

HNCO

Visualization of Walsh transforms of various functions defined on bit vectors

July 10, 2018

Abstract

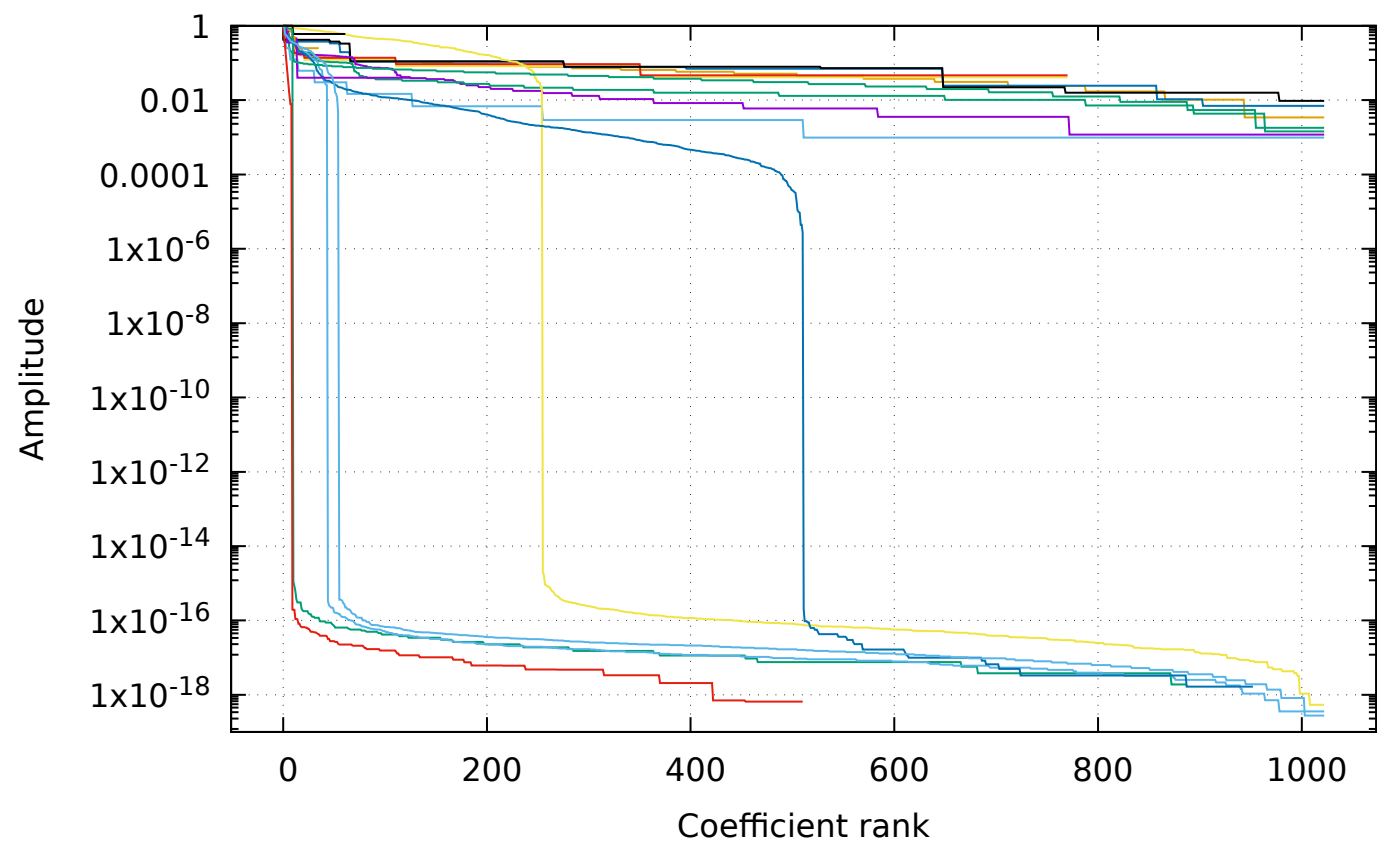
This document proposes to visualize Walsh (or Fourier) transforms of various functions defined on bit vectors (hypercube) of size $n = 10$. For each function, two graphics are displayed. In the first one, coefficients of the Walsh transform are sorted in decreasing order of amplitude and normalized relatively to the greatest amplitude. In particular, we are interested in how fast coefficient amplitudes decrease. The second graphics displays the energy (sum of square of coefficients) as a function of the order (or Hamming weight) of features. This can be thought of as a spectrum.

