances...
Completed 992/1000 instances...
Completed 993/1000 instances...
Completed 994/1000 instances...
Completed 995/1000 instances...
Completed 996/1000 instances...
Completed 997/1000 instances...
Completed 998/1000 instances...
Completed 999/1000 instances...
Completed 1000/1000 instances...
--- Evaluation Complete ---

instance_paths = [os.path.join(wuf_50_m_path,x) for x in
os.listdir(wuf_50_m_path)]
solutions = get_solution_dict(os.path.join(wuf_50_path, "wuf50-218-M-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=100,
    max_workers=12 # Uses all cores automatically
)
df_results.to_csv("wuf-50-218-M")
display(df_results)
print(df_results["Rel_Error"].mean())

--- Starting Black Box Evaluation ---
Instances: 1000
Repeats per Instance: 100
Total Runs: 100000
Parallel Workers: 12
Completed 1/1000 instances...
Completed 2/1000 instances...
Completed 3/1000 instances...
Completed 4/1000 instances...
Completed 5/1000 instances...
Completed 6/1000 instances...
Completed 7/1000 instances...
Completed 8/1000 instances...
Completed 9/1000 instances...
Completed 10/1000 instances...
Completed 11/1000 instances...
Completed 12/1000 instances...
Completed 13/1000 instances...
```

Completed 14/1000 instances...
Completed 15/1000 instances...
Completed 16/1000 instances...
Completed 17/1000 instances...
Completed 18/1000 instances...
Completed 19/1000 instances...
Completed 20/1000 instances...
Completed 21/1000 instances...
Completed 22/1000 instances...
Completed 23/1000 instances...
Completed 24/1000 instances...
Completed 25/1000 instances...
Completed 26/1000 instances...
Completed 27/1000 instances...
Completed 28/1000 instances...
Completed 29/1000 instances...
Completed 30/1000 instances...
Completed 31/1000 instances...
Completed 32/1000 instances...
Completed 33/1000 instances...
Completed 34/1000 instances...
Completed 35/1000 instances...
Completed 36/1000 instances...
Completed 37/1000 instances...
Completed 38/1000 instances...
Completed 39/1000 instances...
Completed 40/1000 instances...
Completed 41/1000 instances...
Completed 42/1000 instances...
Completed 43/1000 instances...
Completed 44/1000 instances...
Completed 45/1000 instances...
Completed 46/1000 instances...
Completed 47/1000 instances...
Completed 48/1000 instances...
Completed 49/1000 instances...
Completed 50/1000 instances...
Completed 51/1000 instances...
Completed 52/1000 instances...
Completed 53/1000 instances...
Completed 54/1000 instances...
Completed 55/1000 instances...
Completed 56/1000 instances...
Completed 57/1000 instances...
Completed 58/1000 instances...
Completed 59/1000 instances...
Completed 60/1000 instances...
Completed 61/1000 instances...
Completed 62/1000 instances...

Completed 63/1000 instances...
Completed 64/1000 instances...
Completed 65/1000 instances...
Completed 66/1000 instances...
Completed 67/1000 instances...
Completed 68/1000 instances...
Completed 69/1000 instances...
Completed 70/1000 instances...
Completed 71/1000 instances...
Completed 72/1000 instances...
Completed 73/1000 instances...
Completed 74/1000 instances...
Completed 75/1000 instances...
Completed 76/1000 instances...
Completed 77/1000 instances...
Completed 78/1000 instances...
Completed 79/1000 instances...
Completed 80/1000 instances...
Completed 81/1000 instances...
Completed 82/1000 instances...
Completed 83/1000 instances...
Completed 84/1000 instances...
Completed 85/1000 instances...
Completed 86/1000 instances...
Completed 87/1000 instances...
Completed 88/1000 instances...
Completed 89/1000 instances...
Completed 90/1000 instances...
Completed 91/1000 instances...
Completed 92/1000 instances...
Completed 93/1000 instances...
Completed 94/1000 instances...
Completed 95/1000 instances...
Completed 96/1000 instances...
Completed 97/1000 instances...
Completed 98/1000 instances...
Completed 99/1000 instances...
Completed 100/1000 instances...
Completed 101/1000 instances...
Completed 102/1000 instances...
Completed 103/1000 instances...
Completed 104/1000 instances...
Completed 105/1000 instances...
Completed 106/1000 instances...
Completed 107/1000 instances...
Completed 108/1000 instances...
Completed 109/1000 instances...
Completed 110/1000 instances...
Completed 111/1000 instances...

