

HNCO

Visualization of Walsh transforms of various functions defined on bit vectors

July 16, 2018

Abstract

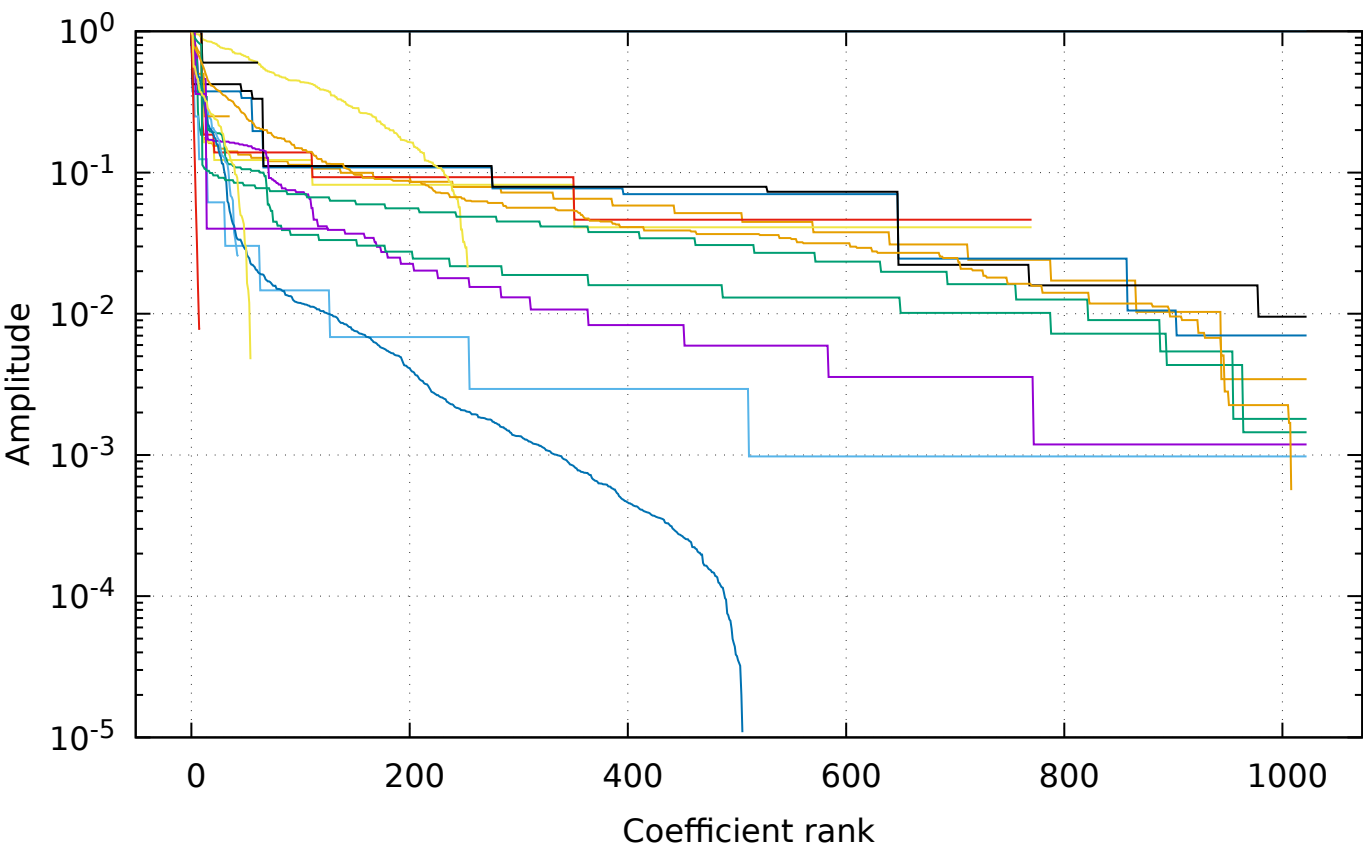
This document proposes to visualize Walsh (or Fourier) transforms of various functions defined on bit vectors (hypercube) of size $n = 10$. For each function, two graphics are displayed. In the first one, coefficients of the Walsh transform are sorted in decreasing order of amplitude and normalized relatively to the largest amplitude. The second graphics displays the energy (sum of square of coefficients) as a function of the Hamming weight of features. This can be thought of as a spectrum. Coefficients c such that $0 < |c/c_{\max}| < 10^{-15}$ have been filtered out as they mostly result from accumulated errors in floating point arithmetic.

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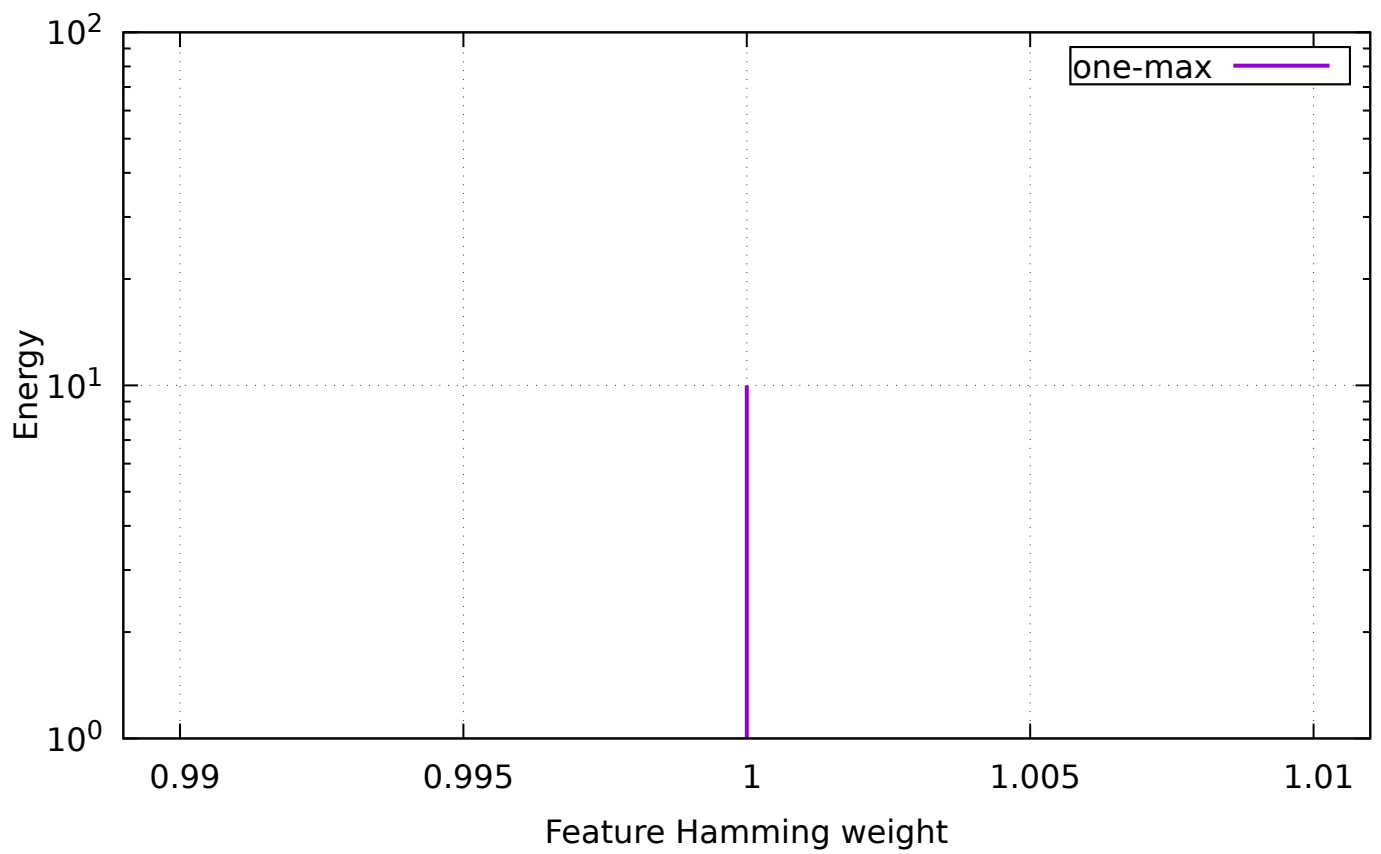
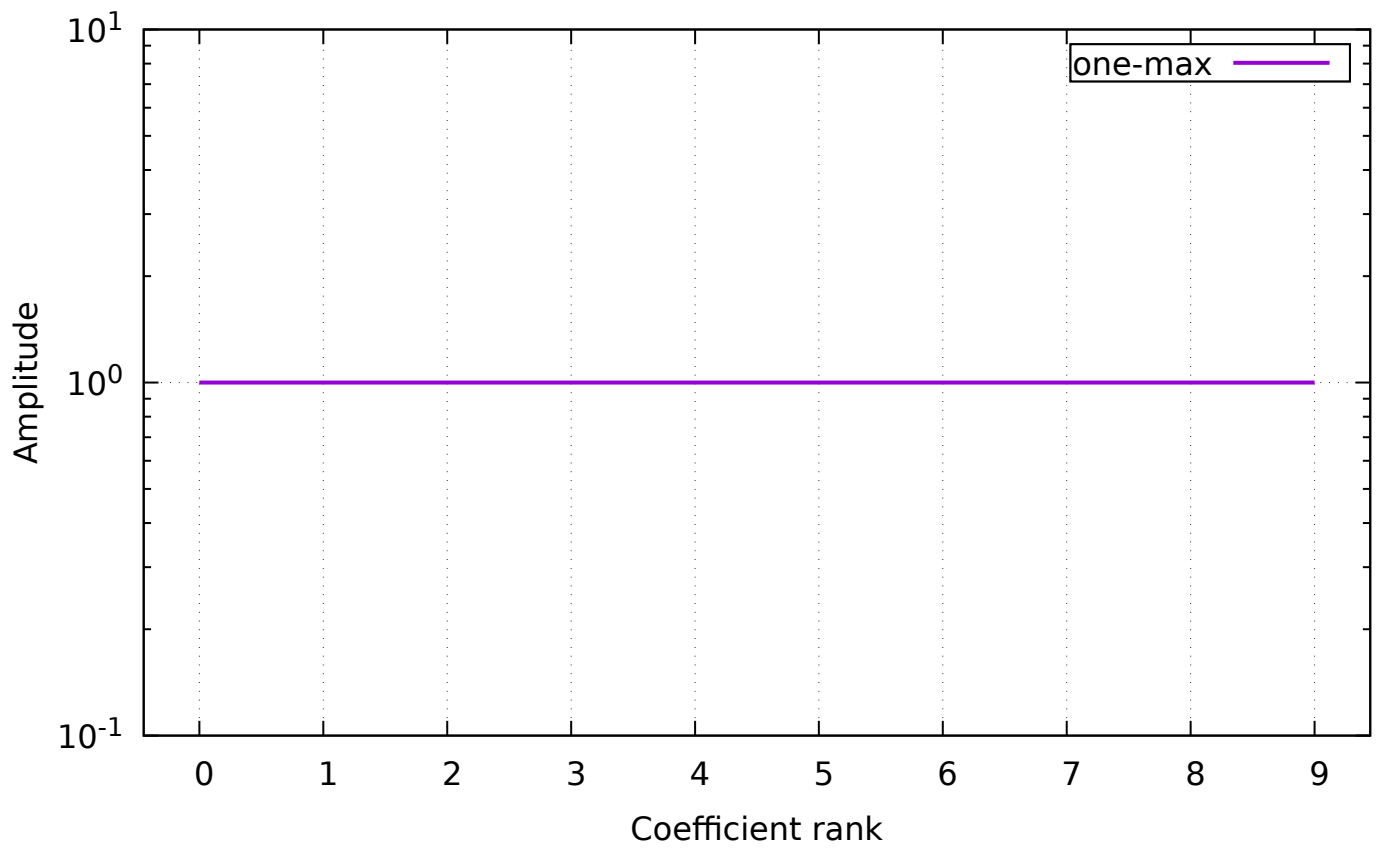
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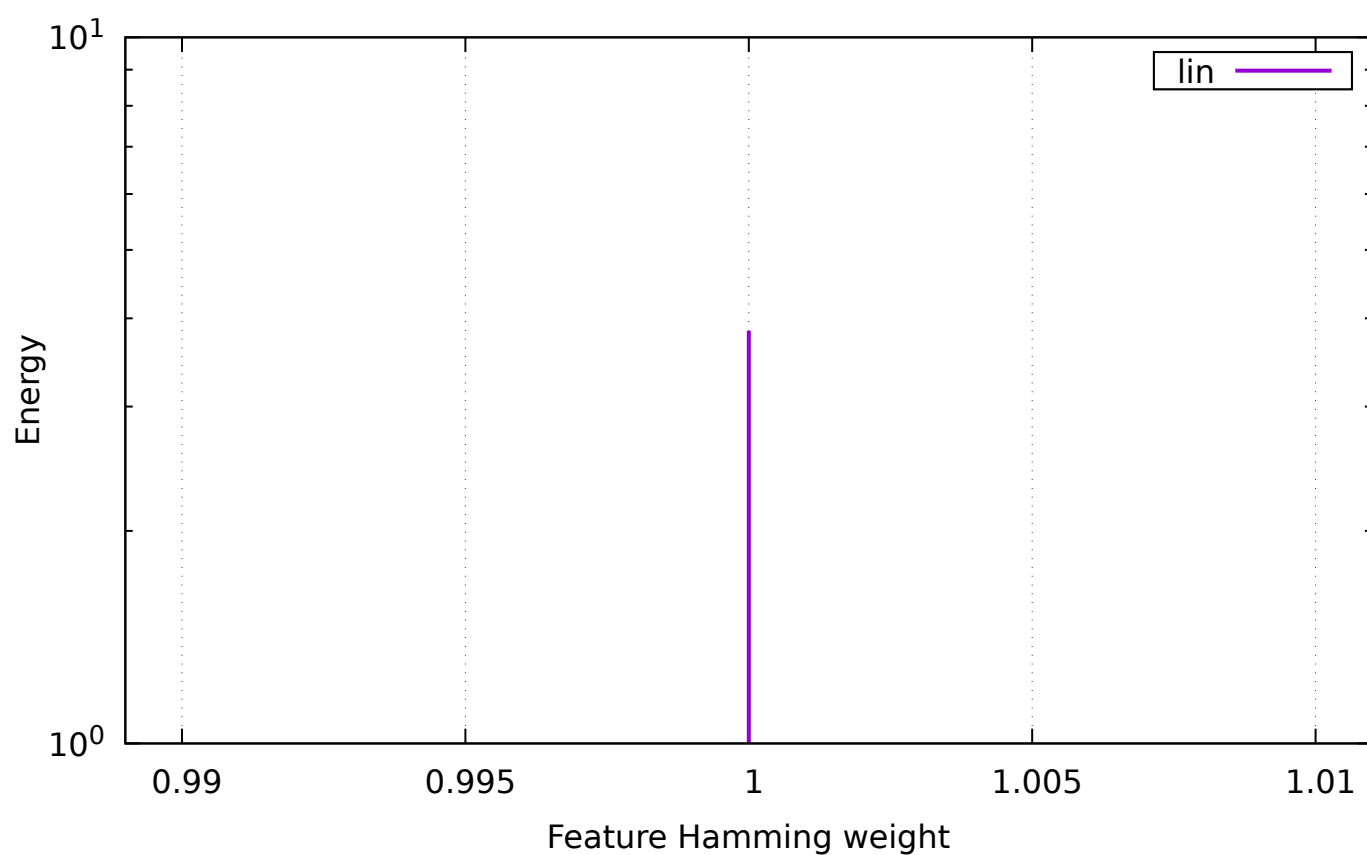
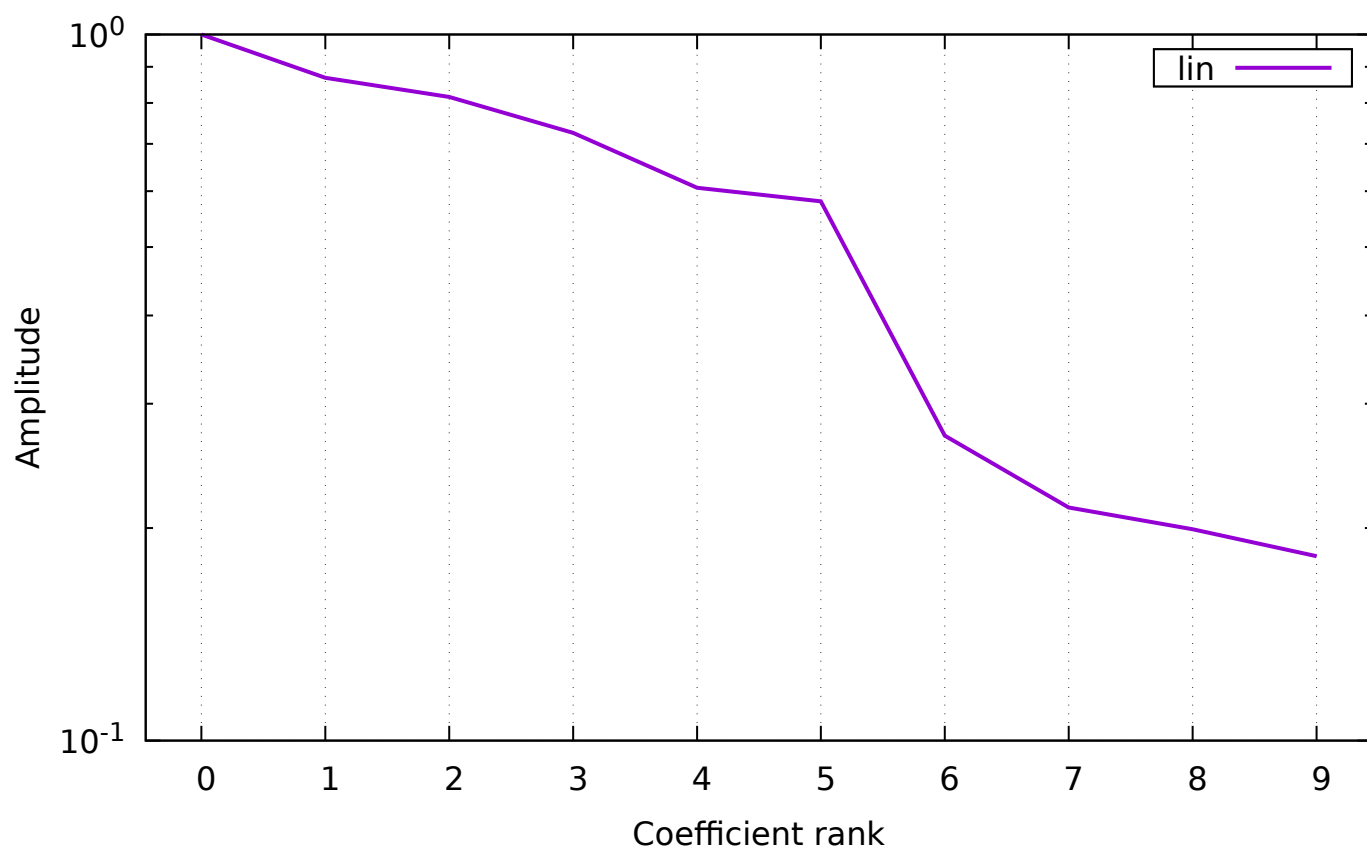
1 All functions



