Deg	1	2	4	6	8
PF (lr)	1.	0.05	0.05	1.	0.05
SPO (lr)	0.01	0.05	0.1	1.	1.
DBB (lr, λ)	(0.1, 10.)	(0.1,1.)	(0.05, 1.)	(0.05, 0.1)	(0.1, 0.1)
I-MLE (lr, λ, ϵ, κ)	(0.5, 100, 1, 5)	(0.5, 100, 0.1, 5)	(0.5, 100.,2.,5)	(0.5, 10., 0.5, 5)	(0.5, 100., 2., 5)
FY (lr, ϵ)	(1., 5)	(0.1, 0.1)	(0.1, 0.1)	(0.05, 5.)	(0.1, 5.)
HSD (lr, μ, damping)	(0.1, 0.001, 1.0)	(0.1, 0.1, 0.01)	(0.1, 10^{-6}, 0.1)	(0.1, 0.001, 10^{-6})	(0.1, 10., 1.)
QPTL (lr, μ)	(0.1, 10.)	(0.5, 10.)	(0.1, 1.)	(0.1, 10.)	(0.1, 10.)
Listwise (lr, τ)	(0.1, 0.1)	(0.1, 0.1)	(1., 0.1)	(0.1, 1.)	(1., 1.)
Pairwise (lr, Θ)	(1., 1.)	(0.1, 0.5)	(0.1, 1.)	(1., 10.)	(1., 10.)
Pairwise(diff) (lr)	0.1	0.1	0.5	0.1	1.
MAP (lr)	0.1	0.1	1.	1.	1.

Table 1: Optimal Hyperparameter Combination for the shortest path problems on a 5×5 grid.

Reference Table of Hyperparameter Configurations

Table 1, Table 2, Table 3, Table 4, Table 5, Table 6 present the hyperaprameter combinations for the instances of the shortest path problem on the grid, portfolio optimization problem, Warcraft shortest path problem, energy-cost aware scheduling, knapsack problem and diverse bipartite matching problem respectively.

Deg	1	4	8	16
PF (lr)	0.01	0.05	0.1	0.05
SPO (lr)	0.5	1.	0.5	0.5
DBB (lr, λ)	(1., 0.1)	(1., 0.1)	(1., 0.1)	(1., 0.1)
I-MLE (lr, λ, ϵ, κ)	(0.5, 0.1, 0.1, 5)	(0.5, 0.1, 0.5, 5)	(0.5, 0.1, 0.05,5)	(0.5, 0.1, 0.05,5)
FY (lr, ϵ)	(0.1, 0.01)	(0.5, 0.01)	(1, 0.01)	(1., 2.)
QPTL (lr, μ)	(0.1, 10.)	(0.05, 10.)	(0.1, 10.)	(0.05, 10.)
Listwise (lr, τ)	(0.1, 0.01)	(0.1, 0.01)	(0.1, 0.01)	(0.05, 0.005)
Pairwise (lr, Θ)	(0.01, 0.01)	(0.01, 0.1)	(0.01, 0.01)	(0.1, 0.05)
Pairwise(diff) (lr)	0.1	0.1	0.1	0.05
MAP (lr)	0.01	1.	0.05	1.

Table 2: Optimal Hyperparameter Combination for the portfolio optimization problem instances.

Image Size	30	24	18	12
PF (lr)	0.01	0.001	0.0005	0.001
SPO (lr)	0.0005	0.005	0.01	0.005
DBB (lr, λ)	(0.005, 10.)	(0.001, 100.)	(0.001, 10.)	(0.001, 10.)
I-MLE (lr, λ, ϵ, κ)	(.001, 100, 0.05, 50)	(0.001, 10., 0.05, 50)	(0.01, 10., 0.05, 5)	(0.001, 10., 0.05, 50)
FY (lr, ϵ)	(0.001, 0.01)	(0.01, 0.01)	(0.01, 0.01)	(0.01, 0.01)
Listwise (lr, τ)	(0.005, 1.)	(0.005, 0.5)	(0.005, 0.05)	(0.005, 0.5)
Pairwise (lr, Θ)	(0.01, 0.1)	(0.01 ,0.1)	(0.005, 0.1)	(0.01, 0.1)
Pairwise(diff) (lr)	0.005	0.005	0.005	0.005
MAP (lr)	0.01	0.005	0.005	0.005

Table 3: Optimal Hyperparameter Combination for the Warcraft shortest path problem instances.