```
Completed 112/1000 instances...
Completed 113/1000 instances...
Completed 114/1000 instances...
Completed 115/1000 instances...
Completed 116/1000 instances...
Completed 117/1000 instances...
Completed 118/1000 instances...
Completed 119/1000 instances...
Completed 120/1000 instances...
Completed 121/1000 instances...
Completed 122/1000 instances...
Completed 123/1000 instances...
Completed 124/1000 instances...
Completed 125/1000 instances...
Completed 126/1000 instances...
Completed 127/1000 instances...
Completed 128/1000 instances...
Completed 129/1000 instances...
Completed 130/1000 instances...
Completed 131/1000 instances...
Completed 132/1000 instances...
Completed 133/1000 instances...
Completed 134/1000 instances...
Completed 135/1000 instances...
Completed 136/1000 instances...
Completed 137/1000 instances...
Completed 138/1000 instances...
Completed 139/1000 instances...
Completed 140/1000 instances...
Completed 141/1000 instances...
Completed 142/1000 instances...
Completed 143/1000 instances...
Completed 144/1000 instances...
Completed 145/1000 instances...
Completed 146/1000 instances...
Completed 147/1000 instances...
Completed 148/1000 instances...
Completed 149/1000 instances...
Completed 150/1000 instances...
Completed 151/1000 instances...
Completed 152/1000 instances...
Completed 153/1000 instances...
Completed 154/1000 instances...
Completed 155/1000 instances...
Completed 156/1000 instances...
Completed 157/1000 instances...
Completed 158/1000 instances...
Completed 159/1000 instances...
Completed 160/1000 instances...
```

Completed 161/1000 instances...
Completed 162/1000 instances...
Completed 163/1000 instances...
Completed 164/1000 instances...
Completed 165/1000 instances...
Completed 166/1000 instances...
Completed 167/1000 instances...
Completed 168/1000 instances...
Completed 169/1000 instances...
Completed 170/1000 instances...
Completed 171/1000 instances...
Completed 172/1000 instances...
Completed 173/1000 instances...
Completed 174/1000 instances...
Completed 175/1000 instances...
Completed 176/1000 instances...
Completed 177/1000 instances...
Completed 178/1000 instances...
Completed 179/1000 instances...
Completed 180/1000 instances...
Completed 181/1000 instances...
Completed 182/1000 instances...
Completed 183/1000 instances...
Completed 184/1000 instances...
Completed 185/1000 instances...
Completed 186/1000 instances...
Completed 187/1000 instances...
Completed 188/1000 instances...
Completed 189/1000 instances...
Completed 190/1000 instances...
Completed 191/1000 instances...
Completed 192/1000 instances...
Completed 193/1000 instances...
Completed 194/1000 instances...
Completed 195/1000 instances...
Completed 196/1000 instances...
Completed 197/1000 instances...
Completed 198/1000 instances...
Completed 199/1000 instances...
Completed 200/1000 instances...
Completed 201/1000 instances...
Completed 202/1000 instances...
Completed 203/1000 instances...
Completed 204/1000 instances...
Completed 205/1000 instances...
Completed 206/1000 instances...
Completed 207/1000 instances...
Completed 208/1000 instances...
Completed 209/1000 instances...

Completed 210/1000 instances...
Completed 211/1000 instances...
Completed 212/1000 instances...
Completed 213/1000 instances...
Completed 214/1000 instances...
Completed 215/1000 instances...
Completed 216/1000 instances...
Completed 217/1000 instances...
Completed 218/1000 instances...
Completed 219/1000 instances...
Completed 220/1000 instances...
Completed 221/1000 instances...
Completed 222/1000 instances...
Completed 223/1000 instances...
Completed 224/1000 instances...
Completed 225/1000 instances...
Completed 226/1000 instances...
Completed 227/1000 instances...
Completed 228/1000 instances...
Completed 229/1000 instances...
Completed 230/1000 instances...
Completed 231/1000 instances...
Completed 232/1000 instances...
Completed 233/1000 instances...
Completed 234/1000 instances...
Completed 235/1000 instances...
Completed 236/1000 instances...
Completed 237/1000 instances...
Completed 238/1000 instances...
Completed 239/1000 instances...
Completed 240/1000 instances...
Completed 241/1000 instances...
Completed 242/1000 instances...
Completed 243/1000 instances...
Completed 244/1000 instances...
Completed 245/1000 instances...
Completed 246/1000 instances...
Completed 247/1000 instances...
Completed 248/1000 instances...
Completed 249/1000 instances...
Completed 250/1000 instances...
Completed 251/1000 instances...
Completed 252/1000 instances...
Completed 253/1000 instances...
Completed 254/1000 instances...
Completed 255/1000 instances...
Completed 256/1000 instances...
Completed 257/1000 instances...
Completed 258/1000 instances...

Completed 259/1000 instances...
Completed 260/1000 instances...
Completed 261/1000 instances...
Completed 262/1000 instances...
Completed 263/1000 instances...
Completed 264/1000 instances...
Completed 265/1000 instances...
Completed 266/1000 instances...
Completed 267/1000 instances...
Completed 268/1000 instances...
Completed 269/1000 instances...
Completed 270/1000 instances...
Completed 271/1000 instances...
Completed 272/1000 instances...
Completed 273/1000 instances...
Completed 274/1000 instances...
Completed 275/1000 instances...
Completed 276/1000 instances...
Completed 277/1000 instances...
Completed 278/1000 instances...
Completed 279/1000 instances...
Completed 280/1000 instances...
Completed 281/1000 instances...
Completed 282/1000 instances...
Completed 283/1000 instances...
Completed 284/1000 instances...
Completed 285/1000 instances...
Completed 286/1000 instances...
Completed 287/1000 instances...
Completed 288/1000 instances...