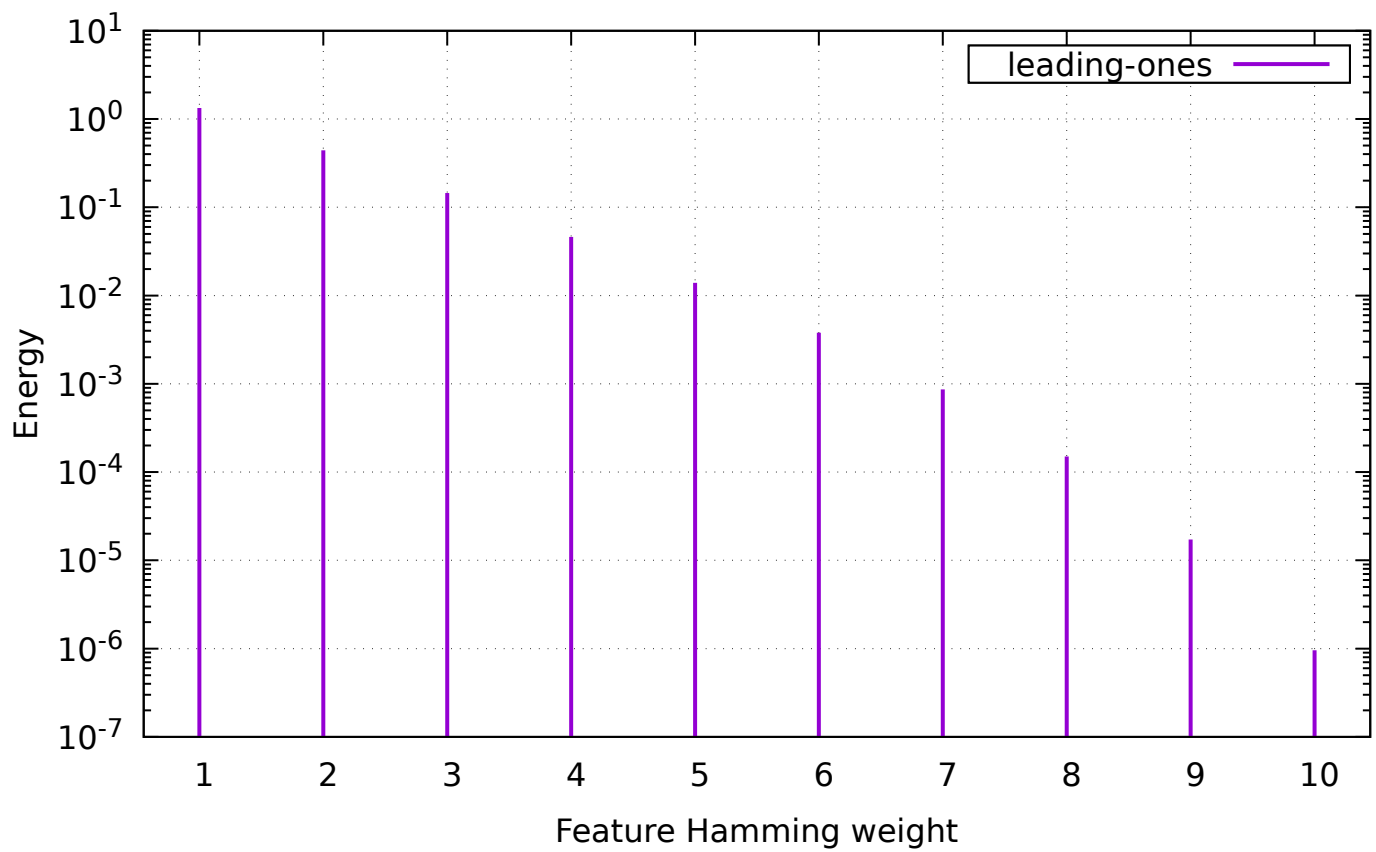
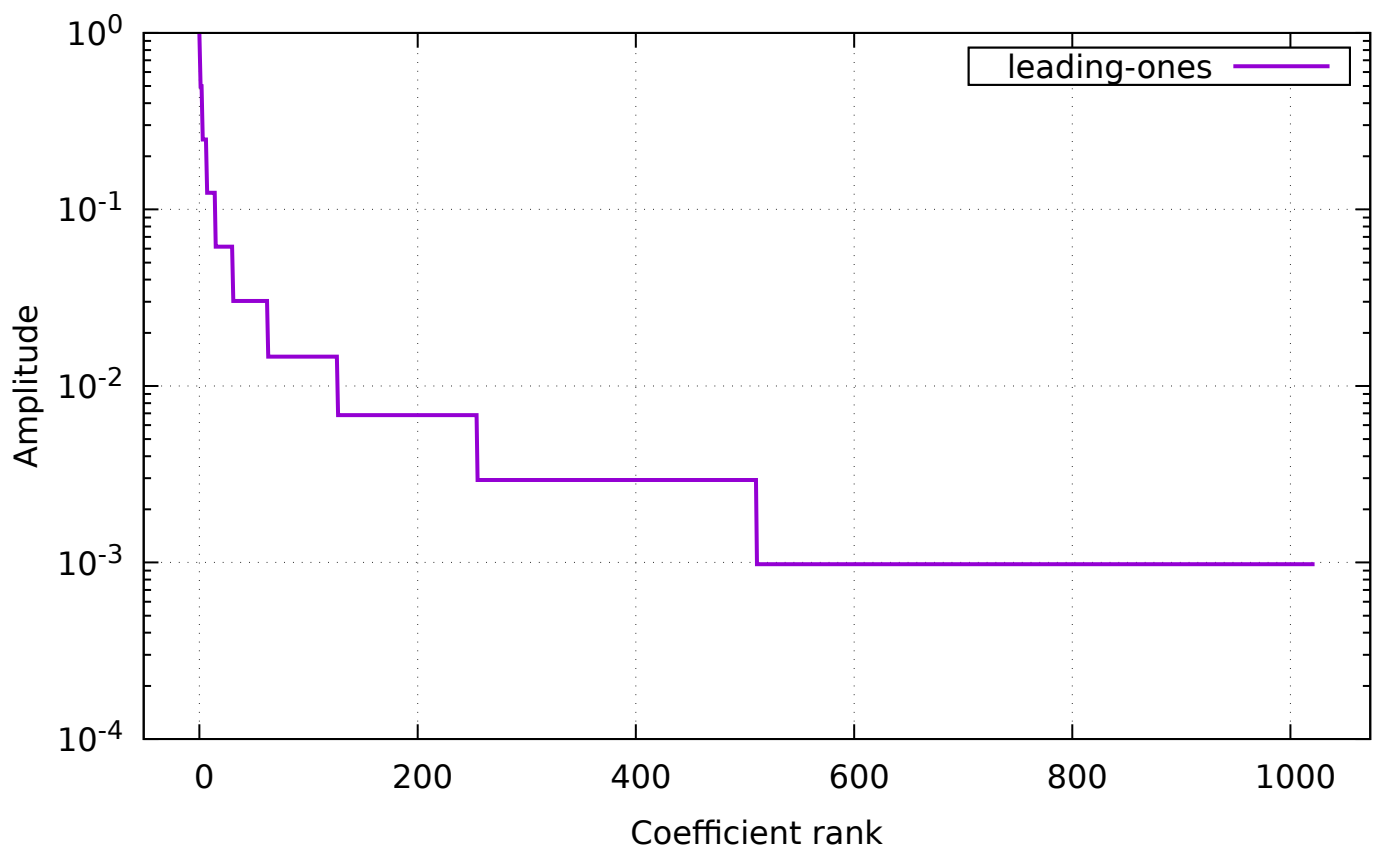
2 one-max



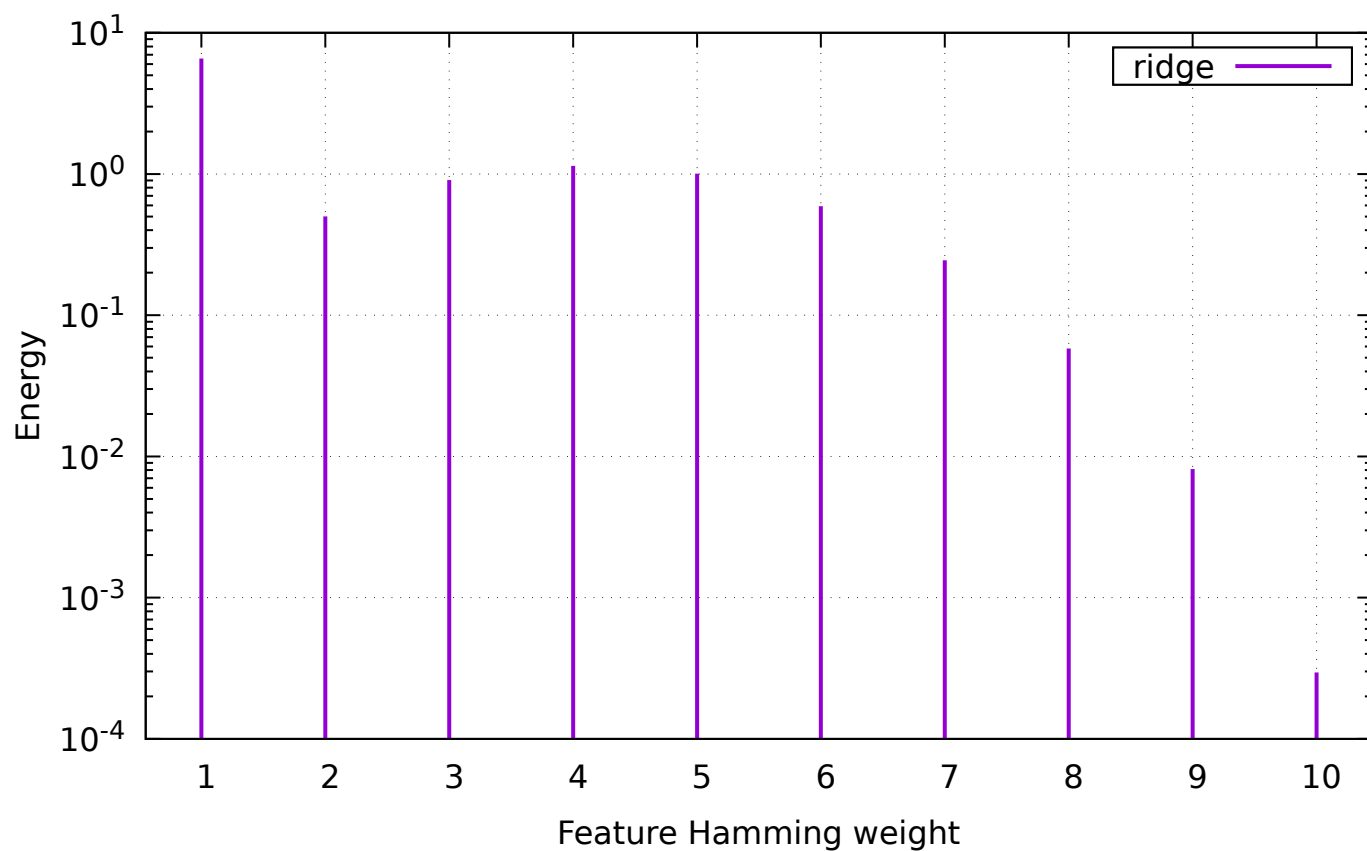
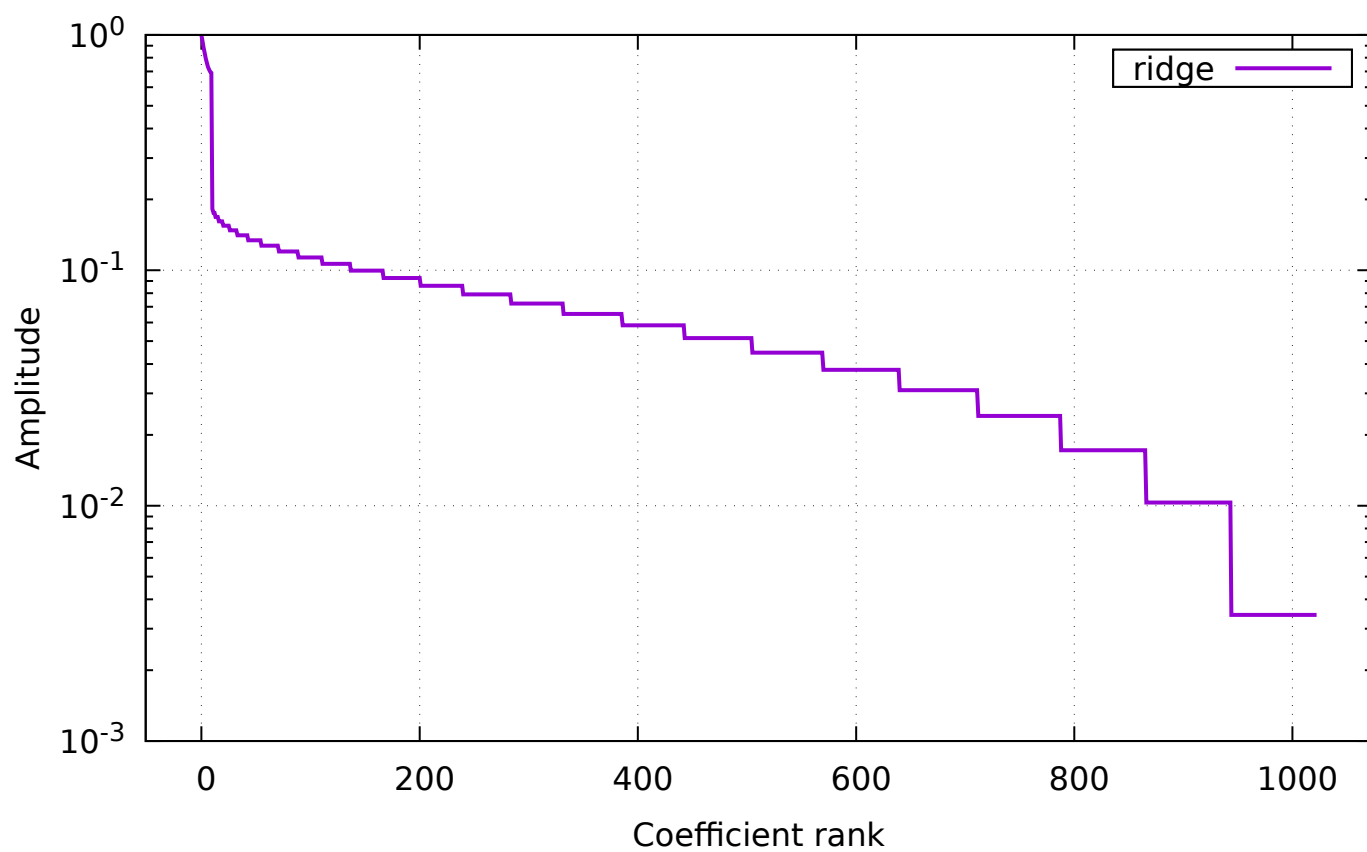
3 lin