Contents

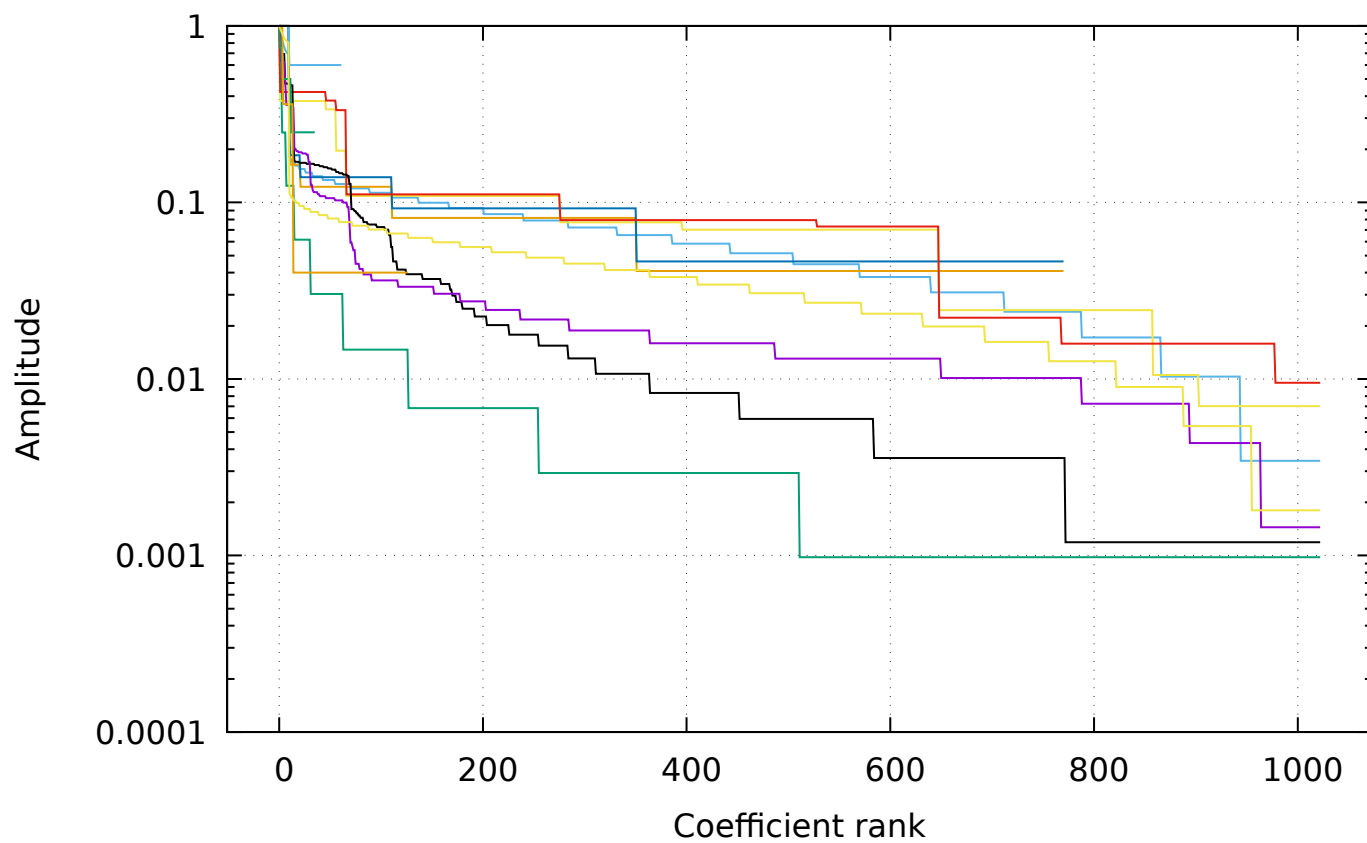
1	All functions	2
2	group1	3