Completed 289/1000 instances...
Completed 290/1000 instances...
Completed 291/1000 instances...
Completed 292/1000 instances...
Completed 293/1000 instances...
Completed 294/1000 instances...
Completed 295/1000 instances...
Completed 296/1000 instances...
Completed 297/1000 instances...
Completed 298/1000 instances...
Completed 299/1000 instances...
Completed 300/1000 instances...
Completed 301/1000 instances...
Completed 302/1000 instances...
Completed 303/1000 instances...
Completed 304/1000 instances...
Completed 305/1000 instances...
Completed 306/1000 instances...
Completed 307/1000 instances...

Completed 308/1000 instances...
Completed 309/1000 instances...
Completed 310/1000 instances...
Completed 311/1000 instances...
Completed 312/1000 instances...
Completed 313/1000 instances...
Completed 314/1000 instances...
Completed 315/1000 instances...
Completed 316/1000 instances...
Completed 317/1000 instances...
Completed 318/1000 instances...
Completed 319/1000 instances...
Completed 320/1000 instances...
Completed 321/1000 instances...
Completed 322/1000 instances...
Completed 323/1000 instances...
Completed 324/1000 instances...
Completed 325/1000 instances...
Completed 326/1000 instances...
Completed 327/1000 instances...
Completed 328/1000 instances...
Completed 329/1000 instances...
Completed 330/1000 instances...
Completed 331/1000 instances...
Completed 332/1000 instances...
Completed 333/1000 instances...
Completed 334/1000 instances...
Completed 335/1000 instances...
Completed 336/1000 instances...
Completed 337/1000 instances...
Completed 338/1000 instances...
Completed 339/1000 instances...
Completed 340/1000 instances...
Completed 341/1000 instances...
Completed 342/1000 instances...
Completed 343/1000 instances...
Completed 344/1000 instances...
Completed 345/1000 instances...
Completed 346/1000 instances...
Completed 347/1000 instances...
Completed 348/1000 instances...
Completed 349/1000 instances...
Completed 350/1000 instances...
Completed 351/1000 instances...
Completed 352/1000 instances...
Completed 353/1000 instances...
Completed 354/1000 instances...
Completed 355/1000 instances...
Completed 356/1000 instances...

Completed 357/1000 instances...
Completed 358/1000 instances...
Completed 359/1000 instances...
Completed 360/1000 instances...
Completed 361/1000 instances...
Completed 362/1000 instances...
Completed 363/1000 instances...
Completed 364/1000 instances...
Completed 365/1000 instances...
Completed 366/1000 instances...
Completed 367/1000 instances...
Completed 368/1000 instances...
Completed 369/1000 instances...
Completed 370/1000 instances...
Completed 371/1000 instances...
Completed 372/1000 instances...
Completed 373/1000 instances...
Completed 374/1000 instances...
Completed 375/1000 instances...
Completed 376/1000 instances...
Completed 377/1000 instances...
Completed 378/1000 instances...
Completed 379/1000 instances...
Completed 380/1000 instances...
Completed 381/1000 instances...
Completed 382/1000 instances...
Completed 383/1000 instances...
Completed 384/1000 instances...
Completed 385/1000 instances...
Completed 386/1000 instances...
Completed 387/1000 instances...
Completed 388/1000 instances...
Completed 389/1000 instances...
Completed 390/1000 instances...
Completed 391/1000 instances...
Completed 392/1000 instances...
Completed 393/1000 instances...
Completed 394/1000 instances...
Completed 395/1000 instances...
Completed 396/1000 instances...
Completed 397/1000 instances...
Completed 398/1000 instances...
Completed 399/1000 instances...
Completed 400/1000 instances...
Completed 401/1000 instances...
Completed 402/1000 instances...
Completed 403/1000 instances...
Completed 404/1000 instances...
Completed 405/1000 instances...

Completed 406/1000 instances...
Completed 407/1000 instances...
Completed 408/1000 instances...
Completed 409/1000 instances...
Completed 410/1000 instances...
Completed 411/1000 instances...
Completed 412/1000 instances...
Completed 413/1000 instances...
Completed 414/1000 instances...
Completed 415/1000 instances...
Completed 416/1000 instances...
Completed 417/1000 instances...
Completed 418/1000 instances...
Completed 419/1000 instances...
Completed 420/1000 instances...
Completed 421/1000 instances...
Completed 422/1000 instances...
Completed 423/1000 instances...
Completed 424/1000 instances...
Completed 425/1000 instances...
Completed 426/1000 instances...
Completed 427/1000 instances...
Completed 428/1000 instances...
Completed 429/1000 instances...
Completed 430/1000 instances...
Completed 431/1000 instances...
Completed 432/1000 instances...
Completed 433/1000 instances...
Completed 434/1000 instances...
Completed 435/1000 instances...
Completed 436/1000 instances...
Completed 437/1000 instances...
Completed 438/1000 instances...
Completed 439/1000 instances...
Completed 440/1000 instances...
Completed 441/1000 instances...
Completed 442/1000 instances...
Completed 443/1000 instances...
Completed 444/1000 instances...
Completed 445/1000 instances...
Completed 446/1000 instances...
Completed 447/1000 instances...
Completed 448/1000 instances...
Completed 449/1000 instances...
Completed 450/1000 instances...
Completed 451/1000 instances...
Completed 452/1000 instances...
Completed 453/1000 instances...
Completed 454/1000 instances...

Completed 455/1000 instances...
Completed 456/1000 instances...
Completed 457/1000 instances...
Completed 458/1000 instances...
Completed 459/1000 instances...
Completed 460/1000 instances...
Completed 461/1000 instances...
Completed 462/1000 instances...
Completed 463/1000 instances...
Completed 464/1000 instances...