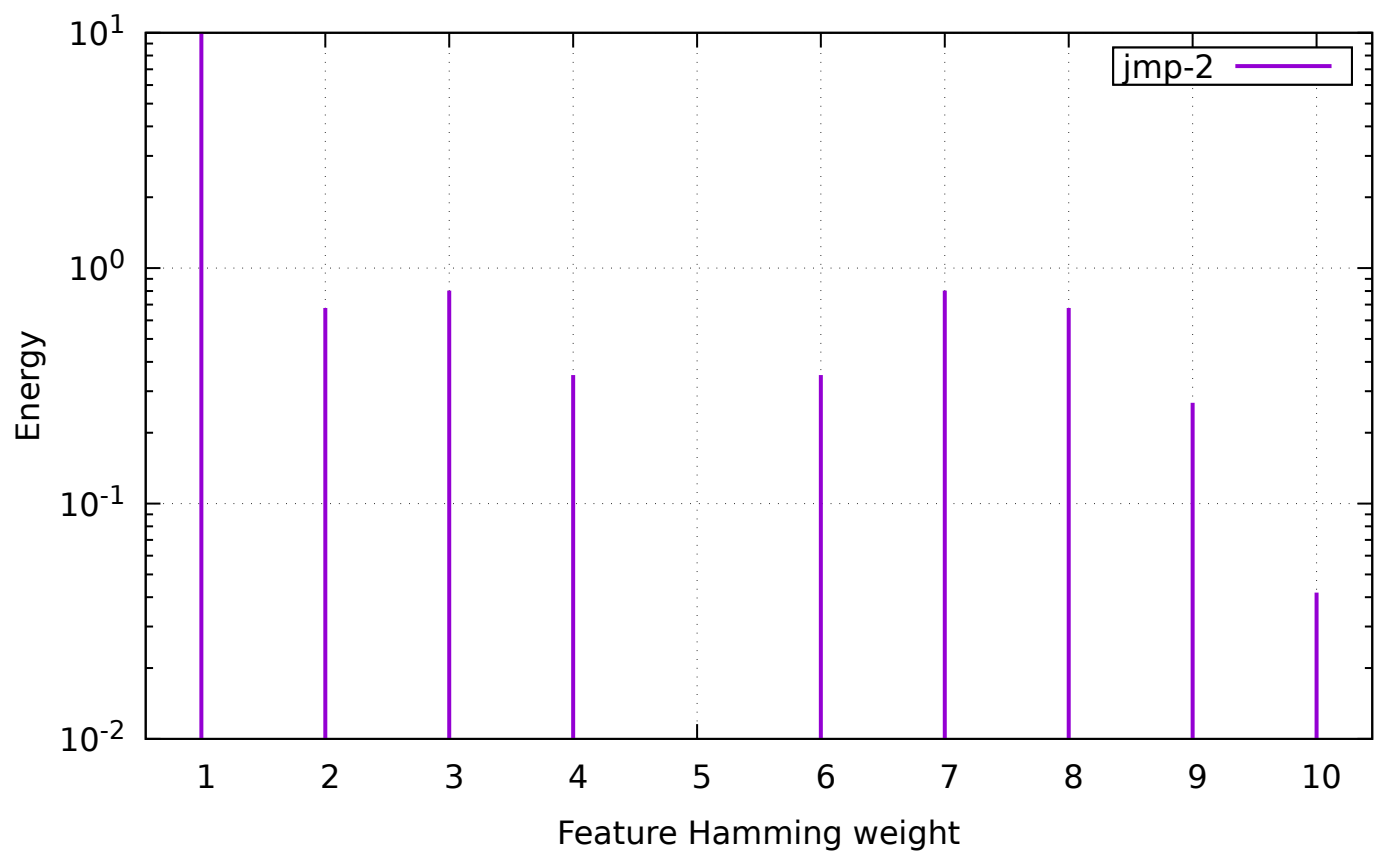
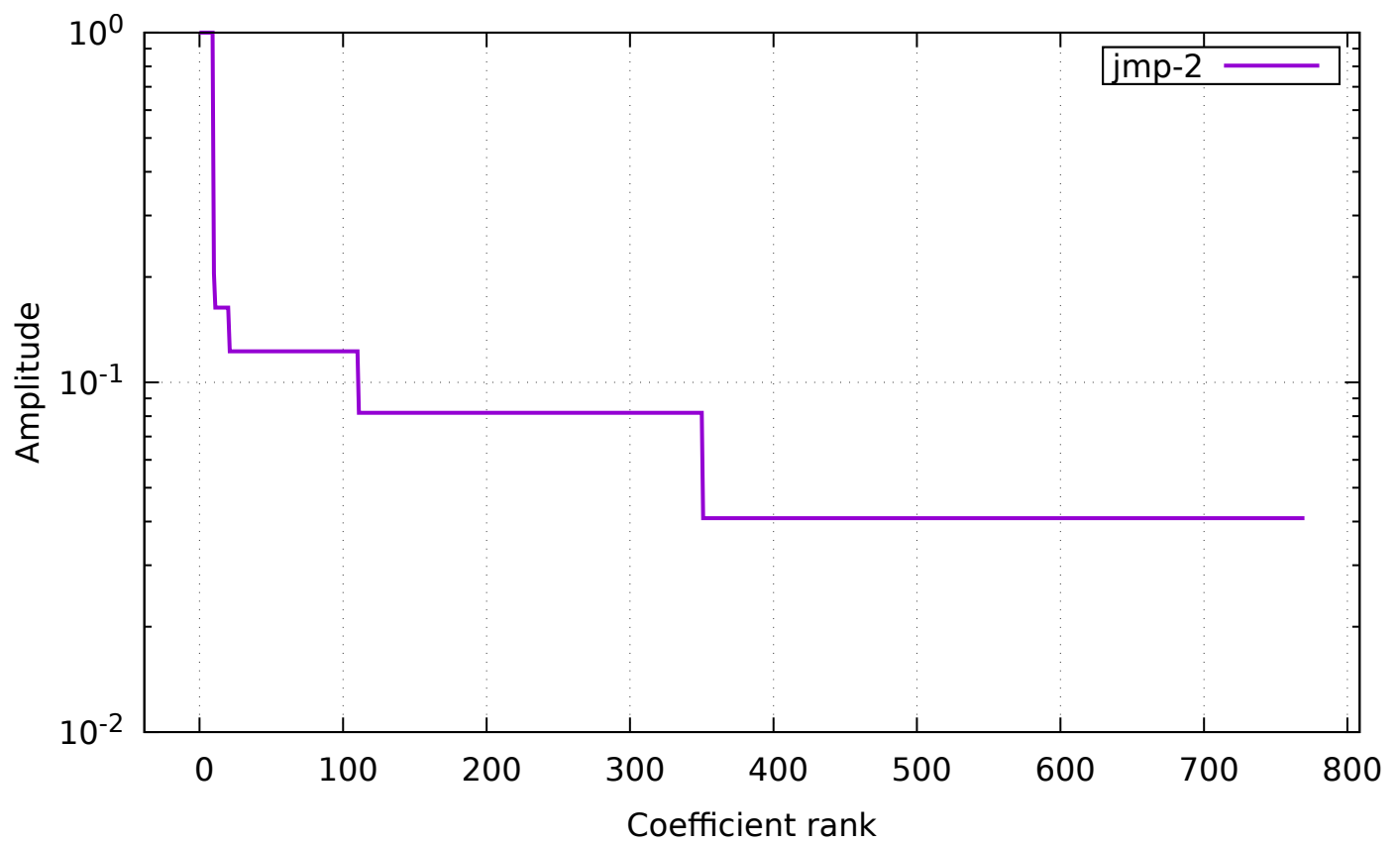
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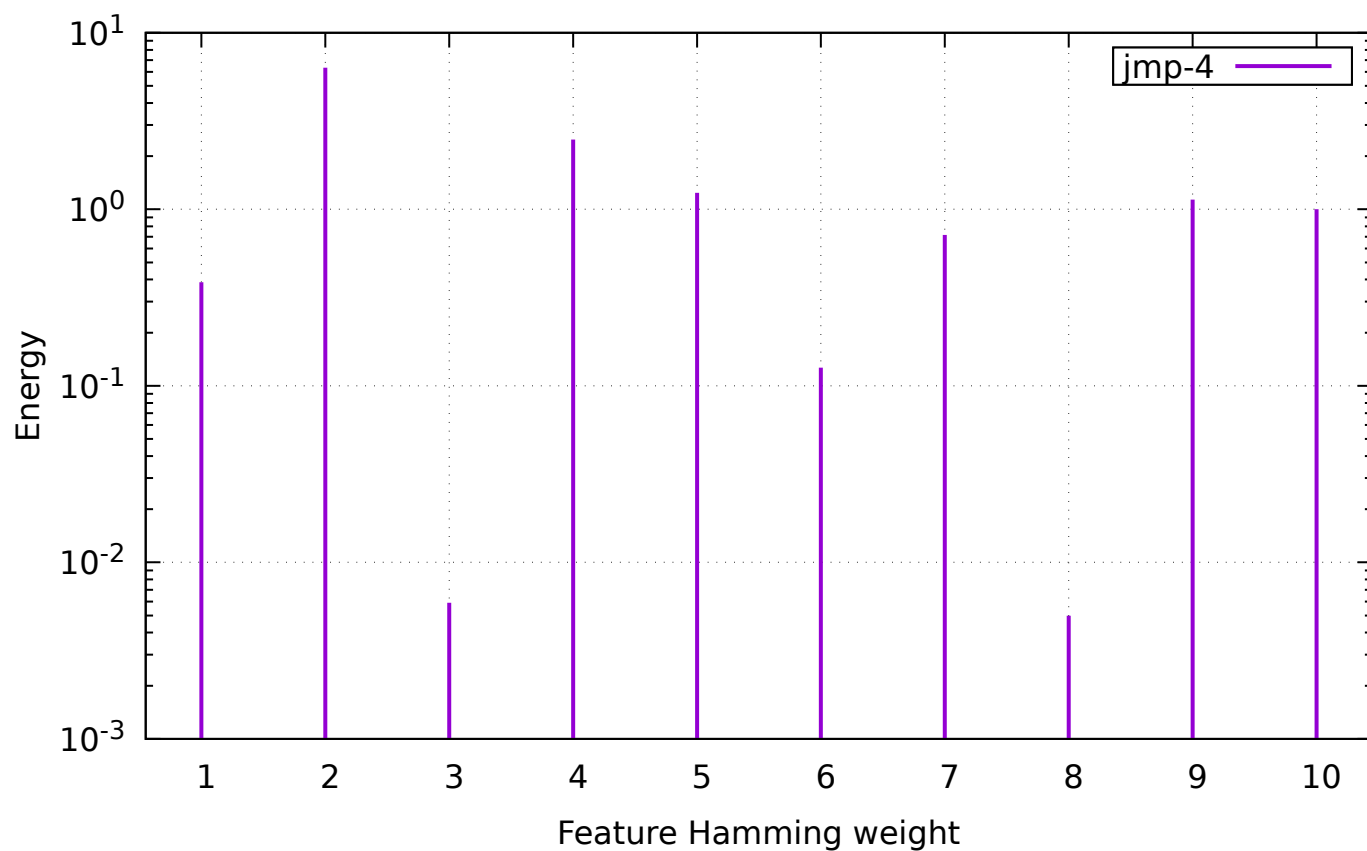
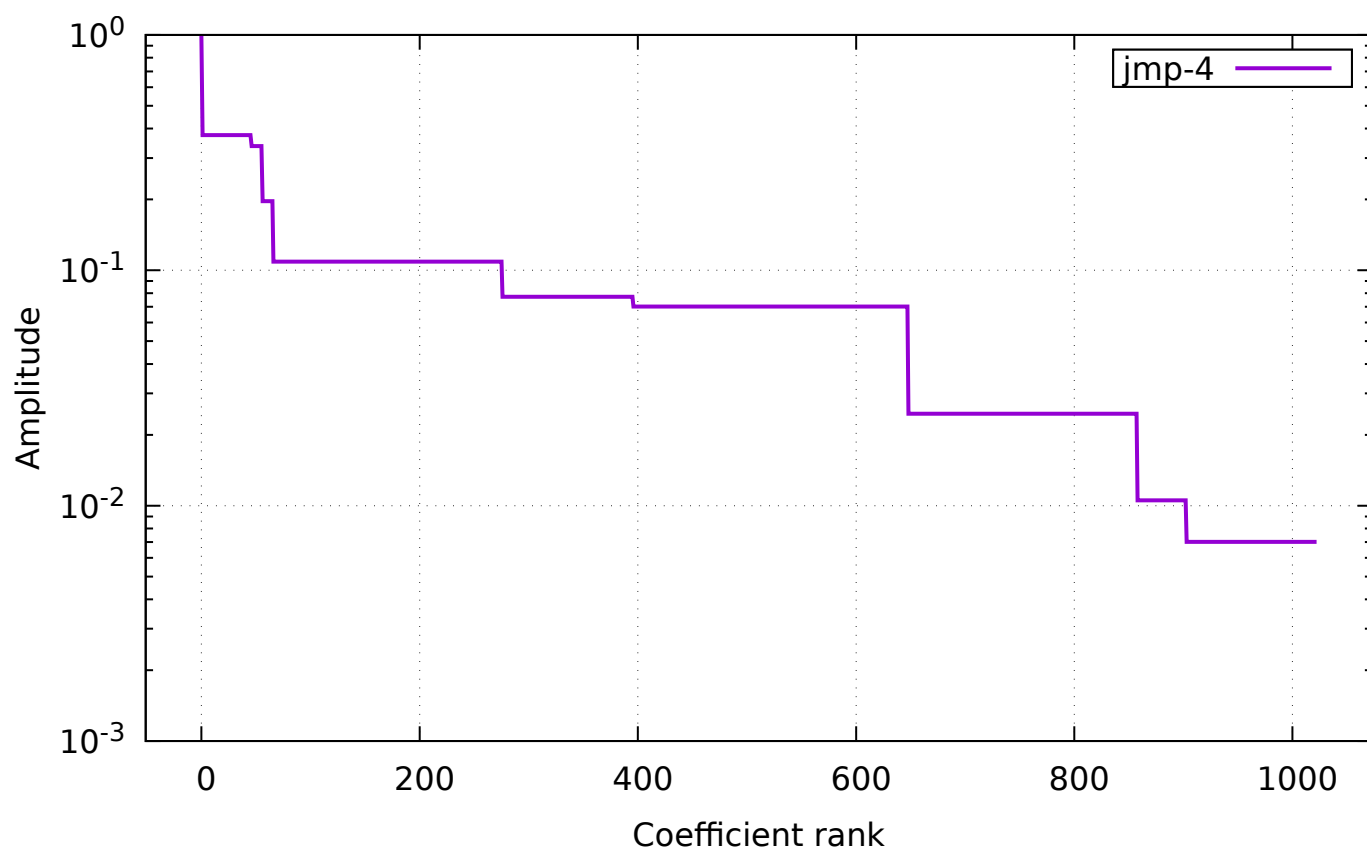
5 ridge



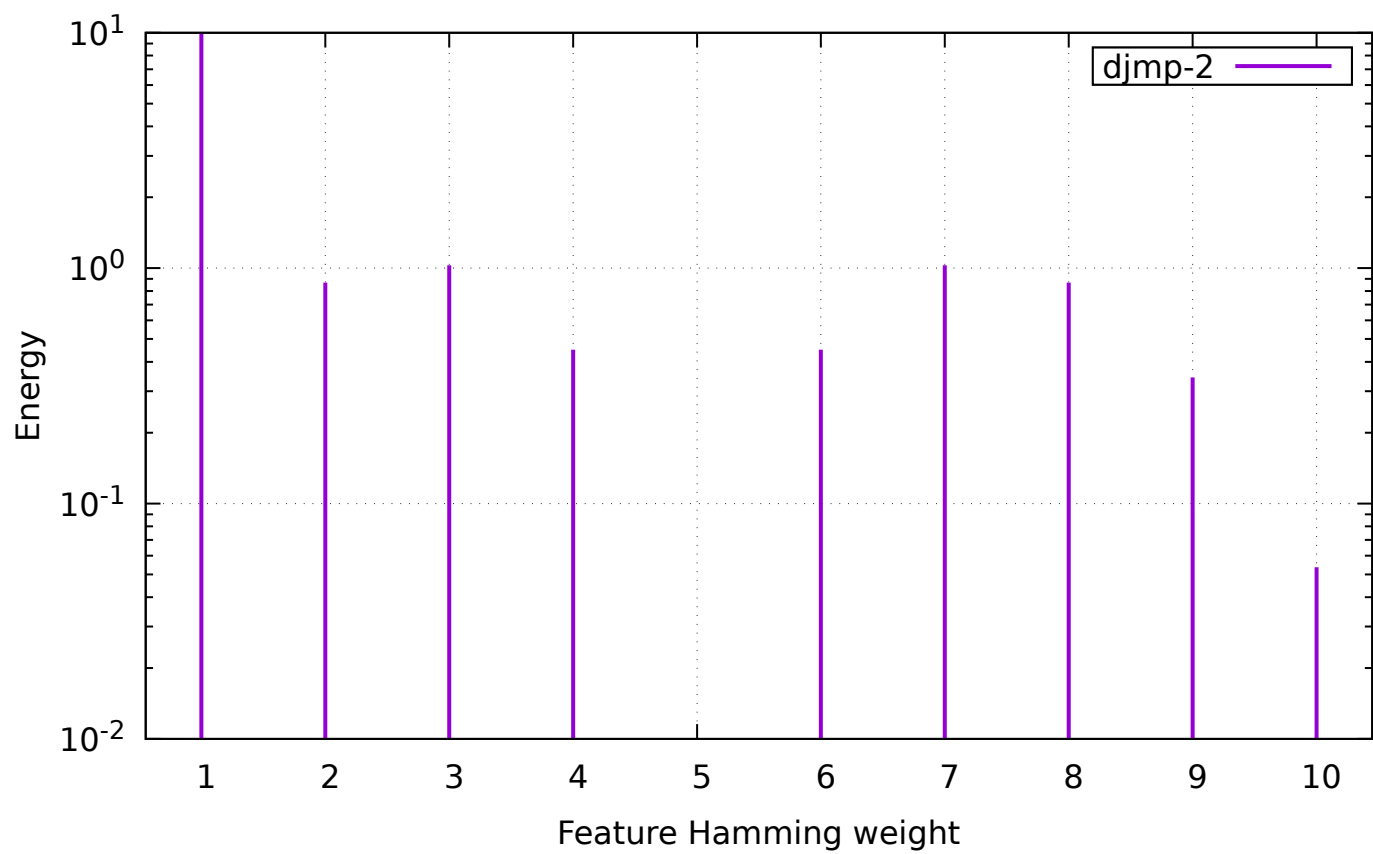
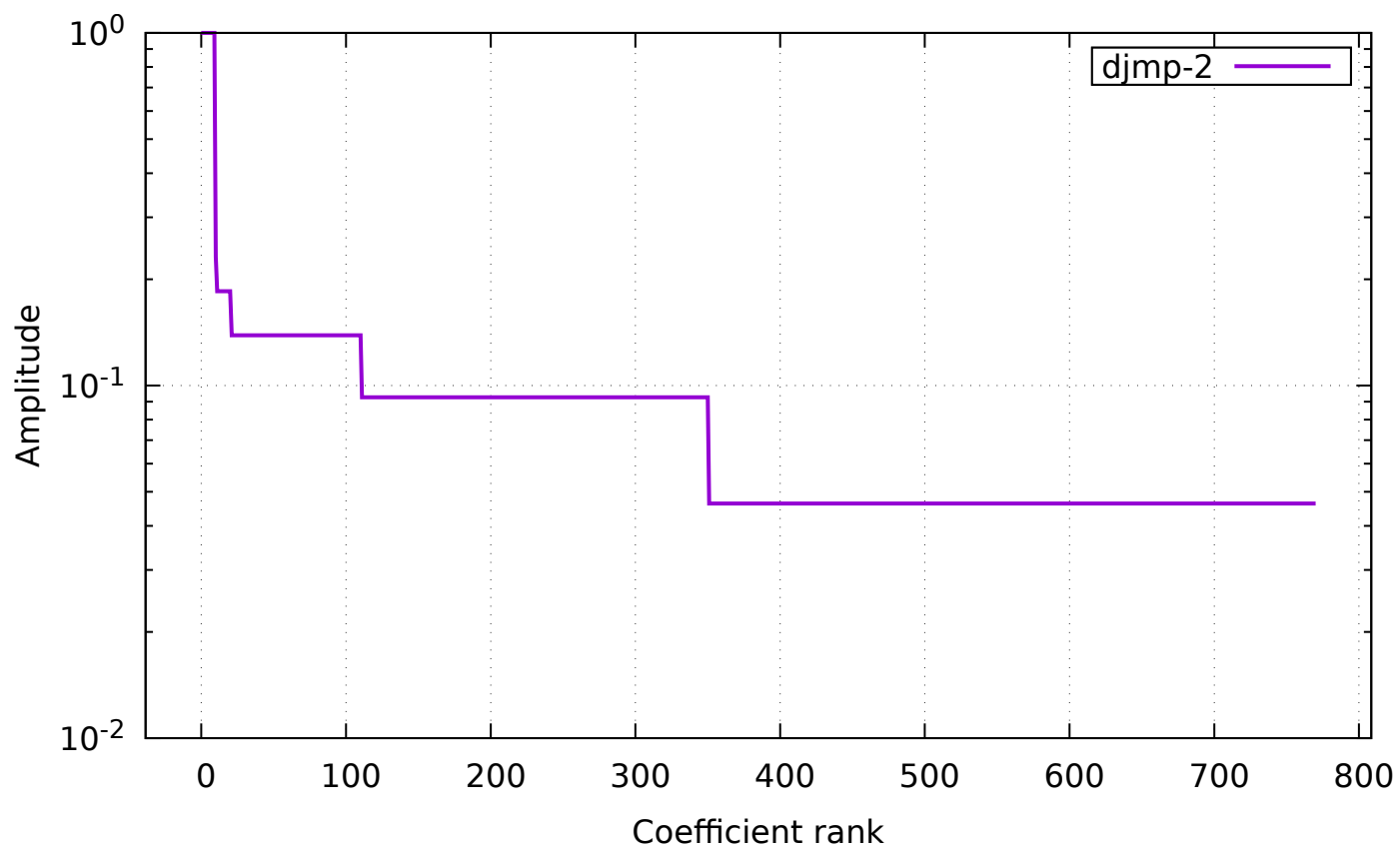
6 jmp-2