3	group2	3
4	one-max	4
5	lin	5
6	leading-ones	6
7	ridge	7
8	jmp-2	8
9	jmp-4	9
10	djmp-2	10
11	djmp-4	11
12	fp-2	12
13	fp-4	13
14	nk	14
15	max-sat	15
16	labs	16
17	ep	17
18	cancel	18
19	trap	19
20	hiff	20
21	plateau	21
22	walsh2	22

1

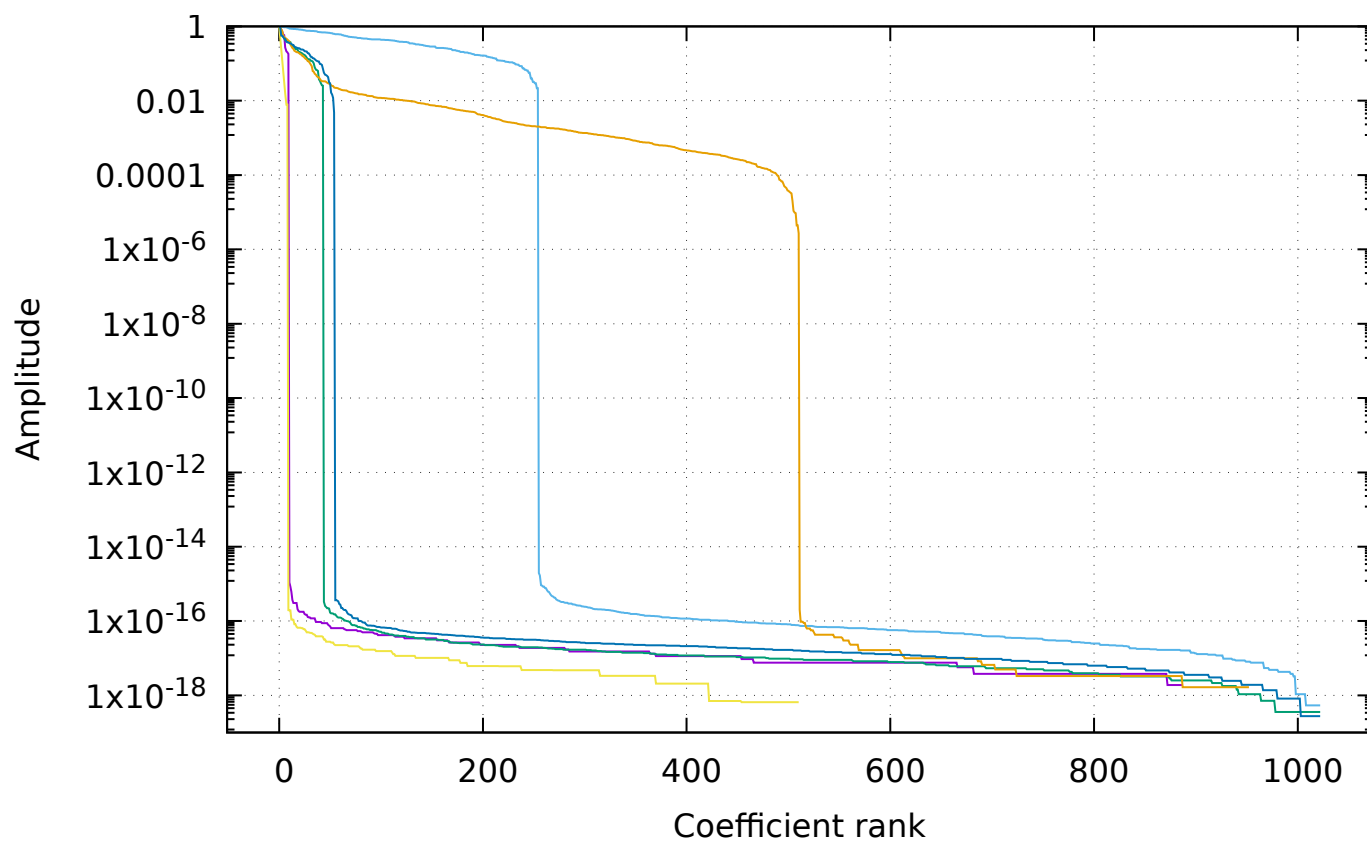