Completed 465/1000 instances...
Completed 466/1000 instances...
Completed 467/1000 instances...
Completed 468/1000 instances...
Completed 469/1000 instances...
Completed 470/1000 instances...
Completed 471/1000 instances...
Completed 472/1000 instances...
Completed 473/1000 instances...
Completed 474/1000 instances...
Completed 475/1000 instances...
Completed 476/1000 instances...
Completed 477/1000 instances...
Completed 478/1000 instances...
Completed 479/1000 instances...
Completed 480/1000 instances...
Completed 481/1000 instances...
Completed 482/1000 instances...
Completed 483/1000 instances...
Completed 484/1000 instances...
Completed 485/1000 instances...
Completed 486/1000 instances...
Completed 487/1000 instances...
Completed 488/1000 instances...
Completed 489/1000 instances...
Completed 490/1000 instances...
Completed 491/1000 instances...
Completed 492/1000 instances...
Completed 493/1000 instances...
Completed 494/1000 instances...
Completed 495/1000 instances...
Completed 496/1000 instances...
Completed 497/1000 instances...
Completed 498/1000 instances...
Completed 499/1000 instances...
Completed 500/1000 instances...
Completed 501/1000 instances...
Completed 502/1000 instances...
Completed 503/1000 instances...
Completed 504/1000 instances...

Completed 505/1000 instances...
Completed 506/1000 instances...
Completed 507/1000 instances...
Completed 508/1000 instances...
Completed 509/1000 instances...
Completed 510/1000 instances...
Completed 511/1000 instances...
Completed 512/1000 instances...
Completed 513/1000 instances...
Completed 514/1000 instances...
Completed 515/1000 instances...
Completed 516/1000 instances...
Completed 517/1000 instances...
Completed 518/1000 instances...
Completed 519/1000 instances...
Completed 520/1000 instances...
Completed 521/1000 instances...
Completed 522/1000 instances...
Completed 523/1000 instances...
Completed 524/1000 instances...
Completed 525/1000 instances...
Completed 526/1000 instances...
Completed 527/1000 instances...
Completed 528/1000 instances...
Completed 529/1000 instances...
Completed 530/1000 instances...
Completed 531/1000 instances...
Completed 532/1000 instances...
Completed 533/1000 instances...
Completed 534/1000 instances...
Completed 535/1000 instances...
Completed 536/1000 instances...
Completed 537/1000 instances...
Completed 538/1000 instances...
Completed 539/1000 instances...
Completed 540/1000 instances...
Completed 541/1000 instances...
Completed 542/1000 instances...
Completed 543/1000 instances...
Completed 544/1000 instances...
Completed 545/1000 instances...
Completed 546/1000 instances...
Completed 547/1000 instances...
Completed 548/1000 instances...
Completed 549/1000 instances...
Completed 550/1000 instances...
Completed 551/1000 instances...
Completed 552/1000 instances...
Completed 553/1000 instances...

Completed 554/1000 instances...
Completed 555/1000 instances...
Completed 556/1000 instances...
Completed 557/1000 instances...
Completed 558/1000 instances...
Completed 559/1000 instances...
Completed 560/1000 instances...
Completed 561/1000 instances...
Completed 562/1000 instances...
Completed 563/1000 instances...
Completed 564/1000 instances...
Completed 565/1000 instances...
Completed 566/1000 instances...
Completed 567/1000 instances...
Completed 568/1000 instances...
Completed 569/1000 instances...
Completed 570/1000 instances...
Completed 571/1000 instances...
Completed 572/1000 instances...
Completed 573/1000 instances...
Completed 574/1000 instances...
Completed 575/1000 instances...
Completed 576/1000 instances...
Completed 577/1000 instances...
Completed 578/1000 instances...
Completed 579/1000 instances...
Completed 580/1000 instances...
Completed 581/1000 instances...
Completed 582/1000 instances...
Completed 583/1000 instances...
Completed 584/1000 instances...
Completed 585/1000 instances...
Completed 586/1000 instances...
Completed 587/1000 instances...
Completed 588/1000 instances...
Completed 589/1000 instances...
Completed 590/1000 instances...
Completed 591/1000 instances...
Completed 592/1000 instances...
Completed 593/1000 instances...
Completed 594/1000 instances...
Completed 595/1000 instances...
Completed 596/1000 instances...
Completed 597/1000 instances...
Completed 598/1000 instances...
Completed 599/1000 instances...
Completed 600/1000 instances...
Completed 601/1000 instances...
Completed 602/1000 instances...

Completed 603/1000 instances...
Completed 604/1000 instances...
Completed 605/1000 instances...
Completed 606/1000 instances...
Completed 607/1000 instances...
Completed 608/1000 instances...
Completed 609/1000 instances...
Completed 610/1000 instances...
Completed 611/1000 instances...
Completed 612/1000 instances...
Completed 613/1000 instances...
Completed 614/1000 instances...
Completed 615/1000 instances...
Completed 616/1000 instances...
Completed 617/1000 instances...
Completed 618/1000 instances...
Completed 619/1000 instances...
Completed 620/1000 instances...
Completed 621/1000 instances...
Completed 622/1000 instances...
Completed 623/1000 instances...
Completed 624/1000 instances...
Completed 625/1000 instances...
Completed 626/1000 instances...
Completed 627/1000 instances...
Completed 628/1000 instances...
Completed 629/1000 instances...
Completed 630/1000 instances...
Completed 631/1000 instances...
Completed 632/1000 instances...
Completed 633/1000 instances...
Completed 634/1000 instances...
Completed 635/1000 instances...
Completed 636/1000 instances...
Completed 637/1000 instances...
Completed 638/1000 instances...
Completed 639/1000 instances...
Completed 640/1000 instances...
Completed 641/1000 instances...