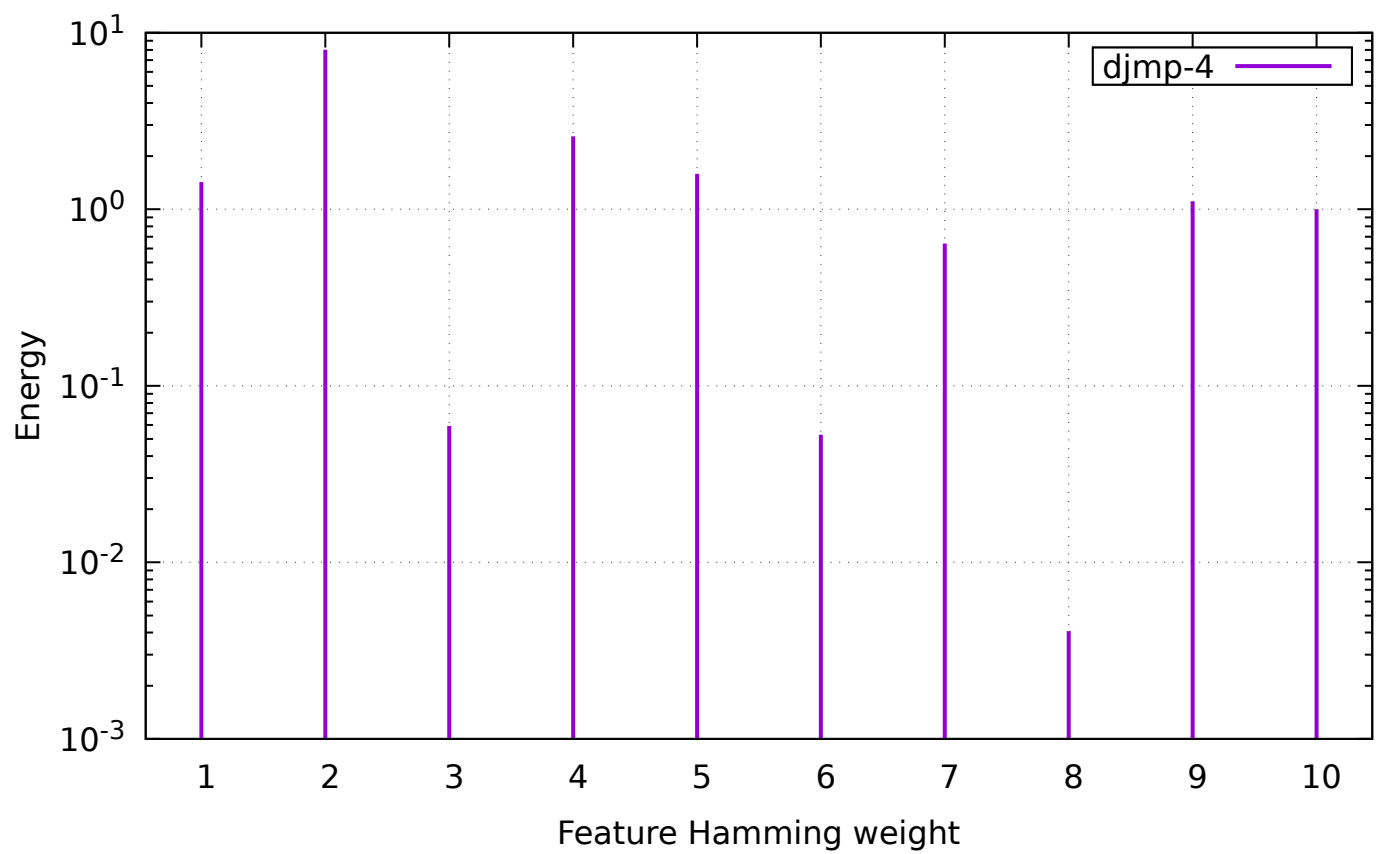
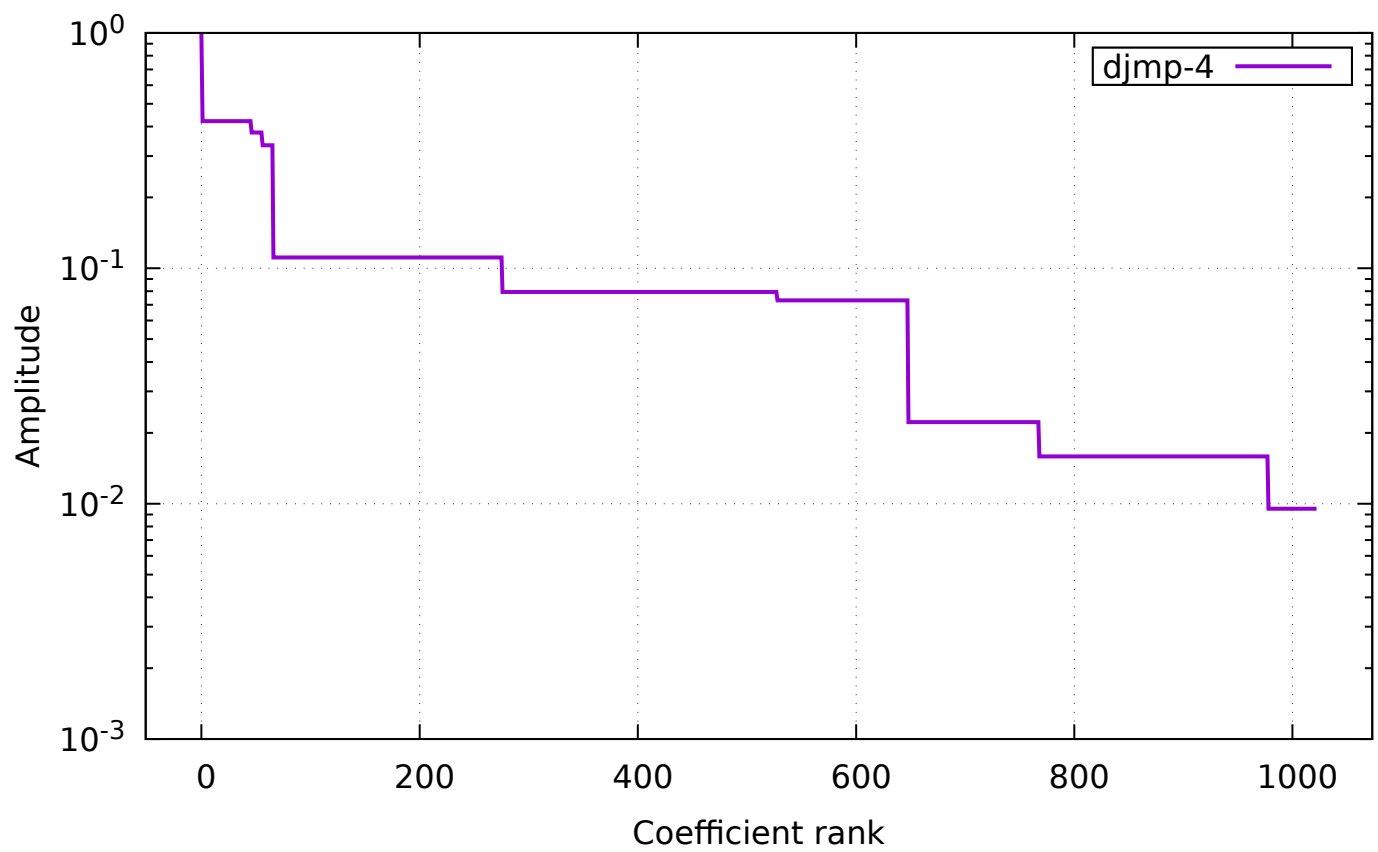
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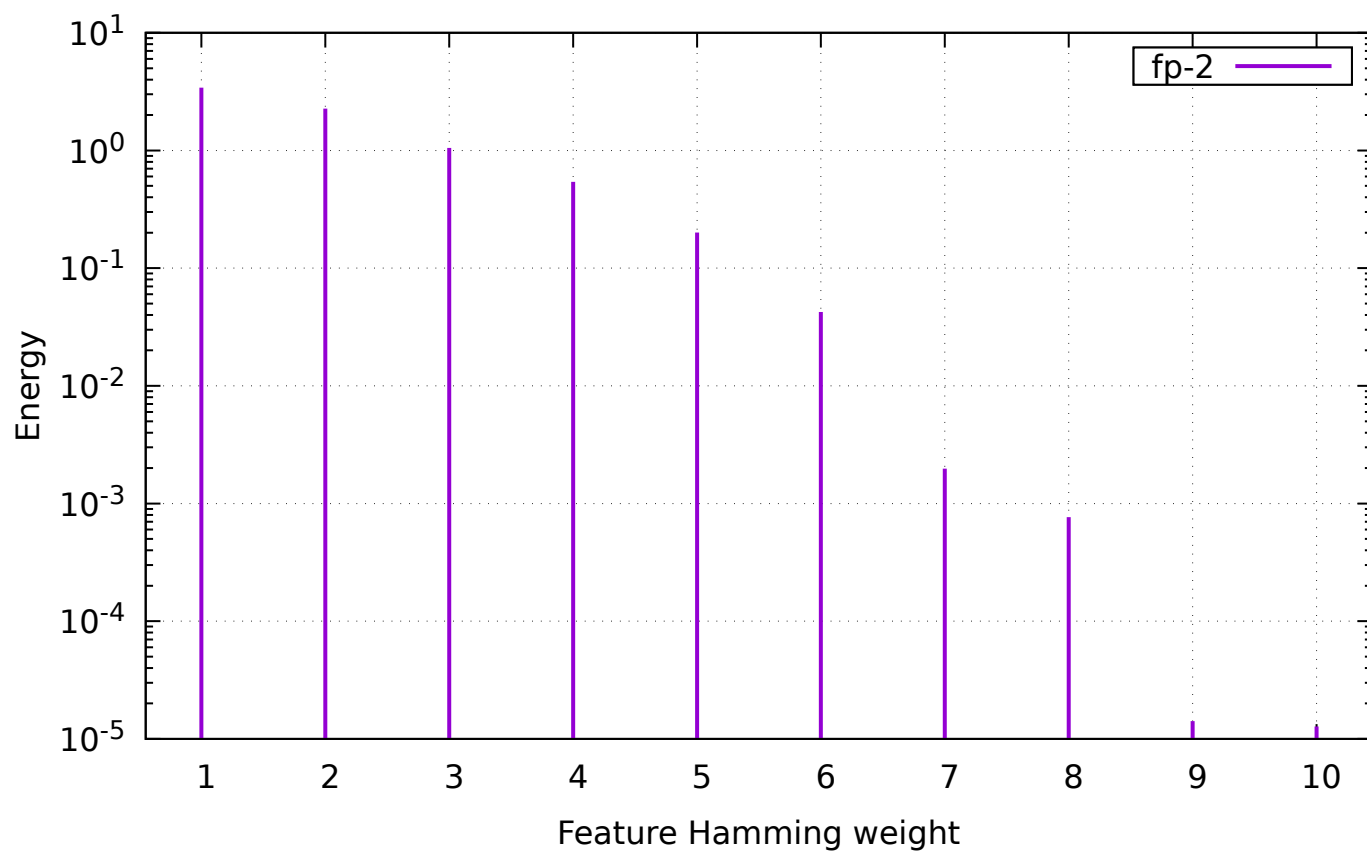
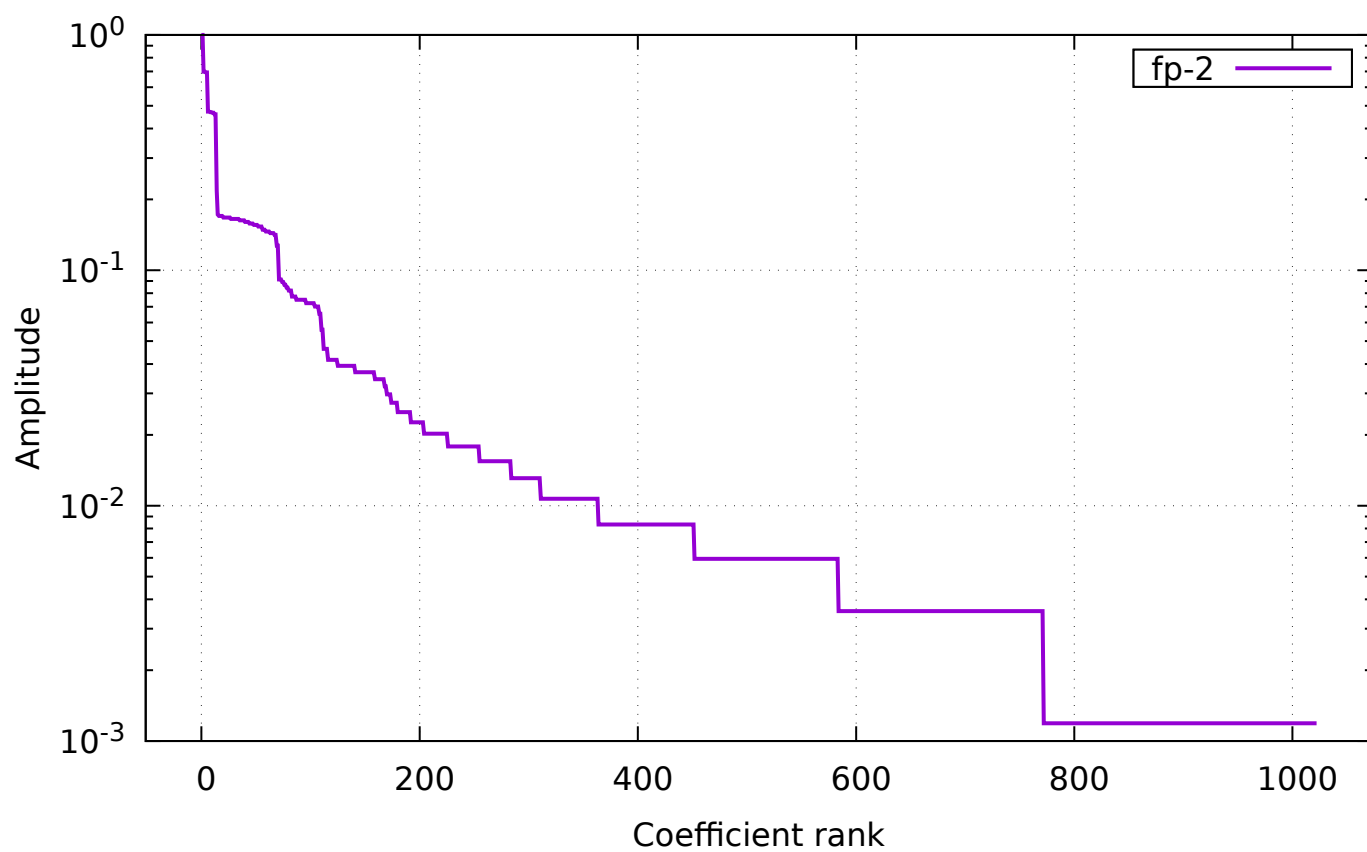
8 djmp-2



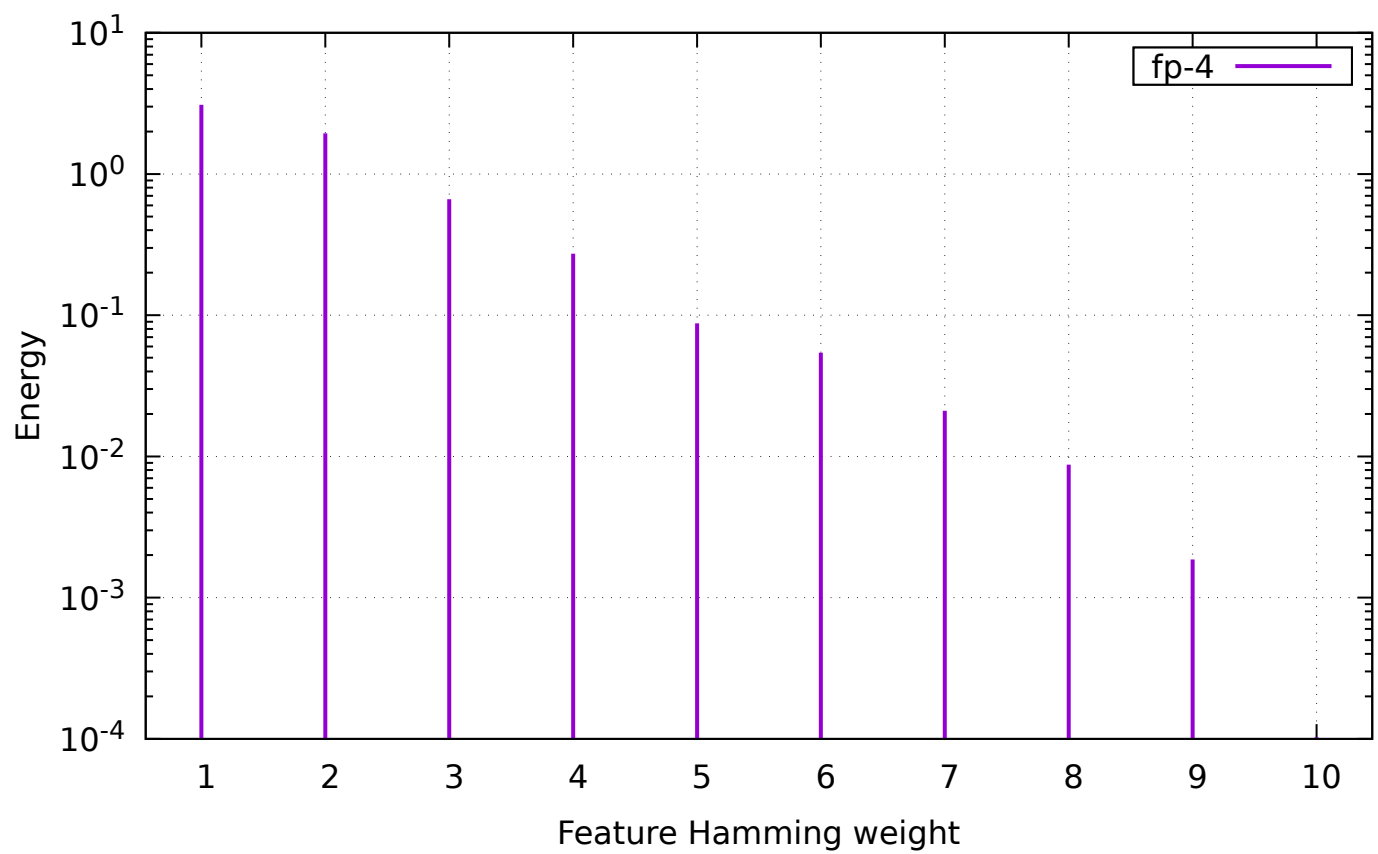
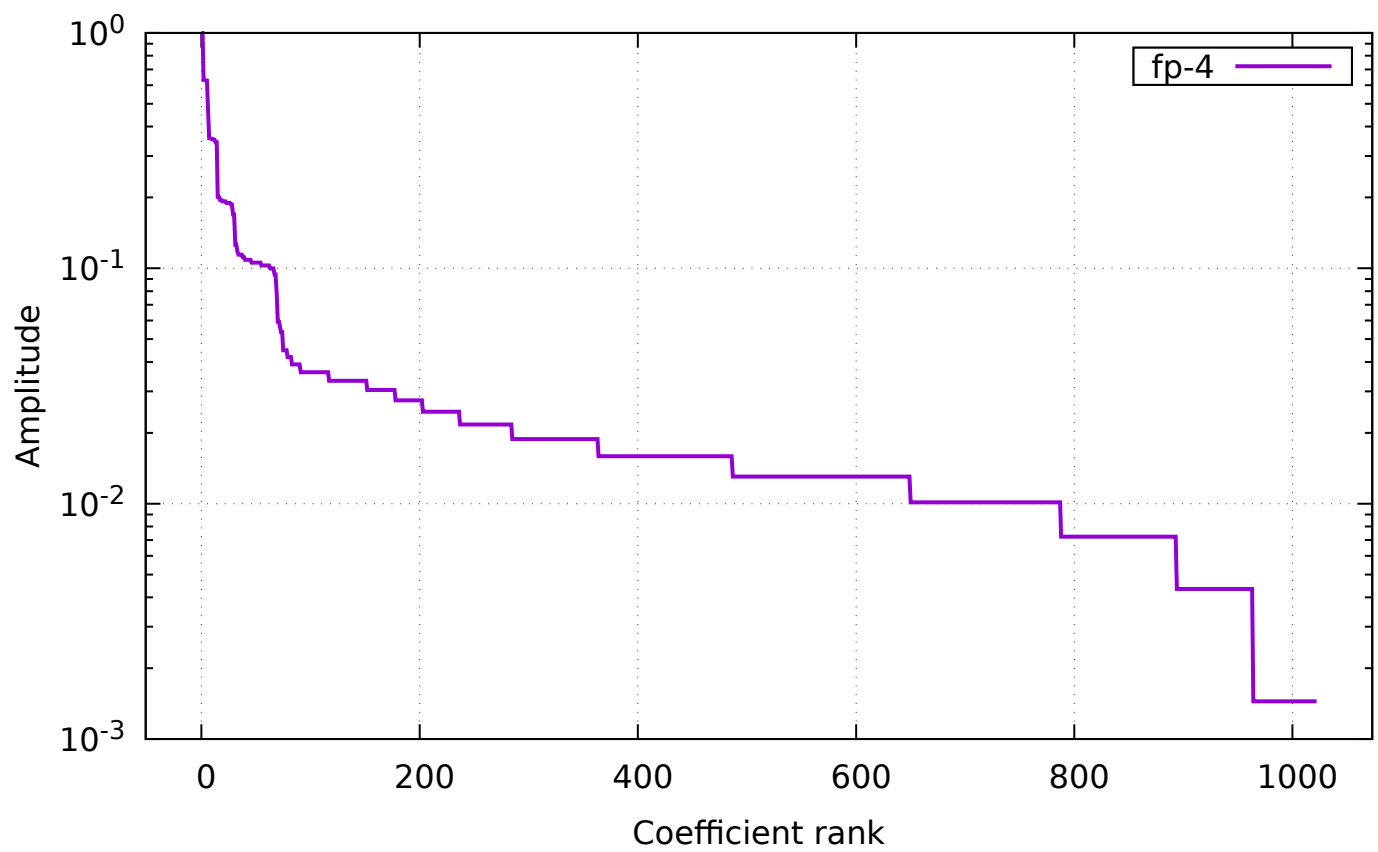
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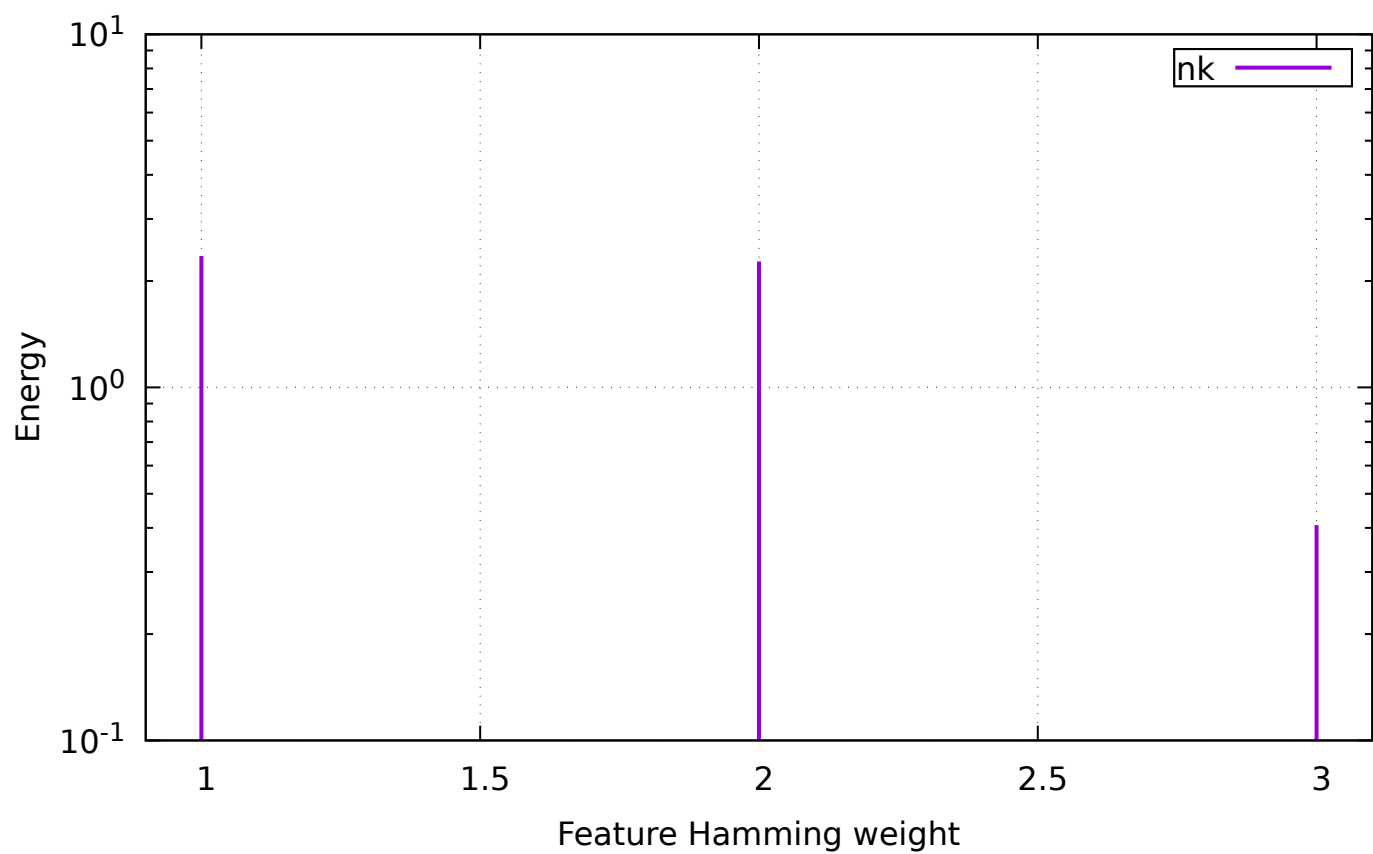
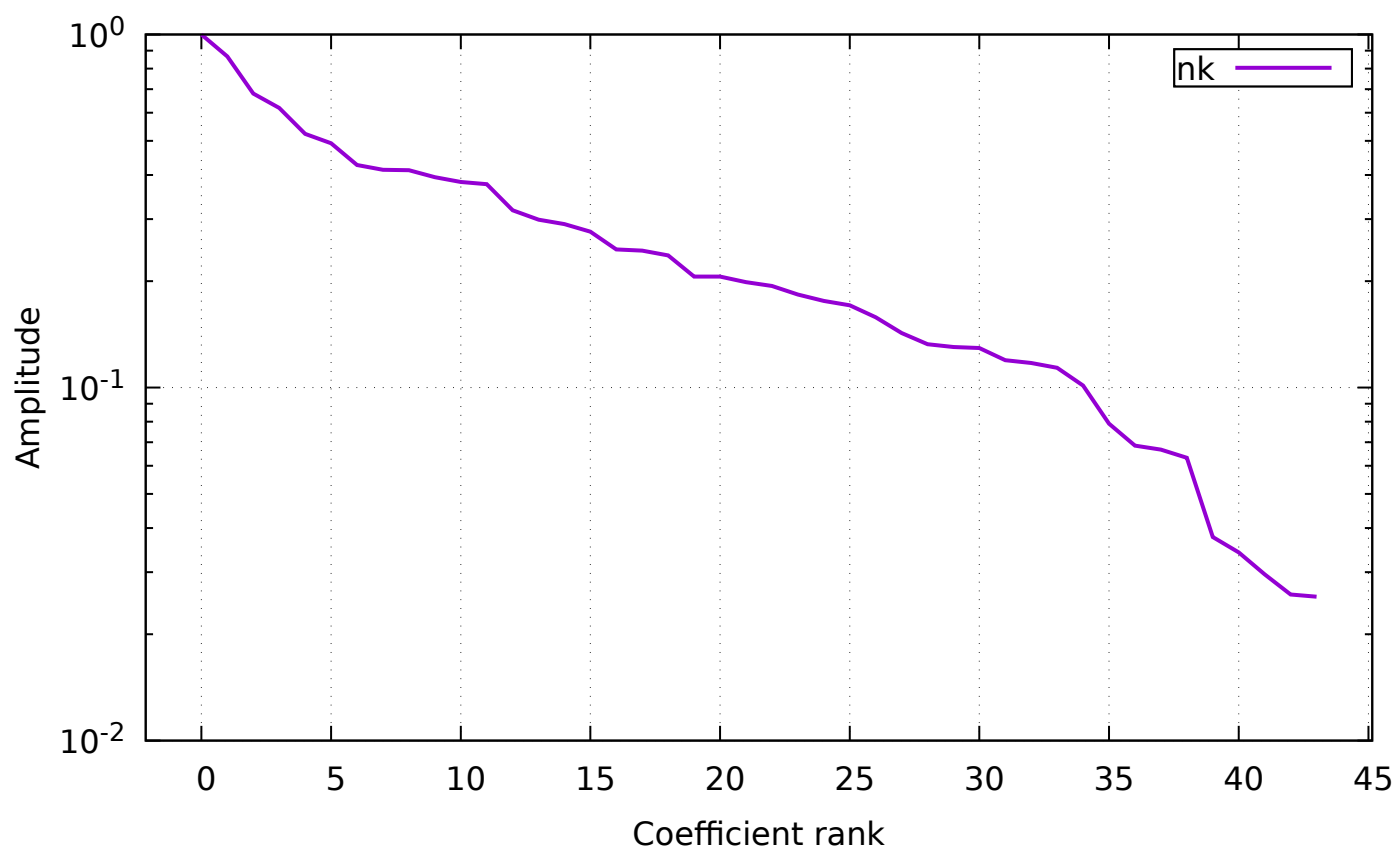
10 fp-2