All functions



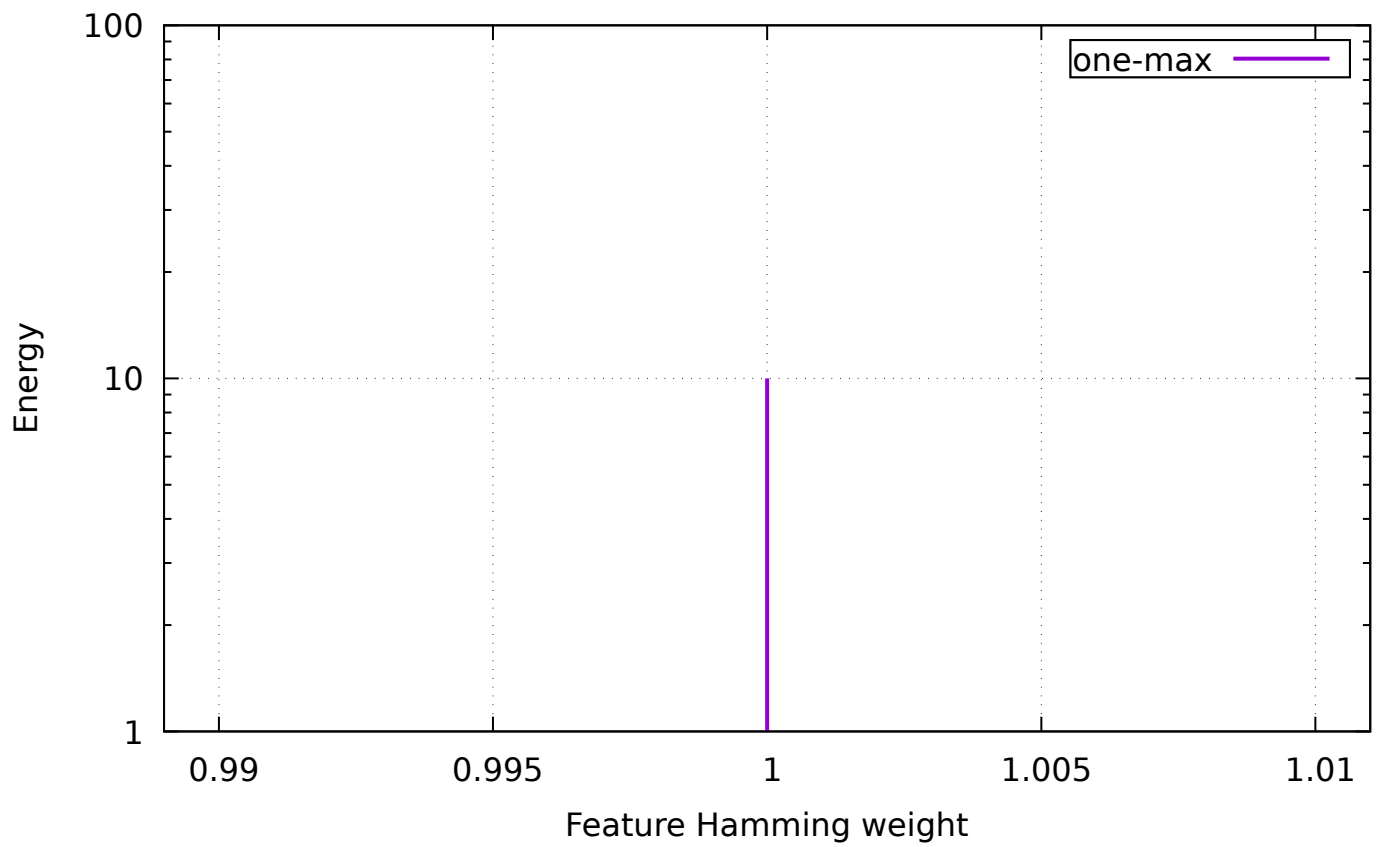