Completed 642/1000 instances...
Completed 643/1000 instances...
Completed 644/1000 instances...
Completed 645/1000 instances...
Completed 646/1000 instances...
Completed 647/1000 instances...
Completed 648/1000 instances...
Completed 649/1000 instances...
Completed 650/1000 instances...
Completed 651/1000 instances...

Completed 652/1000 instances...
Completed 653/1000 instances...
Completed 654/1000 instances...
Completed 655/1000 instances...
Completed 656/1000 instances...
Completed 657/1000 instances...
Completed 658/1000 instances...
Completed 659/1000 instances...
Completed 660/1000 instances...
Completed 661/1000 instances...
Completed 662/1000 instances...
Completed 663/1000 instances...
Completed 664/1000 instances...
Completed 665/1000 instances...
Completed 666/1000 instances...
Completed 667/1000 instances...
Completed 668/1000 instances...
Completed 669/1000 instances...
Completed 670/1000 instances...
Completed 671/1000 instances...
Completed 672/1000 instances...
Completed 673/1000 instances...
Completed 674/1000 instances...
Completed 675/1000 instances...
Completed 676/1000 instances...
Completed 677/1000 instances...
Completed 678/1000 instances...
Completed 679/1000 instances...
Completed 680/1000 instances...
Completed 681/1000 instances...
Completed 682/1000 instances...
Completed 683/1000 instances...
Completed 684/1000 instances...
Completed 685/1000 instances...
Completed 686/1000 instances...
Completed 687/1000 instances...
Completed 688/1000 instances...
Completed 689/1000 instances...
Completed 690/1000 instances...
Completed 691/1000 instances...
Completed 692/1000 instances...
Completed 693/1000 instances...
Completed 694/1000 instances...
Completed 695/1000 instances...
Completed 696/1000 instances...
Completed 697/1000 instances...
Completed 698/1000 instances...
Completed 699/1000 instances...
Completed 700/1000 instances...

Completed 701/1000 instances...
Completed 702/1000 instances...
Completed 703/1000 instances...
Completed 704/1000 instances...
Completed 705/1000 instances...
Completed 706/1000 instances...
Completed 707/1000 instances...
Completed 708/1000 instances...
Completed 709/1000 instances...
Completed 710/1000 instances...
Completed 711/1000 instances...
Completed 712/1000 instances...
Completed 713/1000 instances...
Completed 714/1000 instances...
Completed 715/1000 instances...
Completed 716/1000 instances...
Completed 717/1000 instances...
Completed 718/1000 instances...
Completed 719/1000 instances...
Completed 720/1000 instances...
Completed 721/1000 instances...
Completed 722/1000 instances...
Completed 723/1000 instances...
Completed 724/1000 instances...
Completed 725/1000 instances...
Completed 726/1000 instances...
Completed 727/1000 instances...
Completed 728/1000 instances...
Completed 729/1000 instances...
Completed 730/1000 instances...
Completed 731/1000 instances...
Completed 732/1000 instances...
Completed 733/1000 instances...
Completed 734/1000 instances...
Completed 735/1000 instances...
Completed 736/1000 instances...
Completed 737/1000 instances...
Completed 738/1000 instances...
Completed 739/1000 instances...
Completed 740/1000 instances...
Completed 741/1000 instances...
Completed 742/1000 instances...
Completed 743/1000 instances...
Completed 744/1000 instances...
Completed 745/1000 instances...
Completed 746/1000 instances...
Completed 747/1000 instances...
Completed 748/1000 instances...
Completed 749/1000 instances...

Completed 750/1000 instances...
Completed 751/1000 instances...
Completed 752/1000 instances...
Completed 753/1000 instances...
Completed 754/1000 instances...
Completed 755/1000 instances...
Completed 756/1000 instances...
Completed 757/1000 instances...
Completed 758/1000 instances...
Completed 759/1000 instances...
Completed 760/1000 instances...
Completed 761/1000 instances...
Completed 762/1000 instances...
Completed 763/1000 instances...
Completed 764/1000 instances...
Completed 765/1000 instances...
Completed 766/1000 instances...
Completed 767/1000 instances...
Completed 768/1000 instances...
Completed 769/1000 instances...
Completed 770/1000 instances...
Completed 771/1000 instances...
Completed 772/1000 instances...
Completed 773/1000 instances...
Completed 774/1000 instances...
Completed 775/1000 instances...
Completed 776/1000 instances...
Completed 777/1000 instances...
Completed 778/1000 instances...
Completed 779/1000 instances...
Completed 780/1000 instances...
Completed 781/1000 instances...
Completed 782/1000 instances...
Completed 783/1000 instances...
Completed 784/1000 instances...
Completed 785/1000 instances...
Completed 786/1000 instances...
Completed 787/1000 instances...
Completed 788/1000 instances...
Completed 789/1000 instances...
Completed 790/1000 instances...
Completed 791/1000 instances...
Completed 792/1000 instances...
Completed 793/1000 instances...
Completed 794/1000 instances...
Completed 795/1000 instances...
Completed 796/1000 instances...
Completed 797/1000 instances...
Completed 798/1000 instances...

Completed 799/1000 instances...
Completed 800/1000 instances...
Completed 801/1000 instances...
Completed 802/1000 instances...
Completed 803/1000 instances...
Completed 804/1000 instances...
Completed 805/1000 instances...
Completed 806/1000 instances...
Completed 807/1000 instances...
Completed 808/1000 instances...
Completed 809/1000 instances...
Completed 810/1000 instances...
Completed 811/1000 instances...
Completed 812/1000 instances...
Completed 813/1000 instances...
Completed 814/1000 instances...
Completed 815/1000 instances...
Completed 816/1000 instances...
Completed 817/1000 instances...
Completed 818/1000 instances...