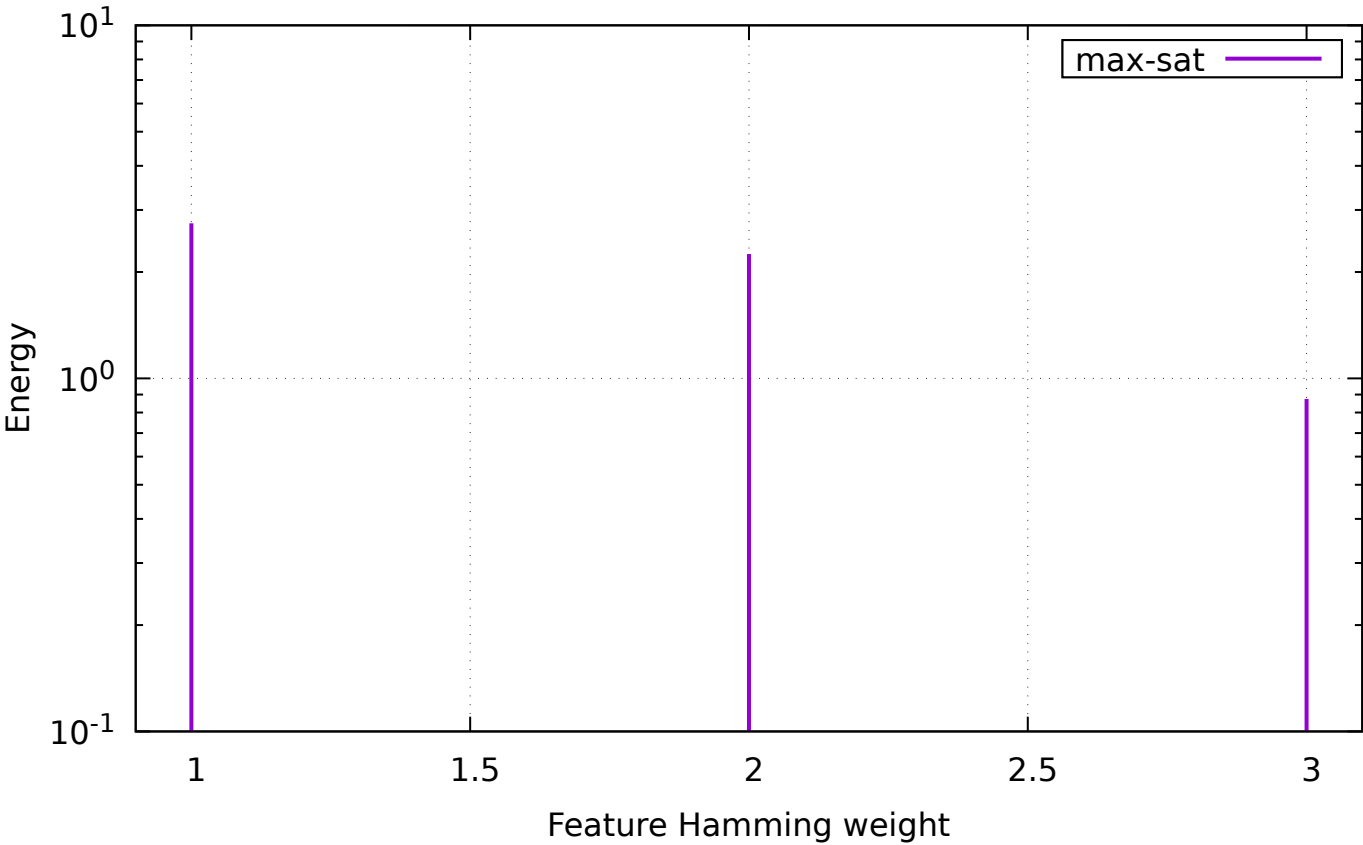
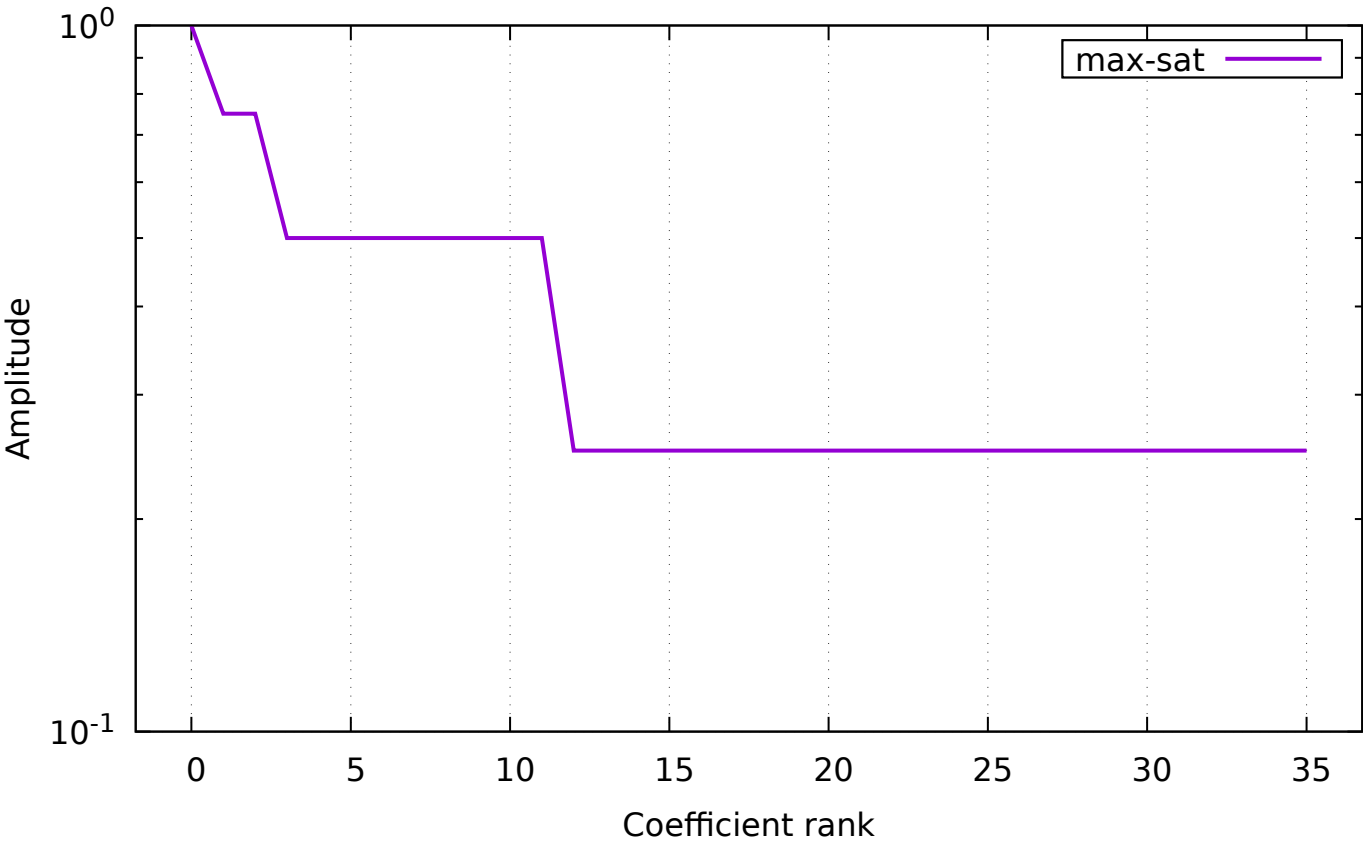
11 fp-4



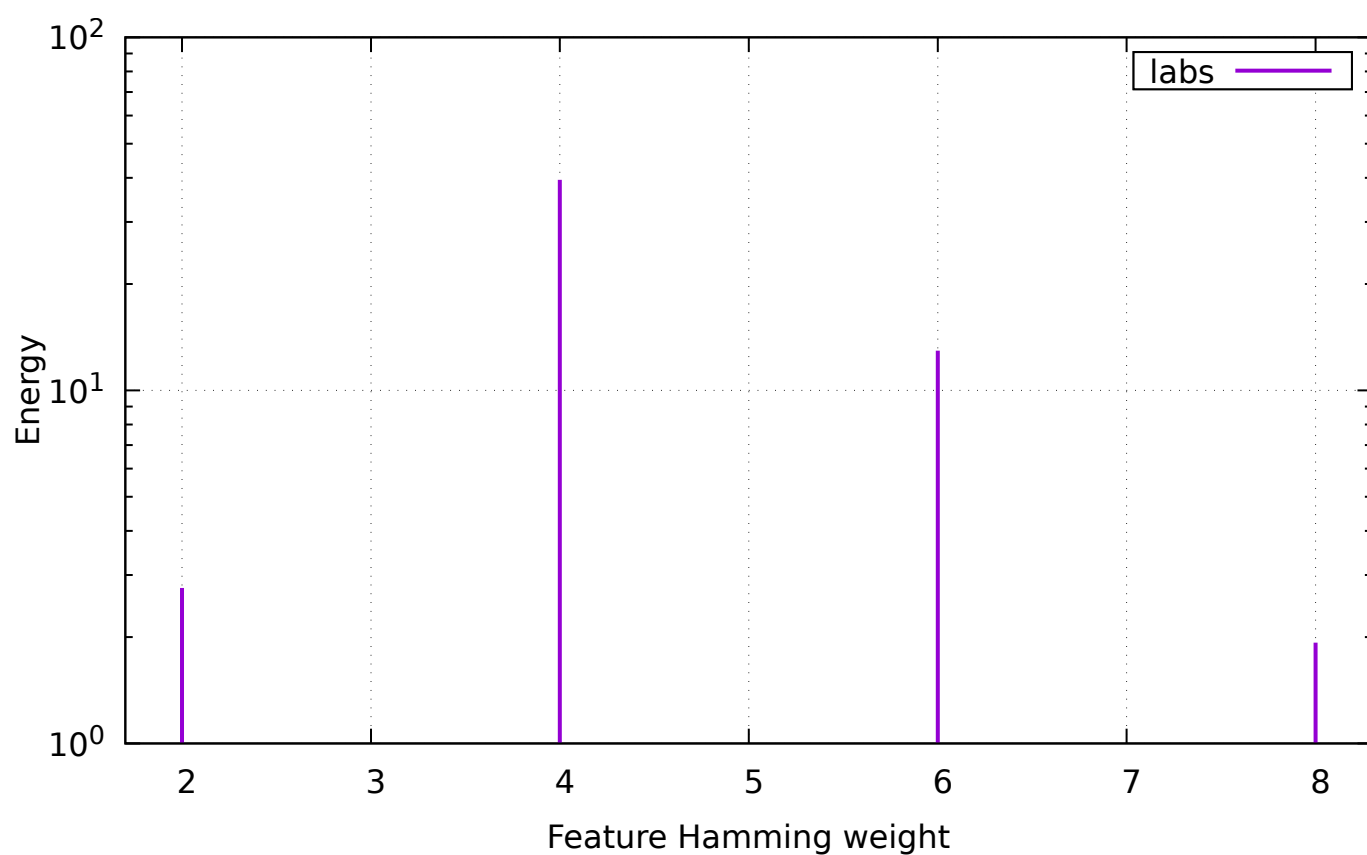
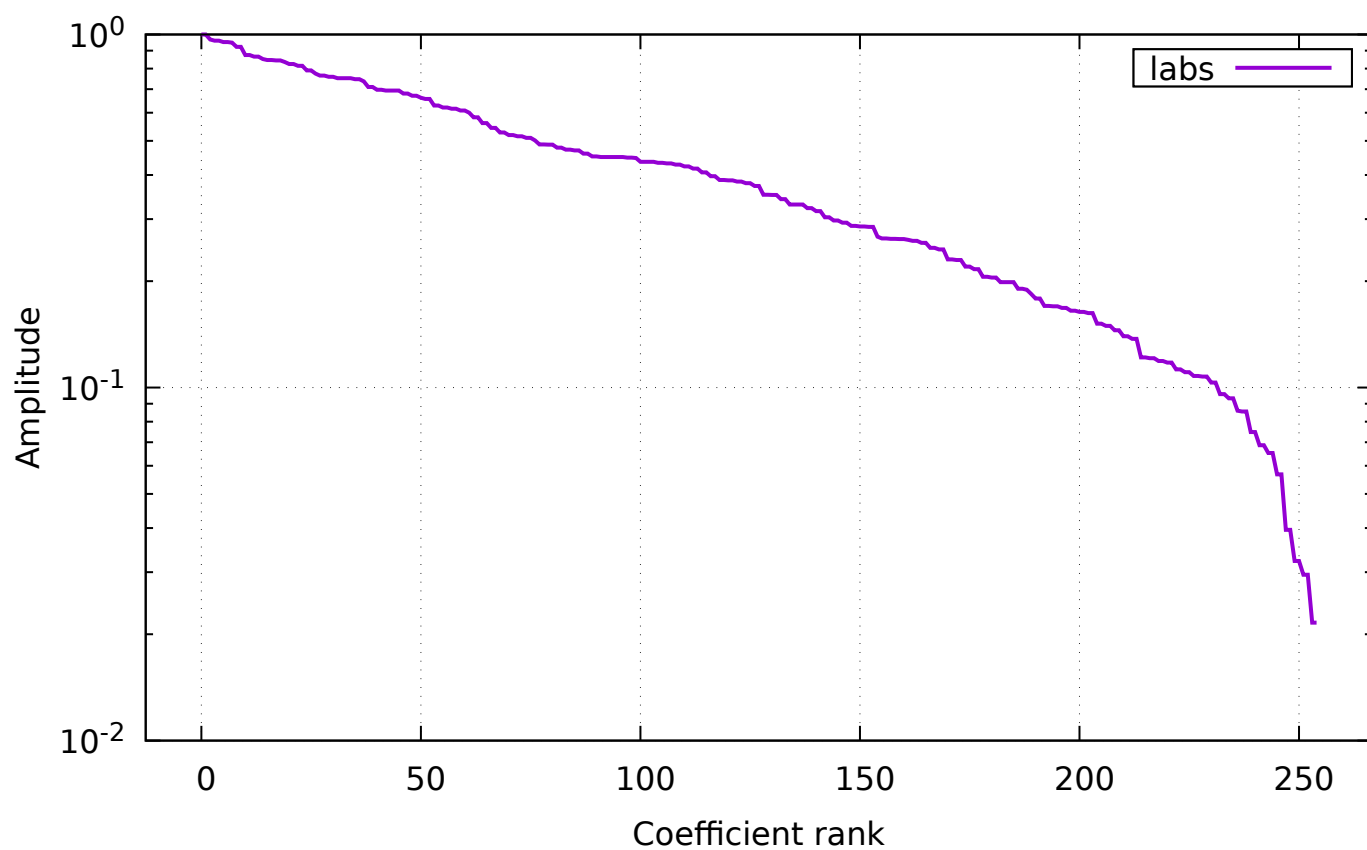
12 nk