Instance	1	2	3
PF (lr)	0.5	0.5	0.5
SPO (lr)	1.	0.5	0.5
DBB (lr, λ)	(0.01, 0.1)	(0.5, 1.)	(0.5, 1.)
I-MLE (lr, λ, ϵ, κ)	(0.5, 1., 2., 5)	(0.5, 1., 1., 5)	(0.5, 1., 1., 5)
FY (lr, ϵ)	(0.01, 0.1)	(0.5, 5)	(0.01, 0.1)
HSD (lr, μ, damping)	(0.1, 0.1, 10^{-6})	(0.1, 0.001, 10^{-6})	(0.1, 0.1, 0.1)
QPTL (lr, μ)	(0.1, 1.)	(0.1, 1.)	(0.1, 1.)
Listwise (lr, τ)	(0.1, 5.)	(0.1, 5.)	(0.1, 5.)
Pairwise (lr, Θ)	(0.1, 1.)	(0.1, 5.)	(0.1, 50.)
Pairwise(diff) (lr)	0.5	0.5	0.1
MAP (lr)	0.5	0.5	0.5

Table 4: Optimal Hyperparameter Combination for the energy-cost aware scheduling problem instances.

Capacity	60	120	180
PF (lr)	0.5	1.	1.
SPO (lr)	0.5	1.	1.
DBB (lr, λ)	(0.5, 0.1)	(1., 1.)	(0.5, 1.)
I-MLE (lr, λ, ϵ, κ)	(0.5, 0.1, 0.5, 5)	(0.5, 0.1, 0.1, 5)	(0.5, 0.1, 5., 5)
FY (lr, ϵ)	(1., 0.005)	(1., 0.5)	(0.5, 0.5)
HSD (lr, μ, damping)	(0.5, 0.01, 10.)	(0.5, 0.1, 10.)	(1., 0.01, 0.1)
QPTL (lr, μ)	(0.5, 10.)	(0.5, 1.)	(0.5, 0.1)
Listwise (lr, τ)	(1., 0.001)	(1., 0.001)	(0.5, 0.0001)
Pairwise (lr, Θ)	(0.5, 10.)	(0.5, 10.)	(0.5, 10.)
Pairwise(diff) (lr)	1.	1.	1.
MAP (lr)	1.	1.	1.

Table 5: Optimal Hyperparameter Combination for the knapsack problem instances.

(ρ_1, ρ_2)	(10%, 10%)	(25%, 25%)	(50%, 50%)
PF (lr)	0.01	0.01	0.0005
SPO (lr)	0.001	0.001	0.005
DBB (lr, λ)	(0.01, 10.)	(0.01, 0.1)	(0.01, 1.)
I-MLE (lr, λ, ϵ, κ)	(0.001, 100, 0.5, 5)	(0.001, 100., 0.5, 5)	(0.001, 100., 0.5, 5)
FY (lr, ϵ)	(0.001, 0.5)	(0.001, 0.01)	(0.001, 5.)
HSD (lr, μ, damping)	(0.001, 1., 0.1)	(0.05, 0.1, 10.)	(0.001, 0.1, 0.1)
QPTL (lr, μ)	(0.01, 100.)	(0.001. 10.)	(0.001, 10.)
Listwise (lr, τ)	(0.001, 5.)	(0.01, 5.)	(0.01, 5.)
Pairwise (lr, Θ)	(0.005, 5)	(0.01, 50.)	(0.01, 50.)
Pairwise(diff) (lr)	0.001	0.01	0.005
MAP (lr)	0.001	0.01	0.005

Table 6: Optimal Hyperparameter Combination for the diverse bipartite matching problem instances.