Completed 819/1000 instances...
Completed 820/1000 instances...
Completed 821/1000 instances...
Completed 822/1000 instances...
Completed 823/1000 instances...
Completed 824/1000 instances...
Completed 825/1000 instances...
Completed 826/1000 instances...
Completed 827/1000 instances...
Completed 828/1000 instances...
Completed 829/1000 instances...
Completed 830/1000 instances...
Completed 831/1000 instances...
Completed 832/1000 instances...
Completed 833/1000 instances...
Completed 834/1000 instances...
Completed 835/1000 instances...
Completed 836/1000 instances...
Completed 837/1000 instances...
Completed 838/1000 instances...
Completed 839/1000 instances...
Completed 840/1000 instances...
Completed 841/1000 instances...
Completed 842/1000 instances...
Completed 843/1000 instances...
Completed 844/1000 instances...
Completed 845/1000 instances...
Completed 846/1000 instances...
Completed 847/1000 instances...

Completed 848/1000 instances...
Completed 849/1000 instances...
Completed 850/1000 instances...
Completed 851/1000 instances...
Completed 852/1000 instances...
Completed 853/1000 instances...
Completed 854/1000 instances...
Completed 855/1000 instances...
Completed 856/1000 instances...
Completed 857/1000 instances...
Completed 858/1000 instances...
Completed 859/1000 instances...
Completed 860/1000 instances...
Completed 861/1000 instances...
Completed 862/1000 instances...
Completed 863/1000 instances...
Completed 864/1000 instances...
Completed 865/1000 instances...
Completed 866/1000 instances...
Completed 867/1000 instances...
Completed 868/1000 instances...
Completed 869/1000 instances...
Completed 870/1000 instances...
Completed 871/1000 instances...
Completed 872/1000 instances...
Completed 873/1000 instances...
Completed 874/1000 instances...
Completed 875/1000 instances...
Completed 876/1000 instances...
Completed 877/1000 instances...
Completed 878/1000 instances...
Completed 879/1000 instances...
Completed 880/1000 instances...
Completed 881/1000 instances...
Completed 882/1000 instances...
Completed 883/1000 instances...
Completed 884/1000 instances...
Completed 885/1000 instances...
Completed 886/1000 instances...
Completed 887/1000 instances...
Completed 888/1000 instances...
Completed 889/1000 instances...
Completed 890/1000 instances...
Completed 891/1000 instances...
Completed 892/1000 instances...
Completed 893/1000 instances...
Completed 894/1000 instances...
Completed 895/1000 instances...
Completed 896/1000 instances...

Completed 897/1000 instances...
Completed 898/1000 instances...
Completed 899/1000 instances...
Completed 900/1000 instances...
Completed 901/1000 instances...
Completed 902/1000 instances...
Completed 903/1000 instances...
Completed 904/1000 instances...
Completed 905/1000 instances...
Completed 906/1000 instances...
Completed 907/1000 instances...
Completed 908/1000 instances...
Completed 909/1000 instances...
Completed 910/1000 instances...
Completed 911/1000 instances...
Completed 912/1000 instances...
Completed 913/1000 instances...
Completed 914/1000 instances...
Completed 915/1000 instances...
Completed 916/1000 instances...
Completed 917/1000 instances...
Completed 918/1000 instances...
Completed 919/1000 instances...
Completed 920/1000 instances...
Completed 921/1000 instances...
Completed 922/1000 instances...
Completed 923/1000 instances...
Completed 924/1000 instances...
Completed 925/1000 instances...
Completed 926/1000 instances...
Completed 927/1000 instances...
Completed 928/1000 instances...
Completed 929/1000 instances...
Completed 930/1000 instances...
Completed 931/1000 instances...
Completed 932/1000 instances...
Completed 933/1000 instances...
Completed 934/1000 instances...
Completed 935/1000 instances...
Completed 936/1000 instances...
Completed 937/1000 instances...
Completed 938/1000 instances...
Completed 939/1000 instances...
Completed 940/1000 instances...
Completed 941/1000 instances...
Completed 942/1000 instances...
Completed 943/1000 instances...
Completed 944/1000 instances...
Completed 945/1000 instances...

Completed 946/1000 instances...
Completed 947/1000 instances...
Completed 948/1000 instances...
Completed 949/1000 instances...
Completed 950/1000 instances...
Completed 951/1000 instances...
Completed 952/1000 instances...
Completed 953/1000 instances...
Completed 954/1000 instances...
Completed 955/1000 instances...
Completed 956/1000 instances...
Completed 957/1000 instances...
Completed 958/1000 instances...
Completed 959/1000 instances...
Completed 960/1000 instances...
Completed 961/1000 instances...
Completed 962/1000 instances...
Completed 963/1000 instances...
Completed 964/1000 instances...
Completed 965/1000 instances...
Completed 966/1000 instances...
Completed 967/1000 instances...
Completed 968/1000 instances...
Completed 969/1000 instances...
Completed 970/1000 instances...
Completed 971/1000 instances...
Completed 972/1000 instances...
Completed 973/1000 instances...
Completed 974/1000 instances...
Completed 975/1000 instances...
Completed 976/1000 instances...
Completed 977/1000 instances...
Completed 978/1000 instances...
Completed 979/1000 instances...
Completed 980/1000 instances...
Completed 981/1000 instances...
Completed 982/1000 instances...
Completed 983/1000 instances...
Completed 984/1000 instances...
Completed 985/1000 instances...
Completed 986/1000 instances...
Completed 987/1000 instances...
Completed 988/1000 instances...
Completed 989/1000 instances...
Completed 990/1000 instances...
Completed 991/1000 instances...
Completed 992/1000 instances...
Completed 993/1000 instances...
Completed 994/1000 instances...
Completed 995/1000 instances...