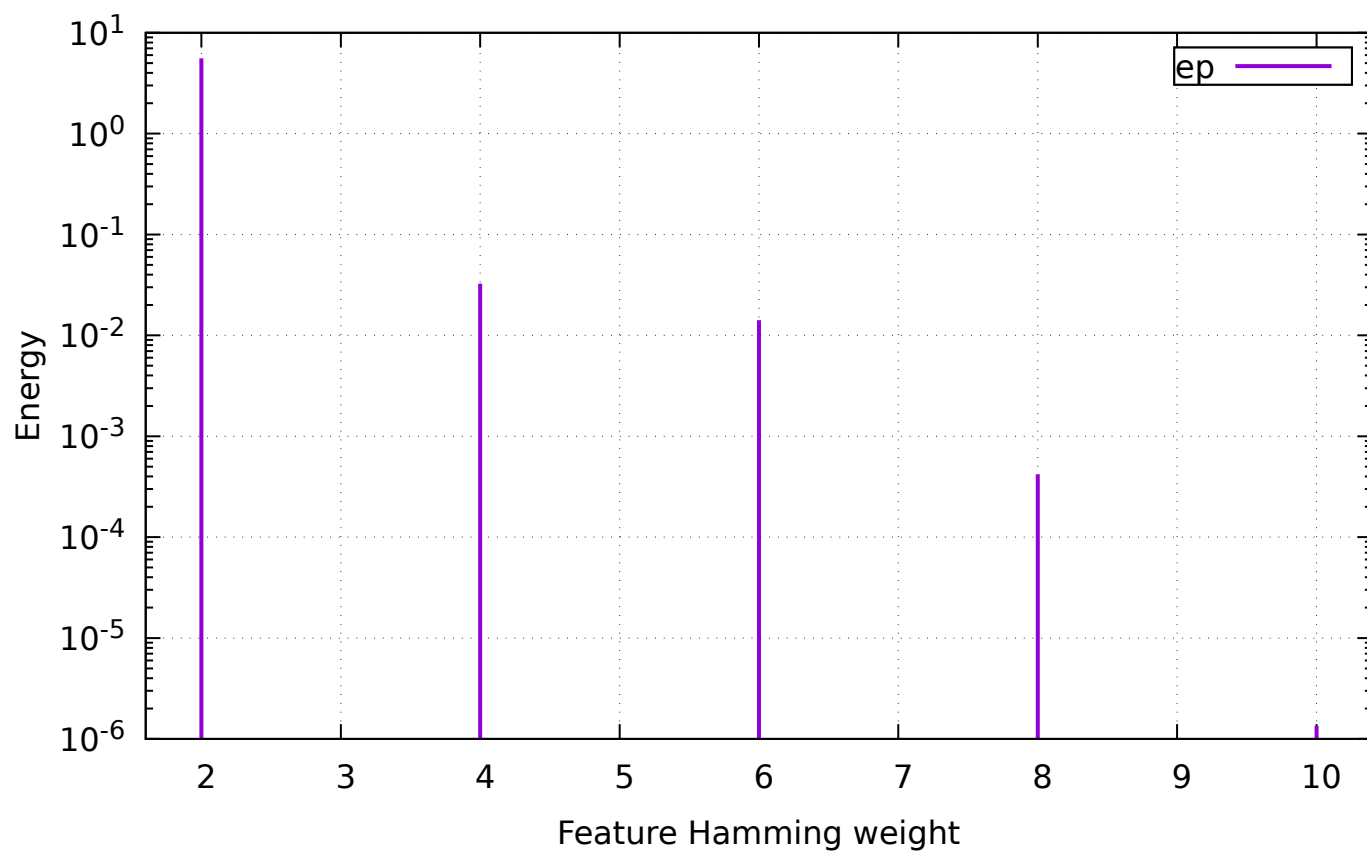
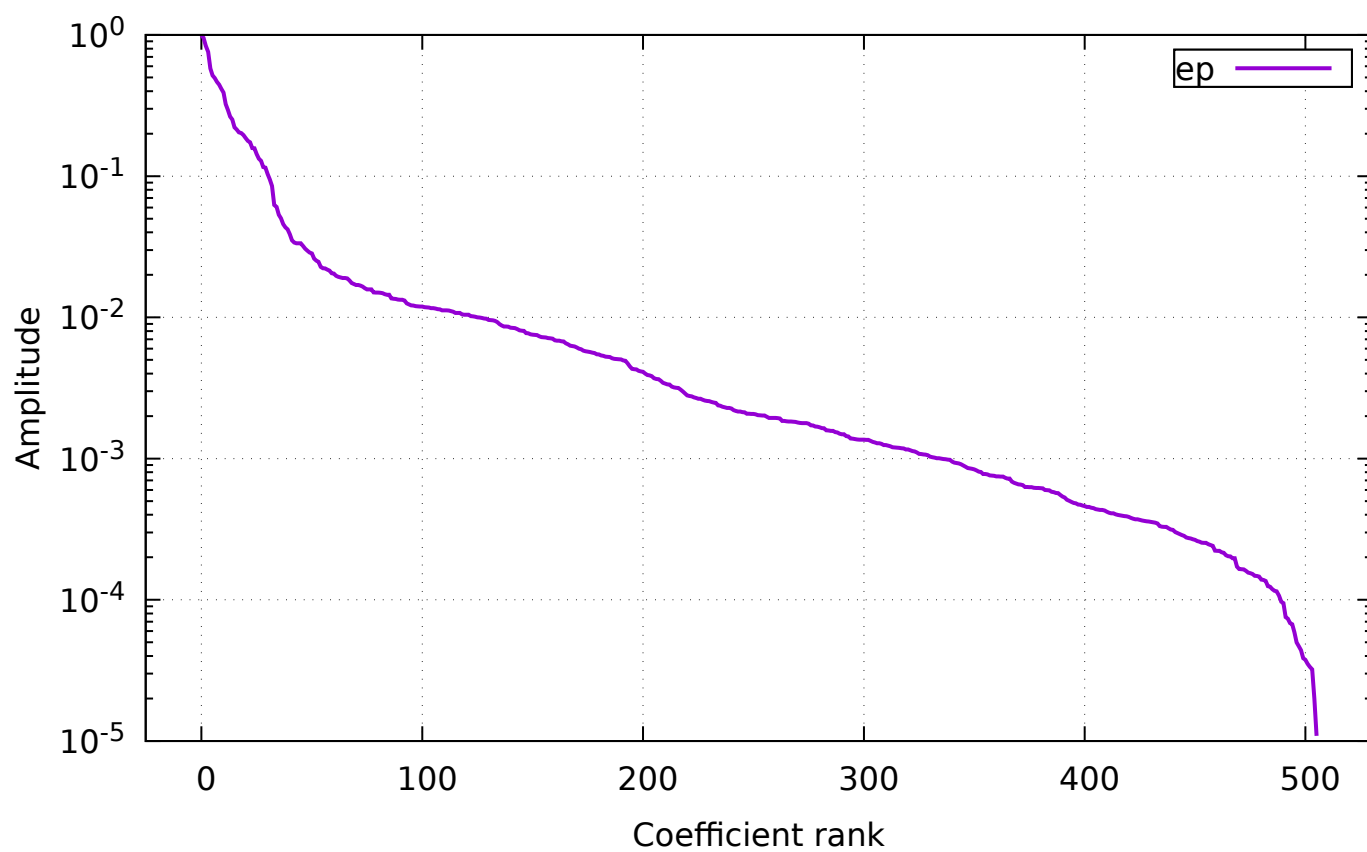
13 max-sat



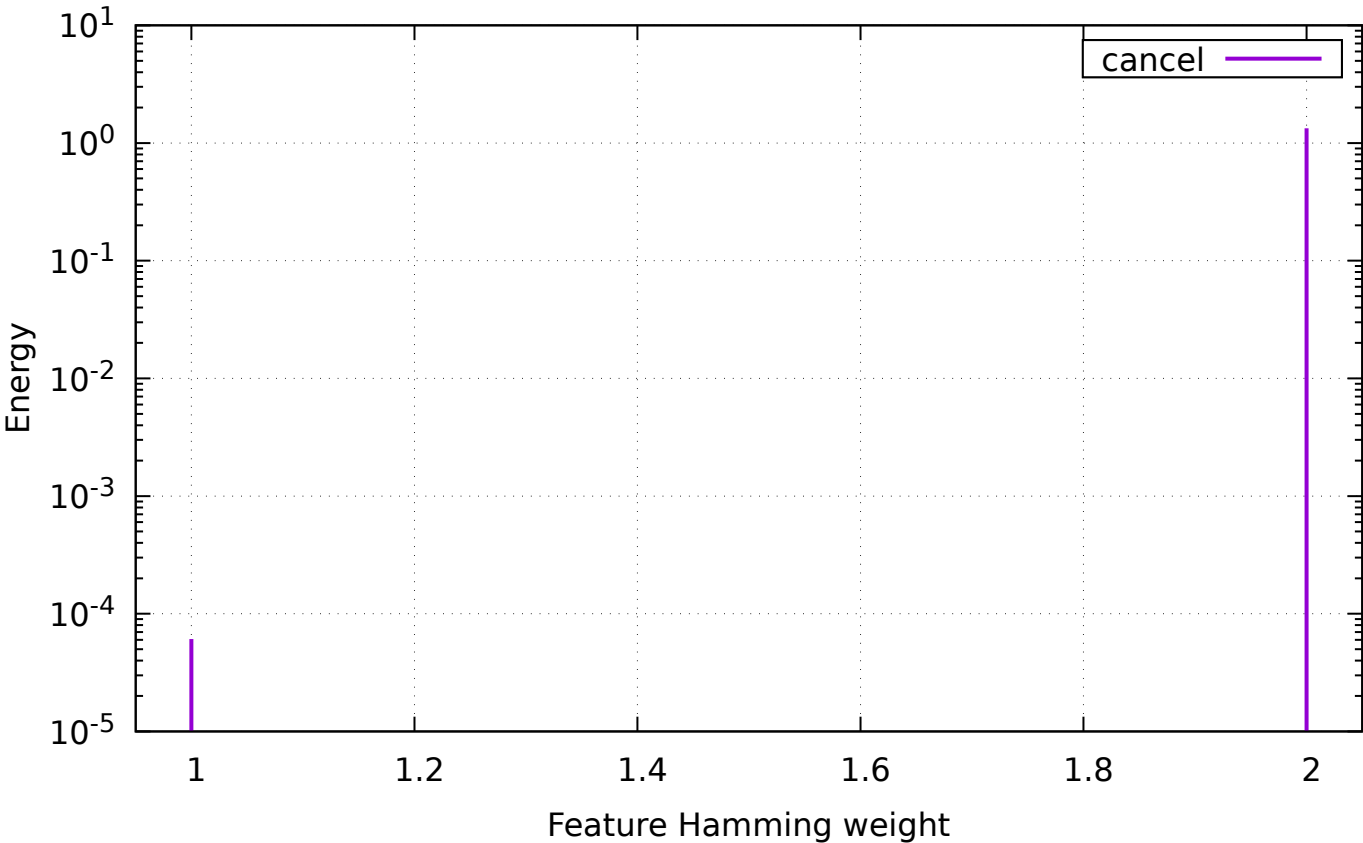
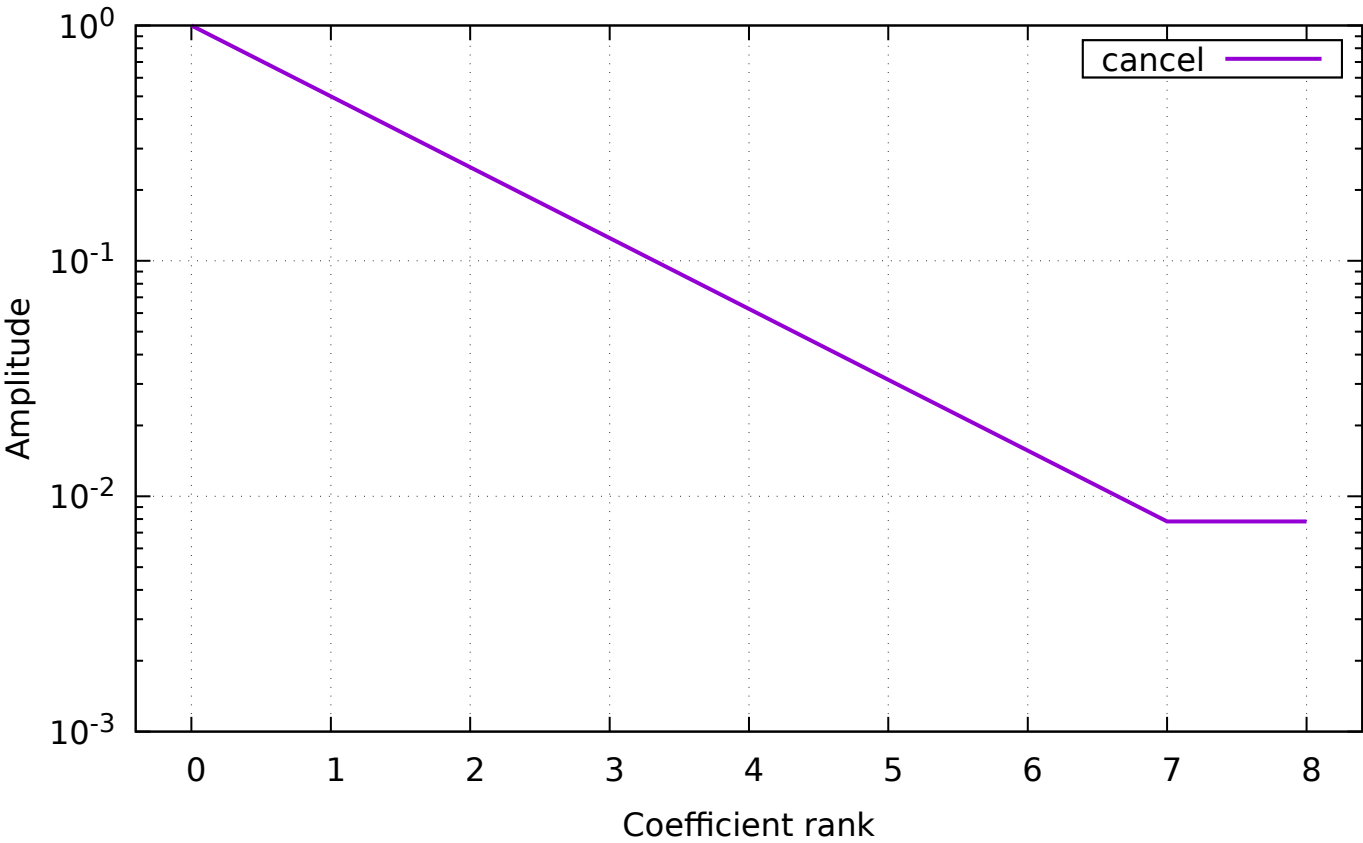
14 labs



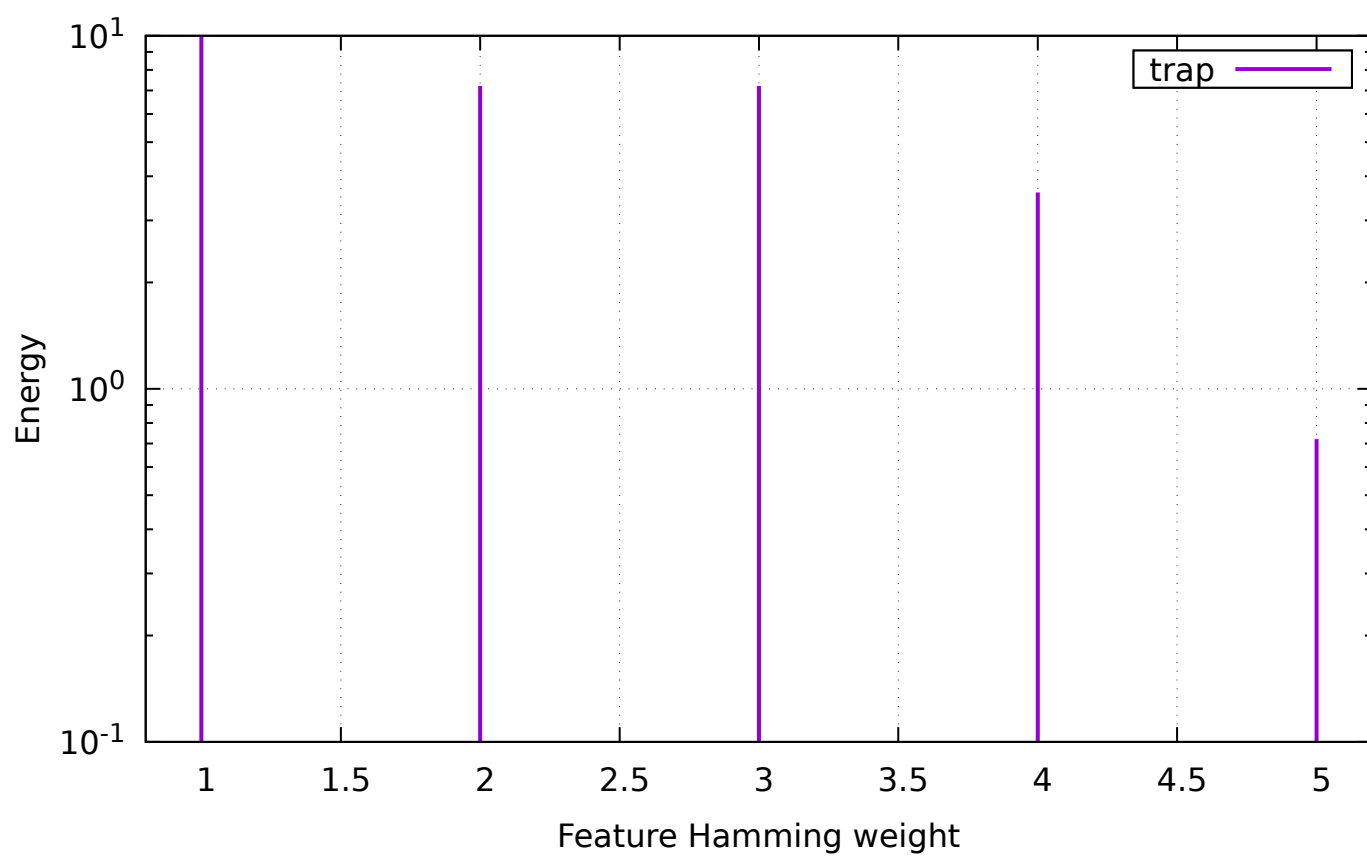
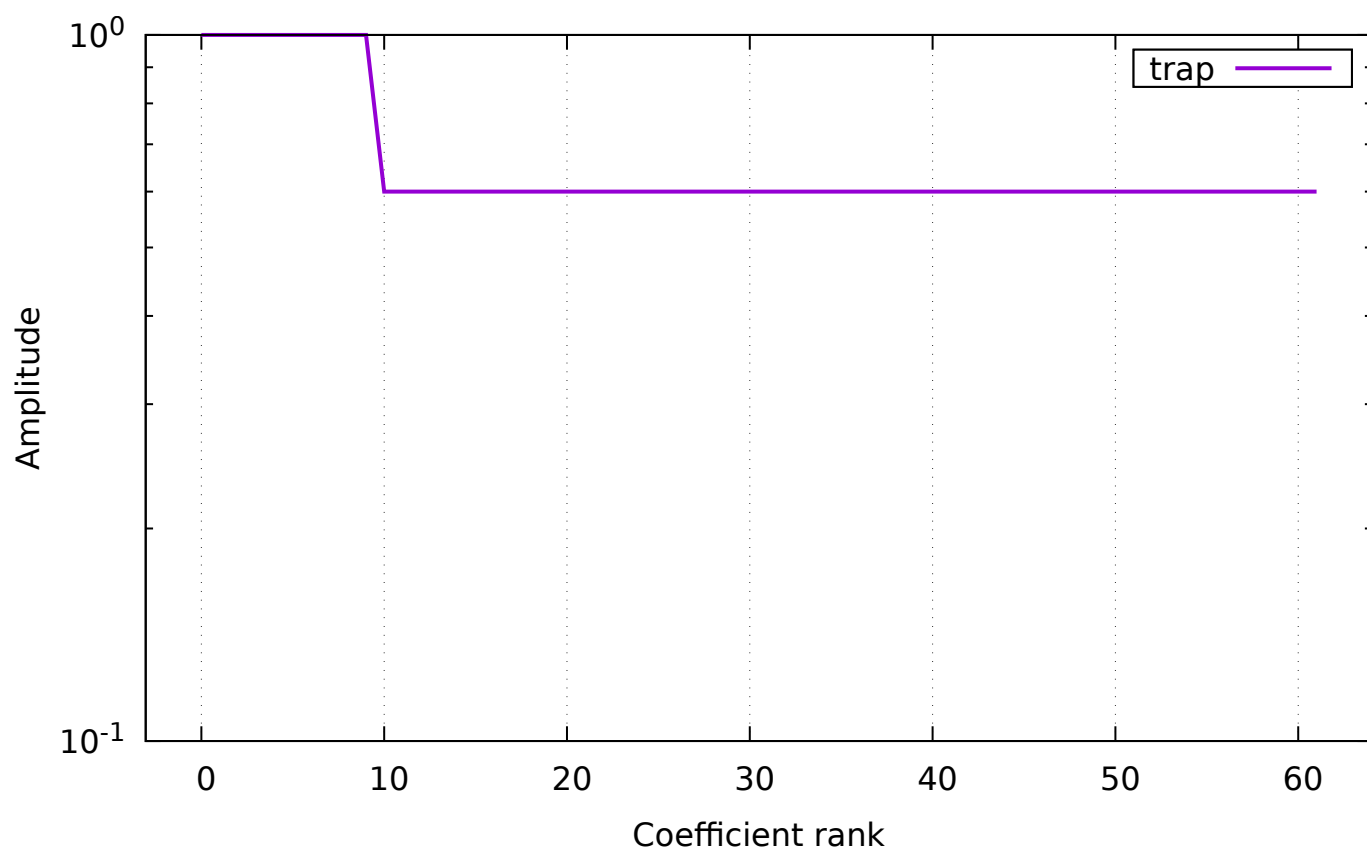
15 ep