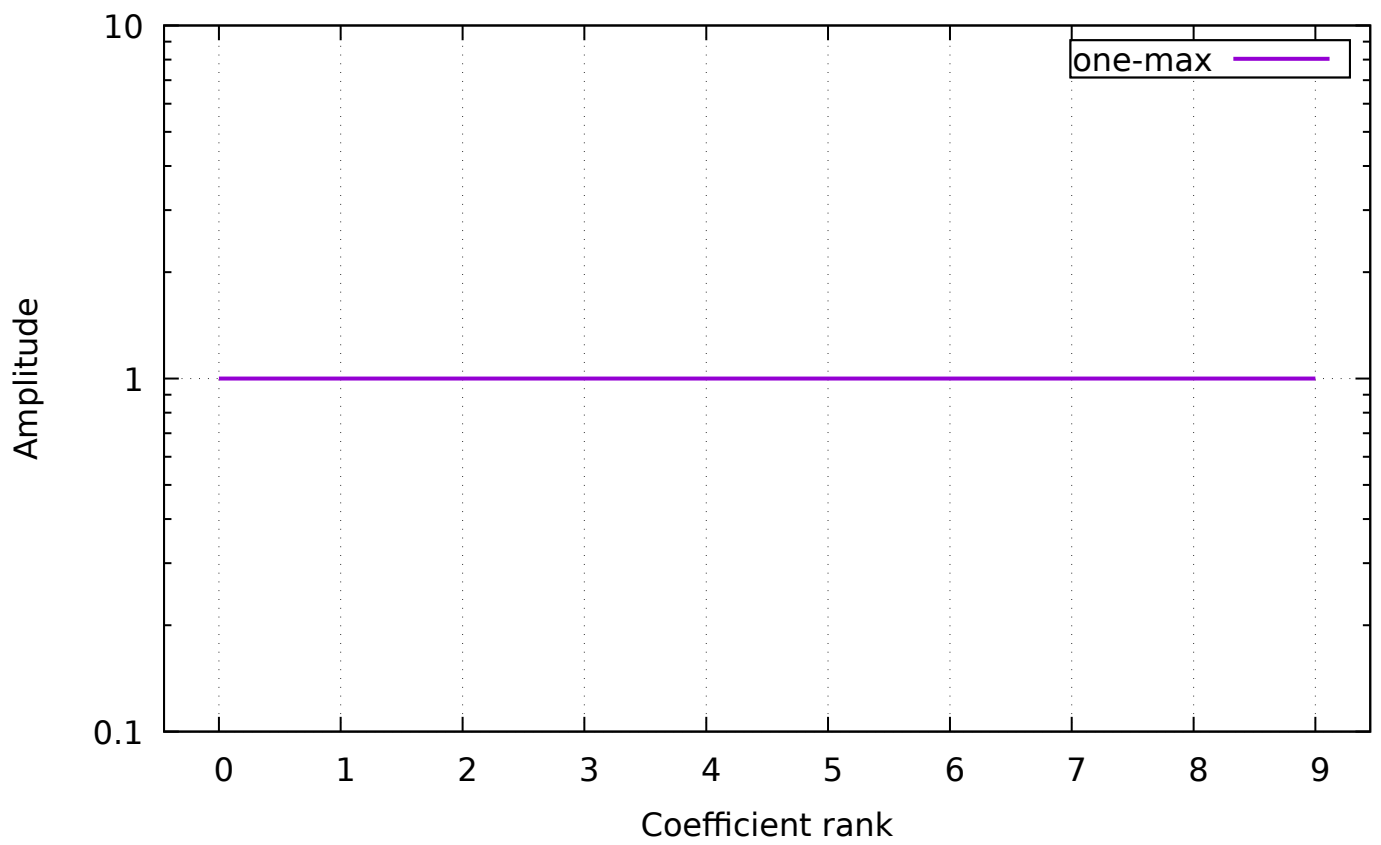
2 group1



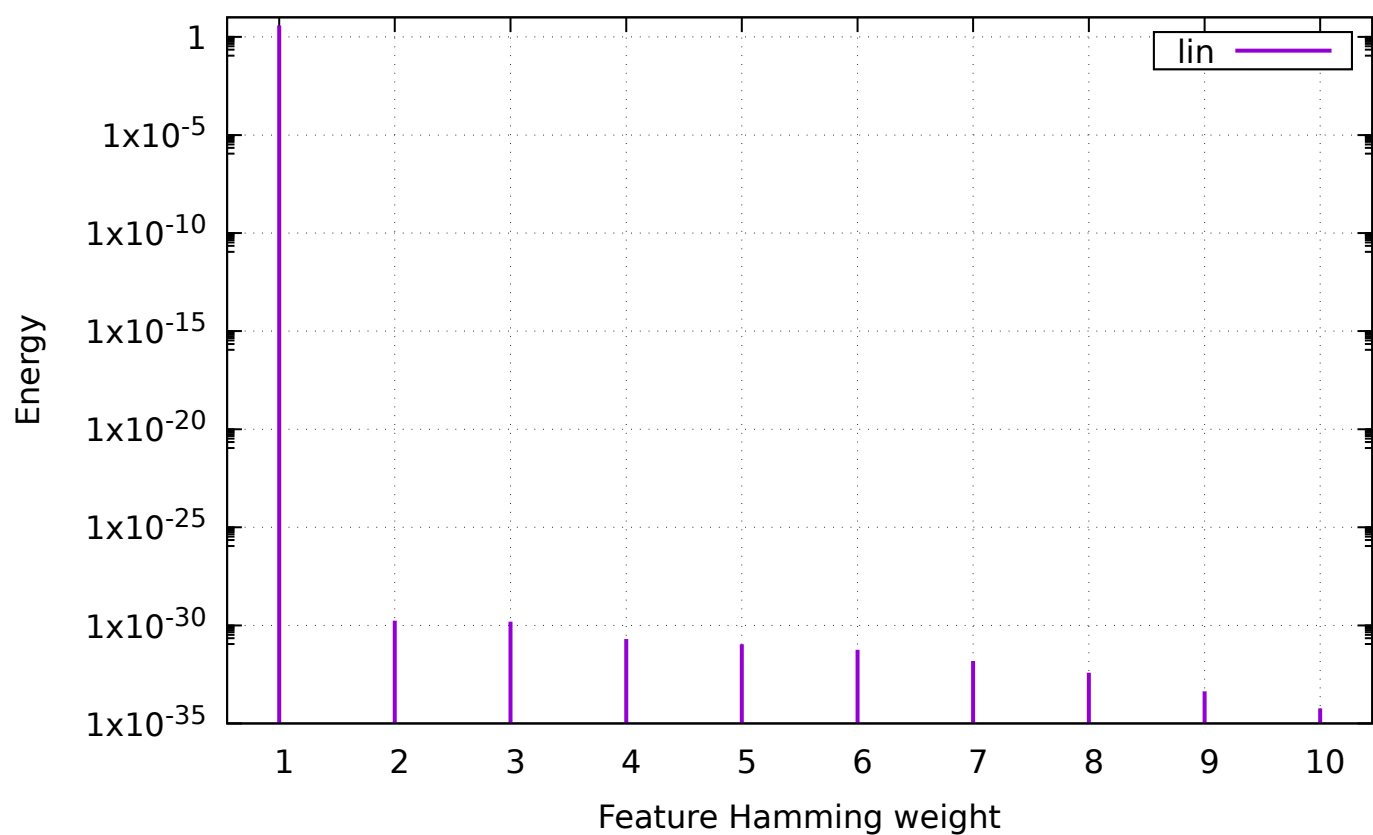