```

Completed 996/1000 instances...
Completed 997/1000 instances...
Completed 998/1000 instances...
Completed 999/1000 instances...
Completed 1000/1000 instances...
--- Evaluation Complete ---

```

Steps	Instance	Is_Valid	Success	Score	Optimum	Rel_Error
0	wuf50-0286.mwcnf	True	True	20379	20379	0.0
188352						
1	wuf50-0286.mwcnf	True	True	20379	20379	0.0
176144						
2	wuf50-0286.mwcnf	True	True	20379	20379	0.0
218000						
3	wuf50-0286.mwcnf	True	True	20379	20379	0.0
198816						
4	wuf50-0286.mwcnf	True	True	20379	20379	0.0
212768						
...
...						
99995	wuf50-0277.mwcnf	True	True	19728	19728	0.0
223232						
99996	wuf50-0277.mwcnf	True	True	19728	19728	0.0
218000						
99997	wuf50-0277.mwcnf	True	True	19728	19728	0.0
216256						
99998	wuf50-0277.mwcnf	True	True	19728	19728	0.0
211024						
99999	wuf50-0277.mwcnf	True	True	19728	19728	0.0
221488						

	Time
0	1.148536
1	1.040327
2	1.316045
3	1.202231
4	1.101906
...	...
99995	1.019140
99996	1.039043
99997	1.031183
99998	0.976260
99999	1.035590

[100000 rows x 8 columns]

0.008190077557986793

```

instance_paths = [os.path.join(wuf_50_q_path,x) for x in
os.listdir(wuf_50_q_path)]
solutions = get_solution_dict(os.path.join(wuf_50_path, "wuf50-218-Q-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=100,
    max_workers=11
)
df_results.to_csv("wuf-50-218-Q")
display(df_results)

--- Starting Black Box Evaluation ---
Instances: 1000
Repeats per Instance: 100
Total Runs: 100000
Parallel Workers: 11
Completed 1/1000 instances...
Completed 2/1000 instances...
Completed 3/1000 instances...
Completed 4/1000 instances...
Completed 5/1000 instances...
Completed 6/1000 instances...
Completed 7/1000 instances...
Completed 8/1000 instances...
Completed 9/1000 instances...
Completed 10/1000 instances...
Completed 11/1000 instances...
Completed 12/1000 instances...
Completed 13/1000 instances...

instance_paths = [os.path.join(wuf_75_q_path,x) for x in
os.listdir(wuf_75_q_path)]
solutions = get_solution_dict(os.path.join(wuf_75_path, "wuf75-325-Q-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=50,
    max_workers=11 # Uses all cores automatically
)
df_results.to_csv("wuf-75-325-Q")
display(df_results)

```

```
--- Starting Black Box Evaluation ---
Instances: 100
Repeats per Instance: 50
Total Runs: 5000
Parallel Workers: 11

instance_paths = [os.path.join(wuf_75_m_path,x) for x in
os.listdir(wuf_75_m_path)]
solutions = get_solution_dict(os.path.join(wuf_75_path,"wuf75-325-M-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=50,
    max_workers=11 # Uses all cores automatically
)
df_results.to_csv("wuf-75-325-M")
display(df_results)
print(df_results['Rel_Error'].mean())
print(df_results['Success'].sum())