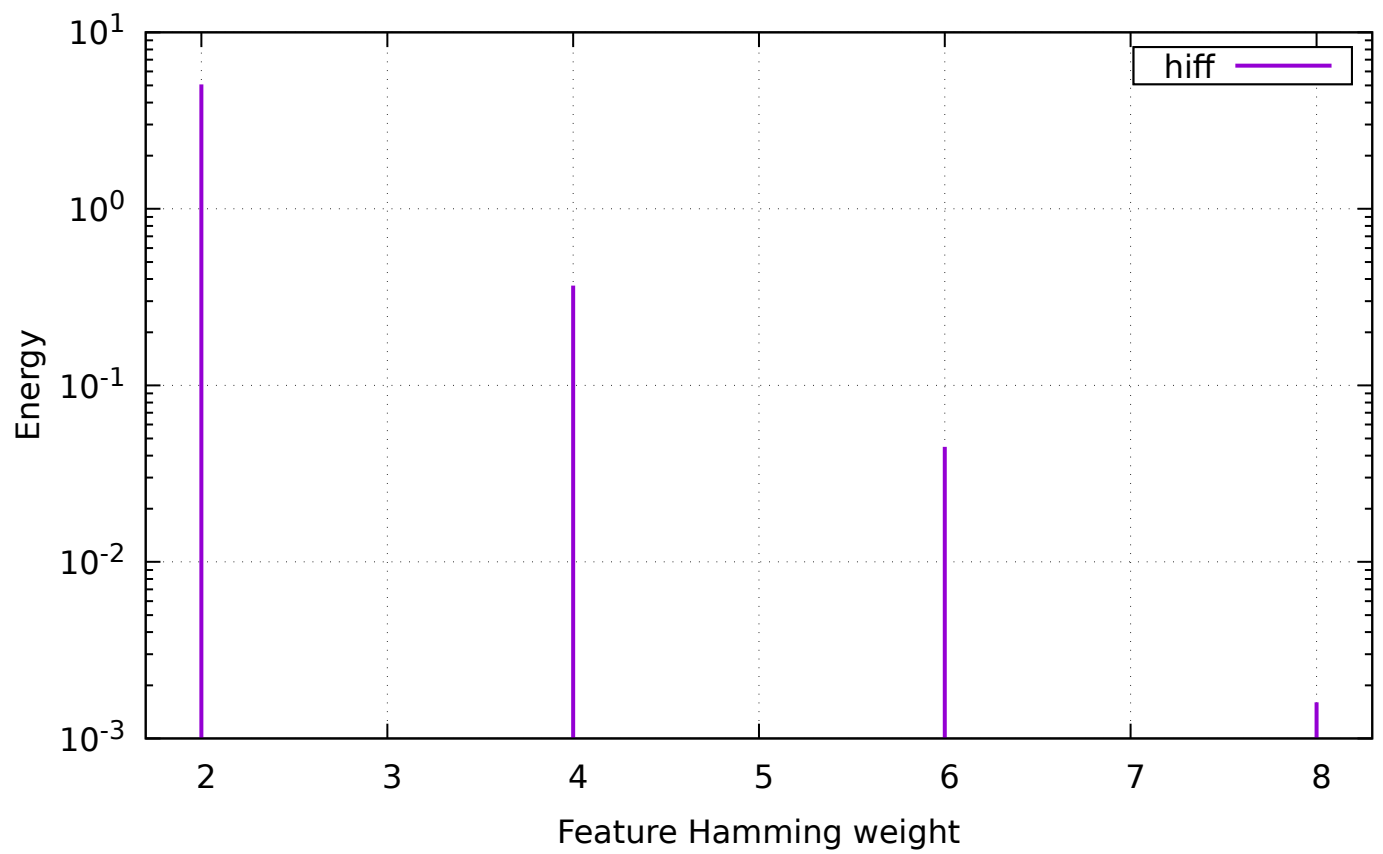
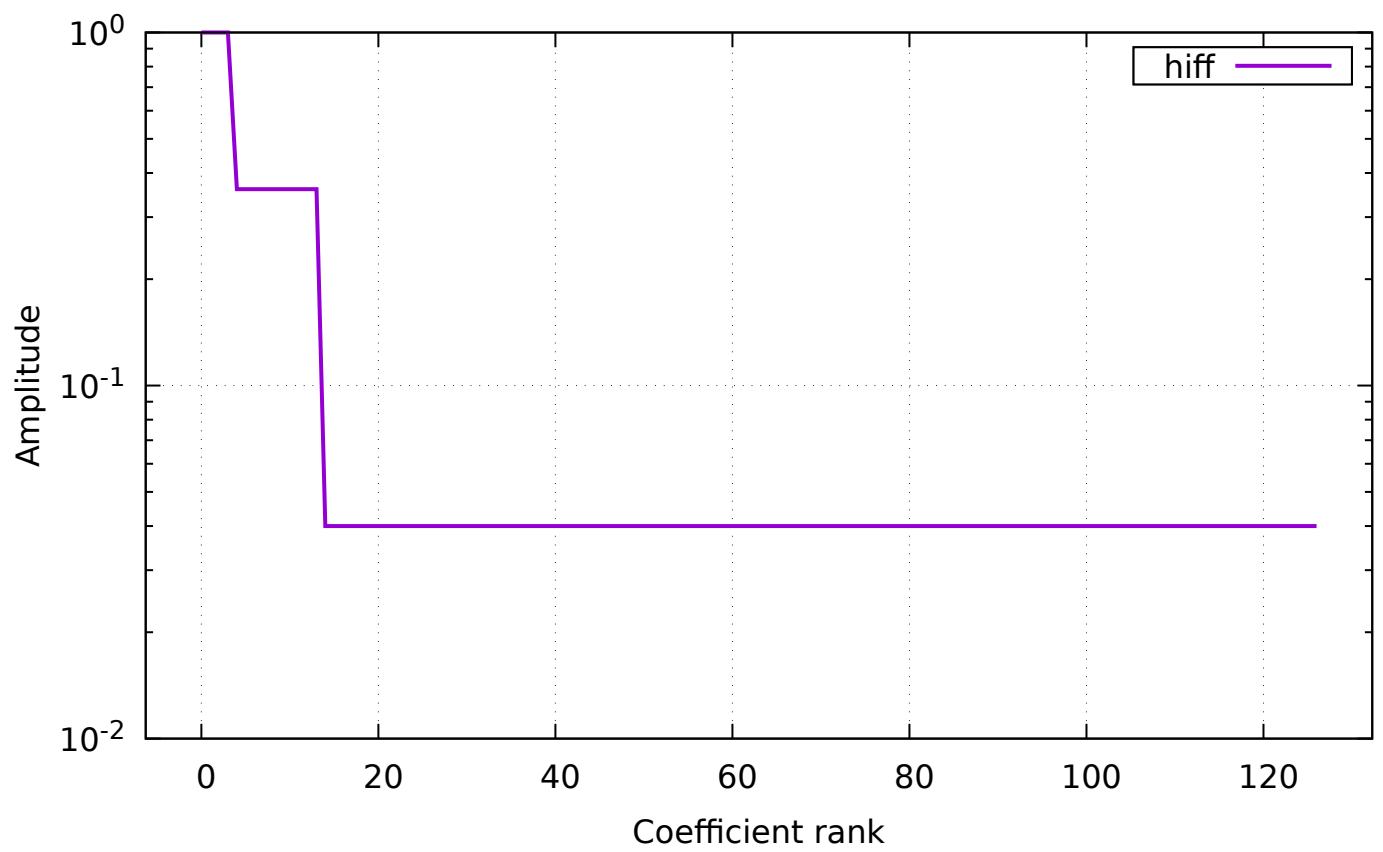
16 cancel



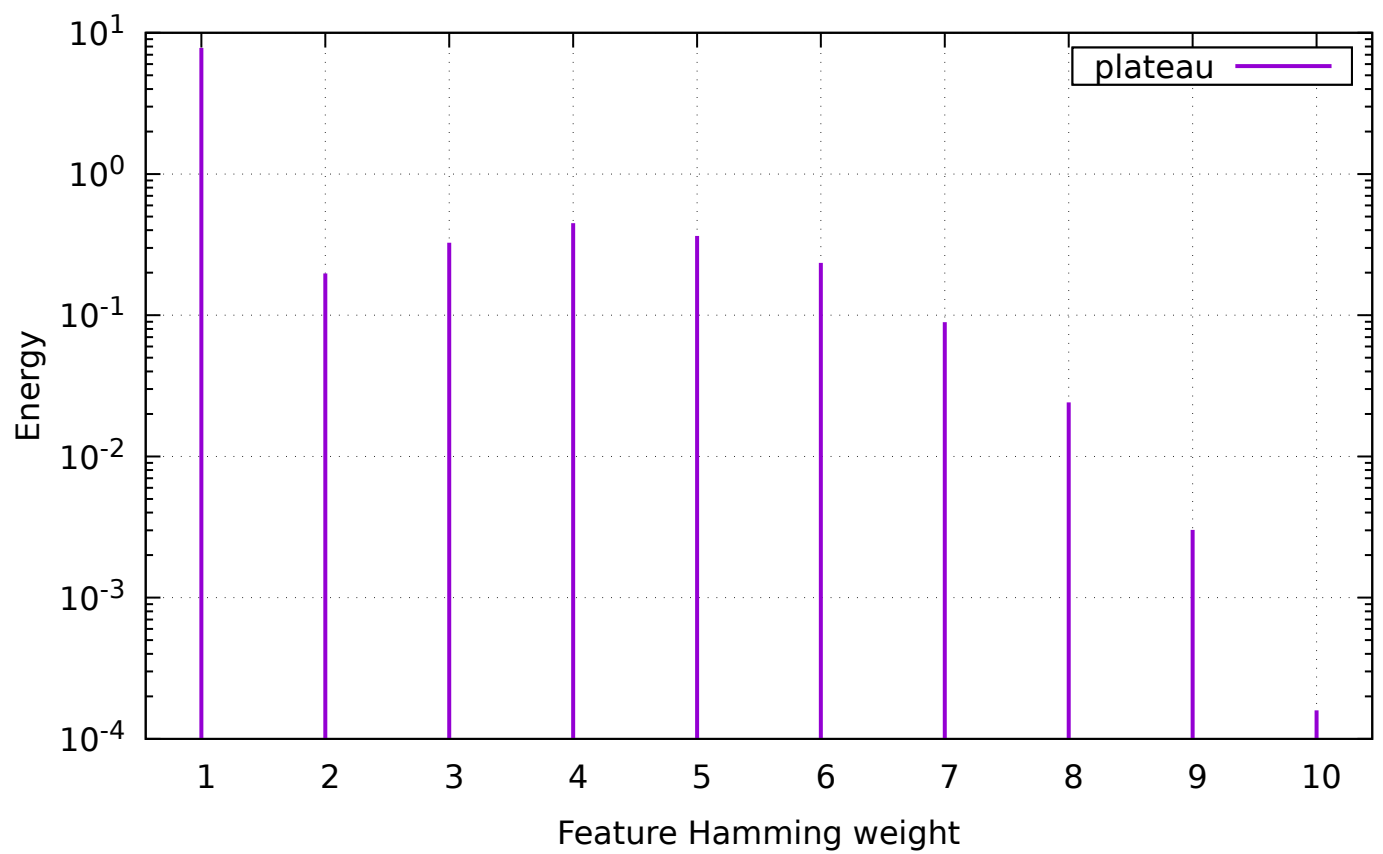
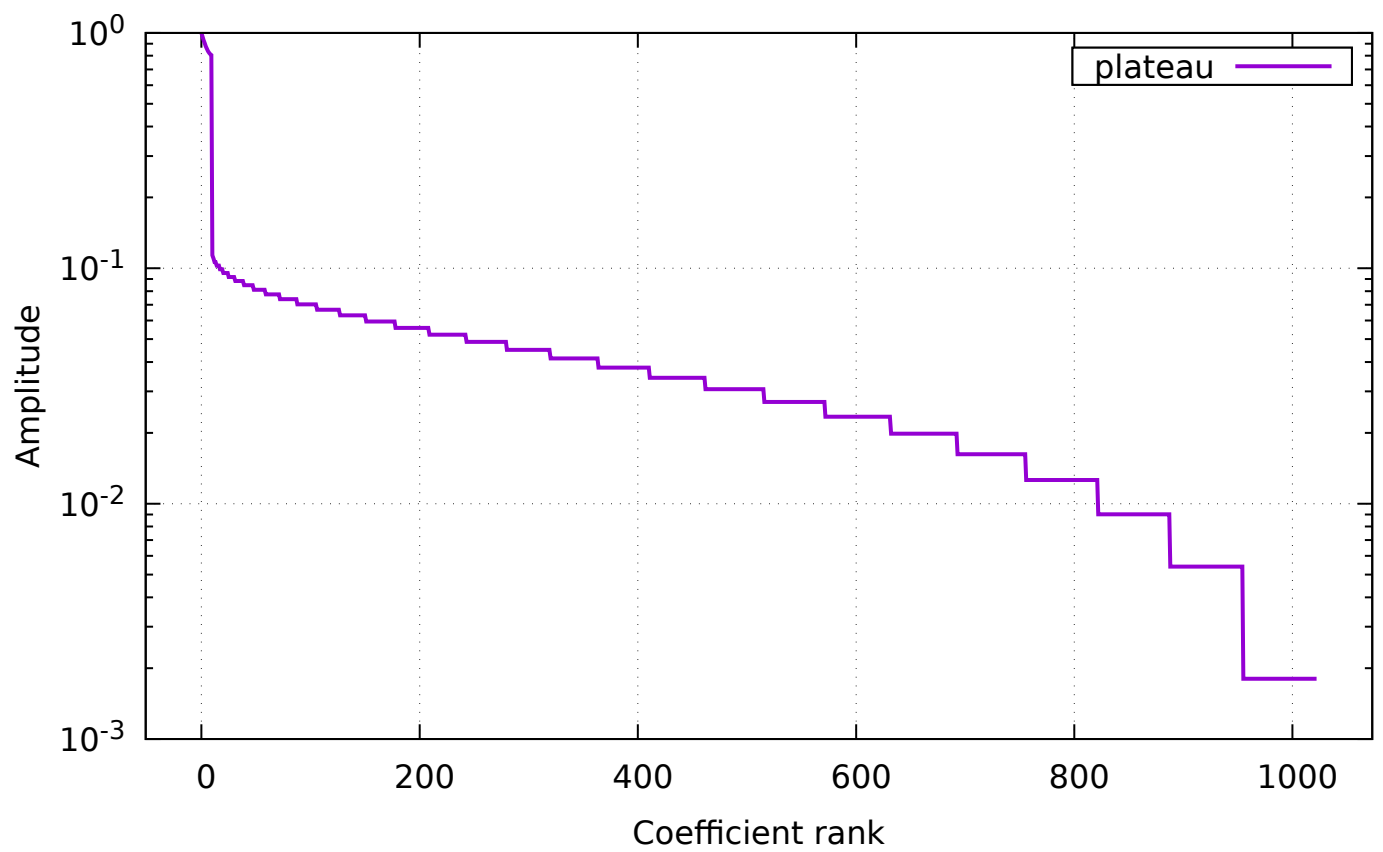
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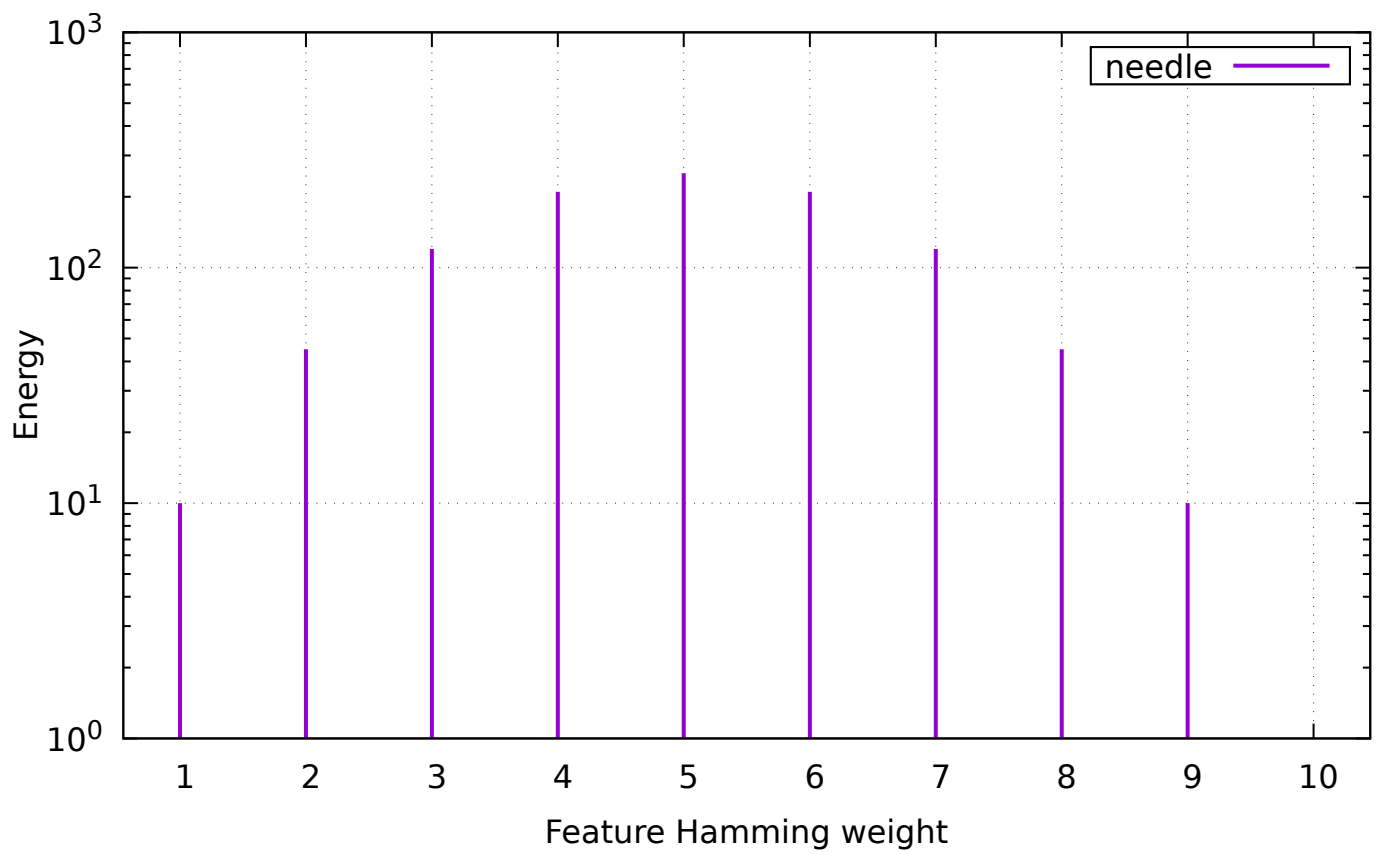
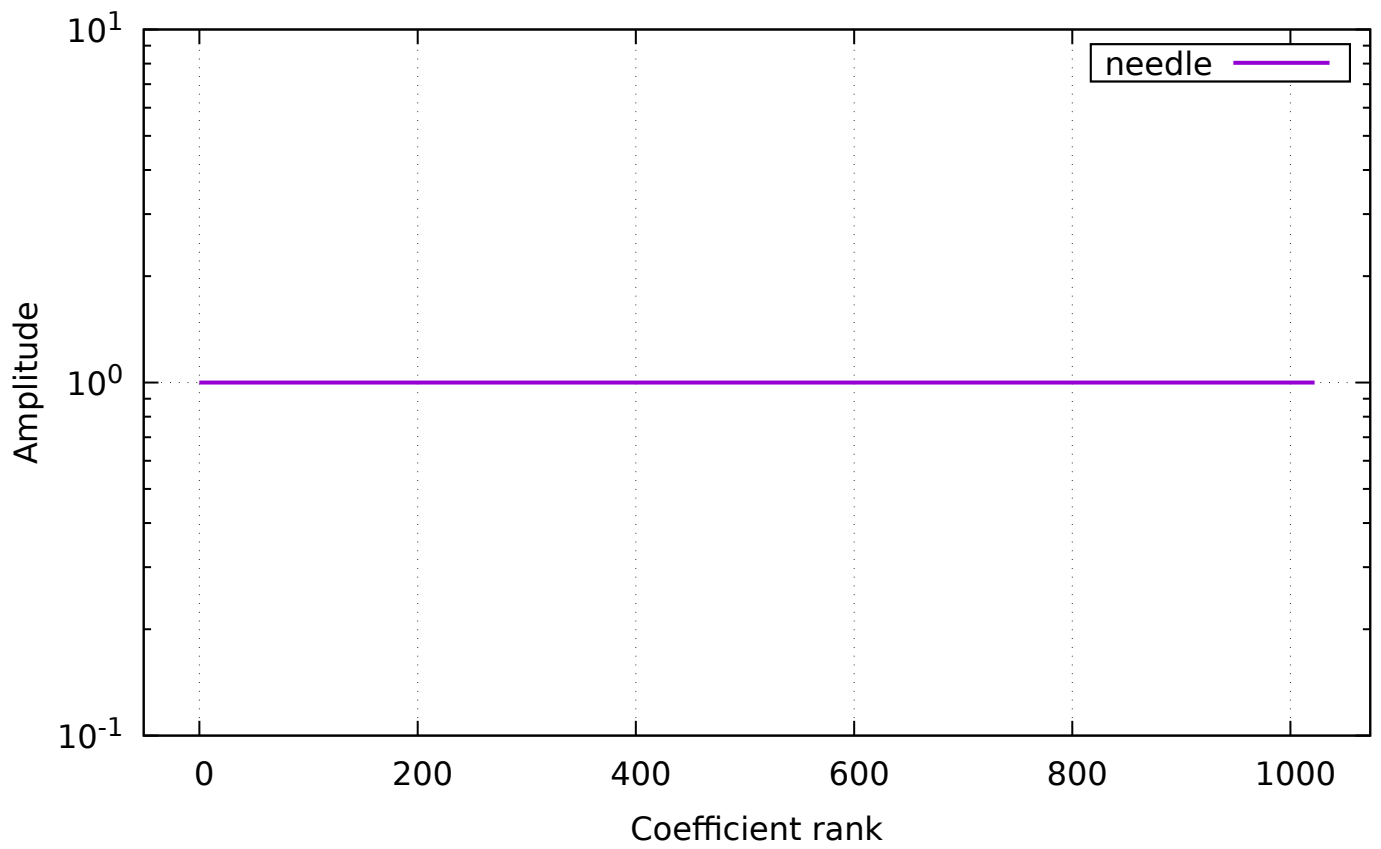
18 hiff



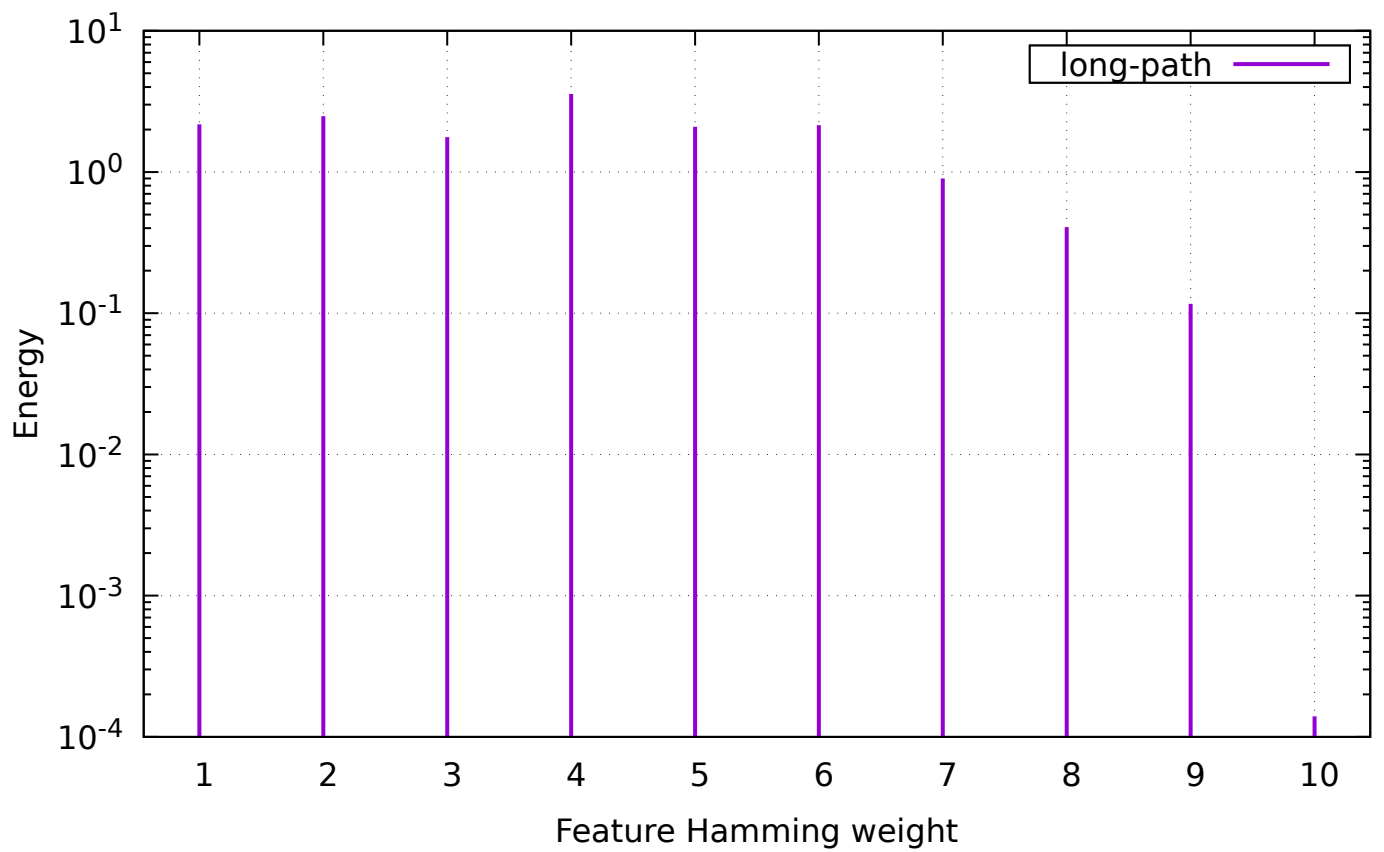
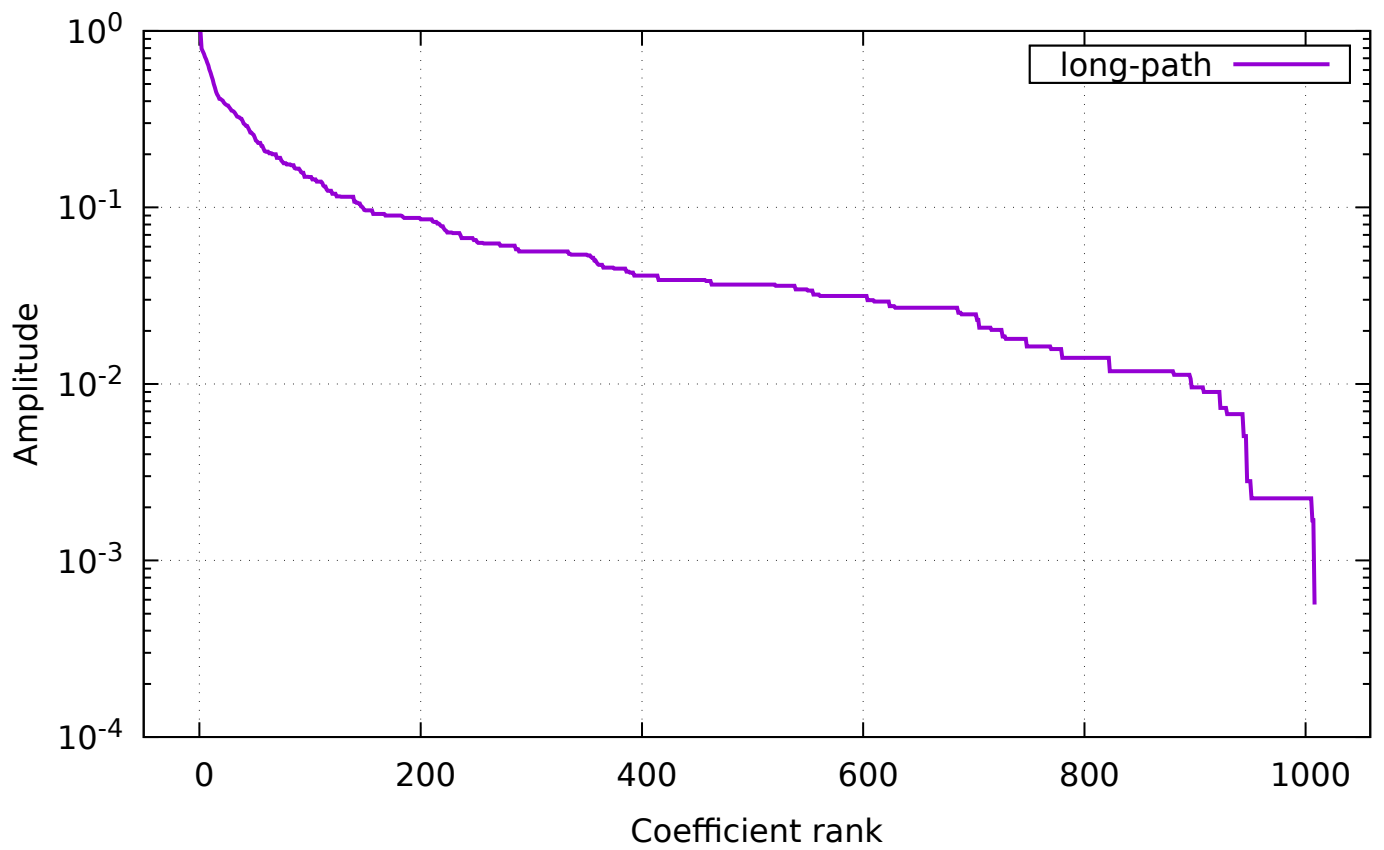
19 plateau



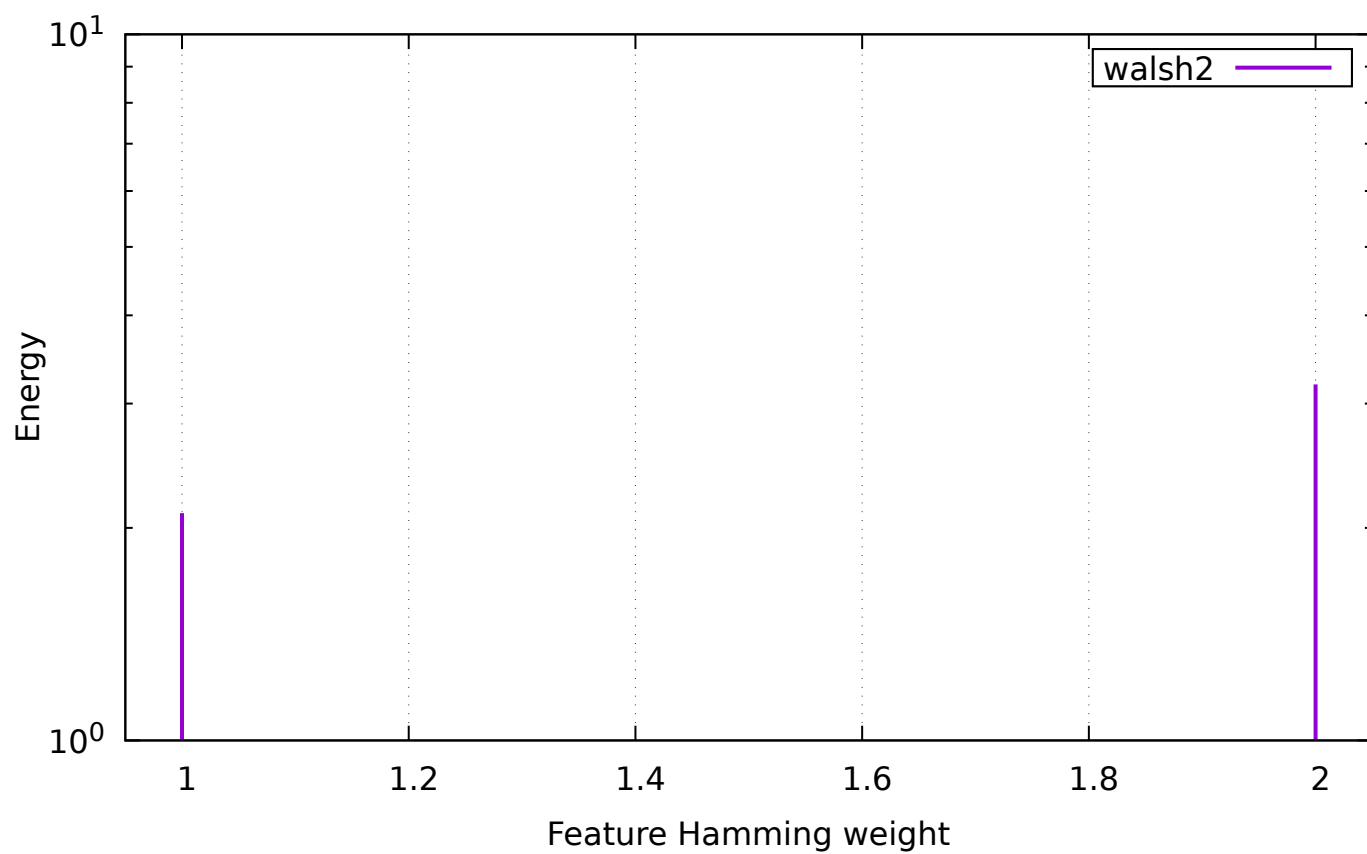
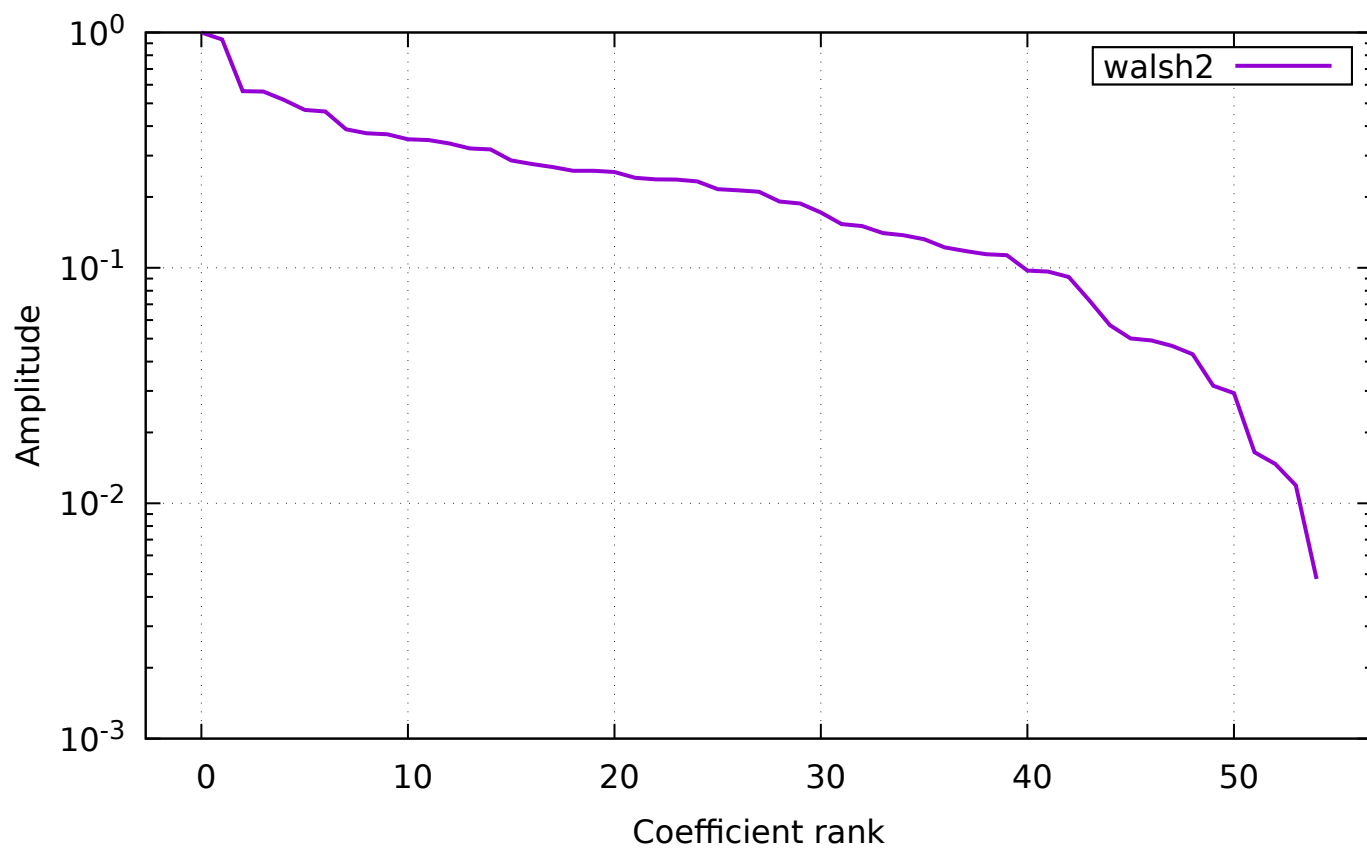
20 needle



21 long-path



22 walsh2



A Plan

```
{  
  "exec": "hnco",  
  "opt": "--fn-walsh-transform -b 0 -s 10",  
}
```

```

"parallel": true,
"results": "results",
"graphics": "graphics",
"report": "report",
"functions": [
  {
    "id": "one-max",
    "opt": "-F 0"
  },
  {
    "id": "lin",
    "opt": "-F 1 -p instances/lin.10"
  },
  {
    "id": "leading-ones",
    "opt": "-F 10"
  },
  {
    "id": "ridge",
    "opt": "-F 11"
  },
  {
    "id": "jump-2",
    "opt": "-F 30 -t 2"
  },
  {
    "id": "jump-4",
    "opt": "-F 30 -t 4"
  },
  {
    "id": "djump-2",
    "opt": "-F 31 -t 2"
  },
  {
    "id": "djump-4",
    "opt": "-F 31 -t 4"
  },
  {
    "id": "fp-2",
    "opt": "-F 40 -t 2"
  },
  {
    "id": "fp-4",
    "opt": "-F 40 -t 4"
  },
  {
    "id": "nk",
    "opt": "-F 60 -p instances/nk.10.2"
  },
  {
    "id": "max-sat",
    "opt": "-F 70 -p instances/ms.10.3.10"
  },
  {
    "id": "labs",
    "opt": "-F 80"
  },
  {
    "id": "ep",
    "opt": "-F 90 -p instances/ep.10"
  },
  {
    "id": "cancel",

```



```

        "opt": "-F 100 -s 9"
    },
    {
        "id": "trap",
        "opt": "-F 110 --fn-num-traps 2"
    },
    {
        "id": "hiff",
        "opt": "-F 120 -s 8"
    },
    {
        "id": "plateau",
        "opt": "-F 130"
    },
    {
        "id": "needle",
        "opt": "-F 20"
    },
    {
        "id": "long-path",
        "opt": "-F 140"
    },
    {
        "id": "walsh2",
        "opt": "-F 162 -p instances/walsh2.10"
    }
]
}

```

B Default parameters

```

# algorithm = 100
# bm_mc_reset_strategy = 1
# bm_num_gs_cycles = 1
# bm_num_gs_steps = 100
# bm_sampling = 1
# budget = 10000
# bv_size = 100
# cache_budget = 0
# ea_lambda = 100
# ea_mu = 10
# fn_name = noname
# fn_num_traps = 10
# fn_prefix_length = 2
# fn_threshold = 10
# function = 0
# ga_crossover_bias = 0.5
# ga_crossover_probability = 0.5
# ga_tournament_size = 10
# hea_binary_dynamics = 0
# hea_delay = 10000
# hea_num_par_updates = 1
# hea_num_seq_updates = 100
# hea_rate_strategy = 0
# hea_reset_period = 0
# hea_sampling_method = 0
# hea_time_constant = 1000
# hea_weight = 1
# learning_rate = 0.001
# map = 0
# map_input_size = 100
# map_path = nopath

```

```
# mutation_probability = 1
# neighborhood = 0
# neighborhood_iterator = 0
# noise_stddev = 1
# num_iterations = 0
# num_threads = 1
# path = nopath
# pn_mutation_probability = 1
# pn_neighborhood = 0
# pn_radius = 2
# population_size = 10
# pv_log_num_components = 5
# radius = 2
# rls_patience = 50
# sa_beta_ratio = 1.2
# sa_initial_acceptance_probability = 0.6
# sa_num_transitions = 50
# sa_num_trials = 100
# seed = 0
# selection_size = 1
# target = 100
# print_defaults
# last_parameter
# exec_name = hnco
# version = 0.9
# Generated from hnco.json
```