--- Starting Black Box Evaluation ---
Instances: 100
Repeats per Instance: 20
Total Runs: 2000
Parallel Workers: 12
Completed 1/100 instances...
Completed 2/100 instances...
Completed 3/100 instances...
Completed 4/100 instances...
Completed 5/100 instances...
Completed 6/100 instances...
Completed 7/100 instances...
Completed 8/100 instances...
Completed 9/100 instances...
Completed 10/100 instances...
Completed 11/100 instances...
Completed 12/100 instances...
Completed 13/100 instances...
Completed 14/100 instances...
Completed 15/100 instances...
Completed 16/100 instances...
Completed 17/100 instances...
Completed 18/100 instances...
Completed 19/100 instances...
Completed 20/100 instances...
Completed 21/100 instances...
Completed 22/100 instances...
```

```
Completed 23/100 instances...
Completed 24/100 instances...
Completed 25/100 instances...
Completed 26/100 instances...
Completed 27/100 instances...
Completed 28/100 instances...
Completed 29/100 instances...
Completed 30/100 instances...
Completed 31/100 instances...
Completed 32/100 instances...
Completed 33/100 instances...
Completed 34/100 instances...
Completed 35/100 instances...
Completed 36/100 instances...
Completed 37/100 instances...
Completed 38/100 instances...
Completed 39/100 instances...
Completed 40/100 instances...
Completed 41/100 instances...
Completed 42/100 instances...
Completed 43/100 instances...
Completed 44/100 instances...
Completed 45/100 instances...
Completed 46/100 instances...
Completed 47/100 instances...
Completed 48/100 instances...
Completed 49/100 instances...
Completed 50/100 instances...
Completed 51/100 instances...
Completed 52/100 instances...
Completed 53/100 instances...
Completed 54/100 instances...
Completed 55/100 instances...
Completed 56/100 instances...
Completed 57/100 instances...
Completed 58/100 instances...
Completed 59/100 instances...
Completed 60/100 instances...
Completed 61/100 instances...
Completed 62/100 instances...
Completed 63/100 instances...
Completed 64/100 instances...
Completed 65/100 instances...
Completed 66/100 instances...
Completed 67/100 instances...
Completed 68/100 instances...
Completed 69/100 instances...
Completed 70/100 instances...
Completed 71/100 instances...
```

```

Completed 72/100 instances...
Completed 73/100 instances...
Completed 74/100 instances...
Completed 75/100 instances...
Completed 76/100 instances...
Completed 77/100 instances...
Completed 78/100 instances...
Completed 79/100 instances...
Completed 80/100 instances...
Completed 81/100 instances...
Completed 82/100 instances...
Completed 83/100 instances...
Completed 84/100 instances...
Completed 85/100 instances...
Completed 86/100 instances...
Completed 87/100 instances...
Completed 88/100 instances...
Completed 89/100 instances...
Completed 90/100 instances...
Completed 91/100 instances...
Completed 92/100 instances...
Completed 93/100 instances...
Completed 94/100 instances...
Completed 95/100 instances...
Completed 96/100 instances...
Completed 97/100 instances...
Completed 98/100 instances...
Completed 99/100 instances...
Completed 100/100 instances...
--- Evaluation Complete ---

```

	Instance	Success	Score	Optimum	Rel_Error	Steps
Time						
0	wuf75-03.mwcnf	True	24453	24453	0.000000	214800
1.326056						
1	wuf75-03.mwcnf	True	24453	24453	0.000000	216600
1.320075						
2	wuf75-03.mwcnf	True	24453	24453	0.000000	223800
1.366110						
3	wuf75-03.mwcnf	True	24453	24453	0.000000	214500
1.289507						
4	wuf75-03.mwcnf	True	24453	24453	0.000000	212100
1.315245						
...
...						
1995	wuf75-010.mwcnf	True	18638	18638	0.000000	267900
1.247617						
1996	wuf75-010.mwcnf	False	18622	18638	0.000858	248700
1.151293						
1997	wuf75-010.mwcnf	False	18636	18638	0.000107	228900

```

1.036679
1998  wuf75-010.mwcnf      True  18638    18638  0.000000  262500
1.190311
1999  wuf75-010.mwcnf      False  18622    18638  0.000858  242400
1.080864

[2000 rows x 7 columns]

0.015575153704304606
1527

instance_paths = [os.path.join(wuf_75_r_path,x) for x in
os.listdir(wuf_75_r_path)]
solutions = get_solution_dict(os.path.join(wuf_75_path,"wuf75-325-R-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=50,
    max_workers=11 # Uses all cores automatically
)
df_results.to_csv("wuf-75-325-R")
display(df_results)
print(df_results['Rel_Error'].mean())
print(df_results['Success'].sum())
print(df_results["Is_Valid"].sum())

instance_paths = [os.path.join(wuf_75_n_path,x) for x in
os.listdir(wuf_75_n_path)]
solutions = get_solution_dict(os.path.join(wuf_75_path,"wuf75-325-N-
opt.dat"))

df_results = run_blackbox_parallel(
    instance_paths=instance_paths,
    solutions_dict=solutions,
    params=FINAL_CONFIG,
    n_repeats=50,
    max_workers=11 # Uses all cores automatically
)
df_results.to_csv("wuf-75-325-N")
display(df_results)

```