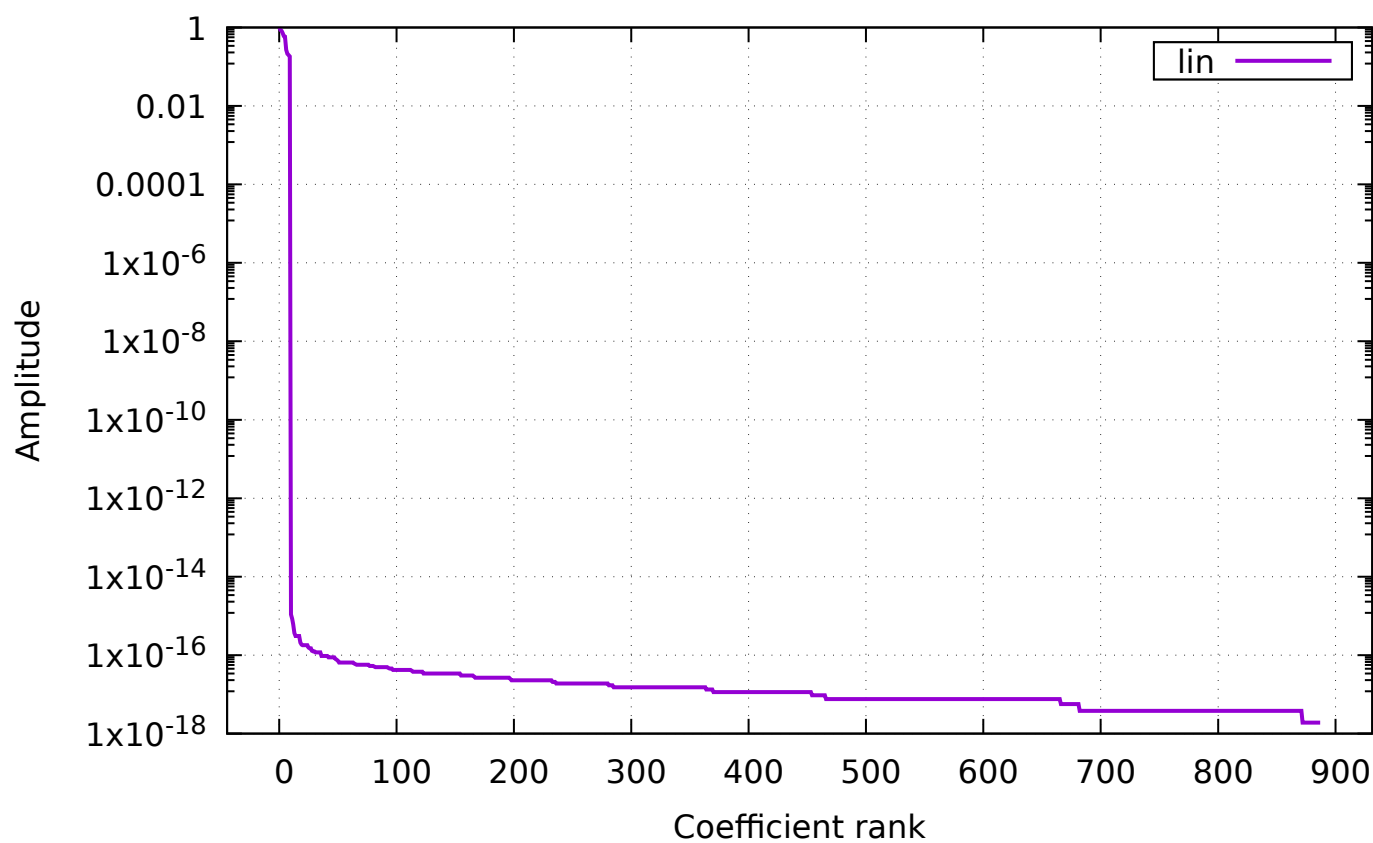
3 group2



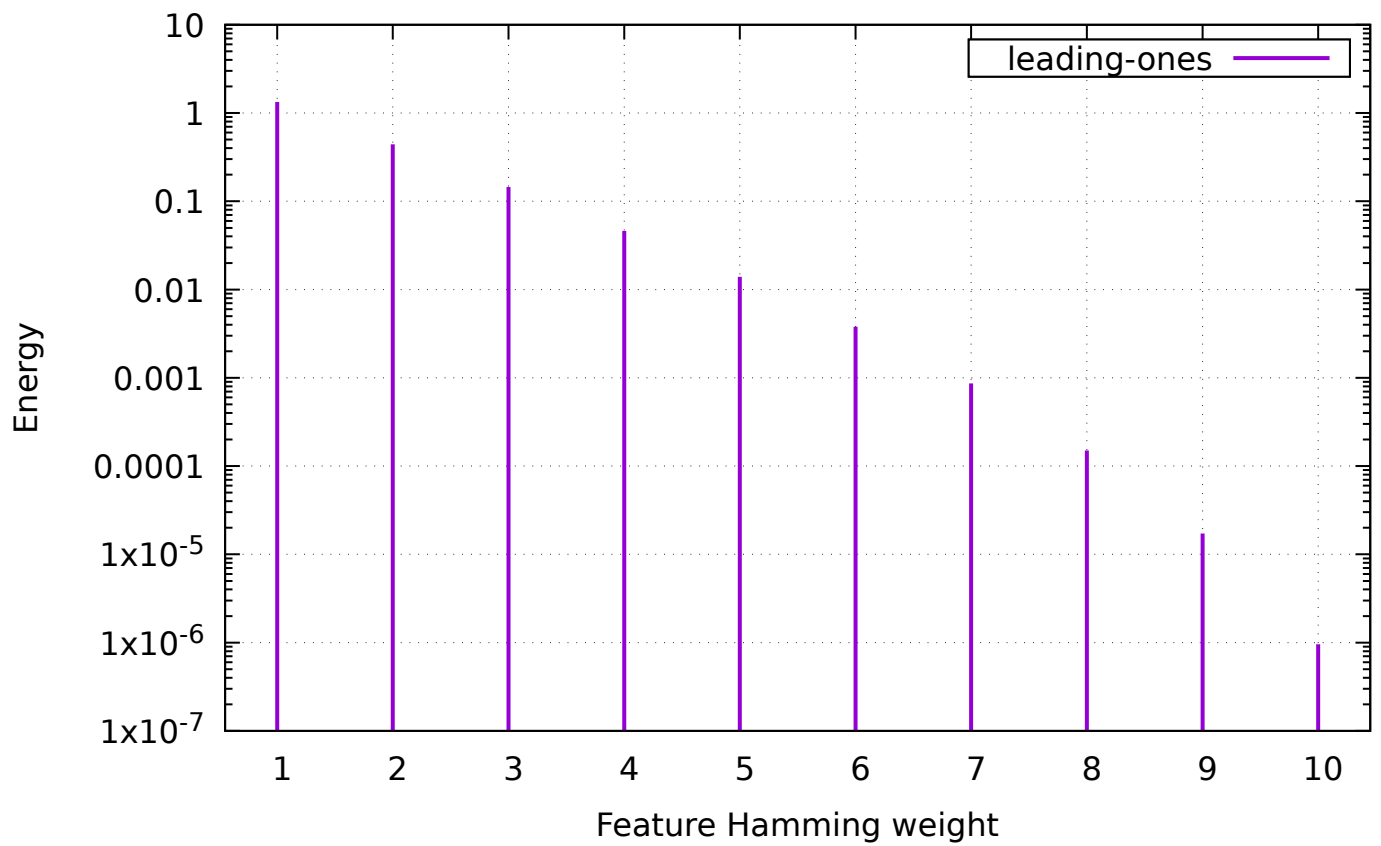
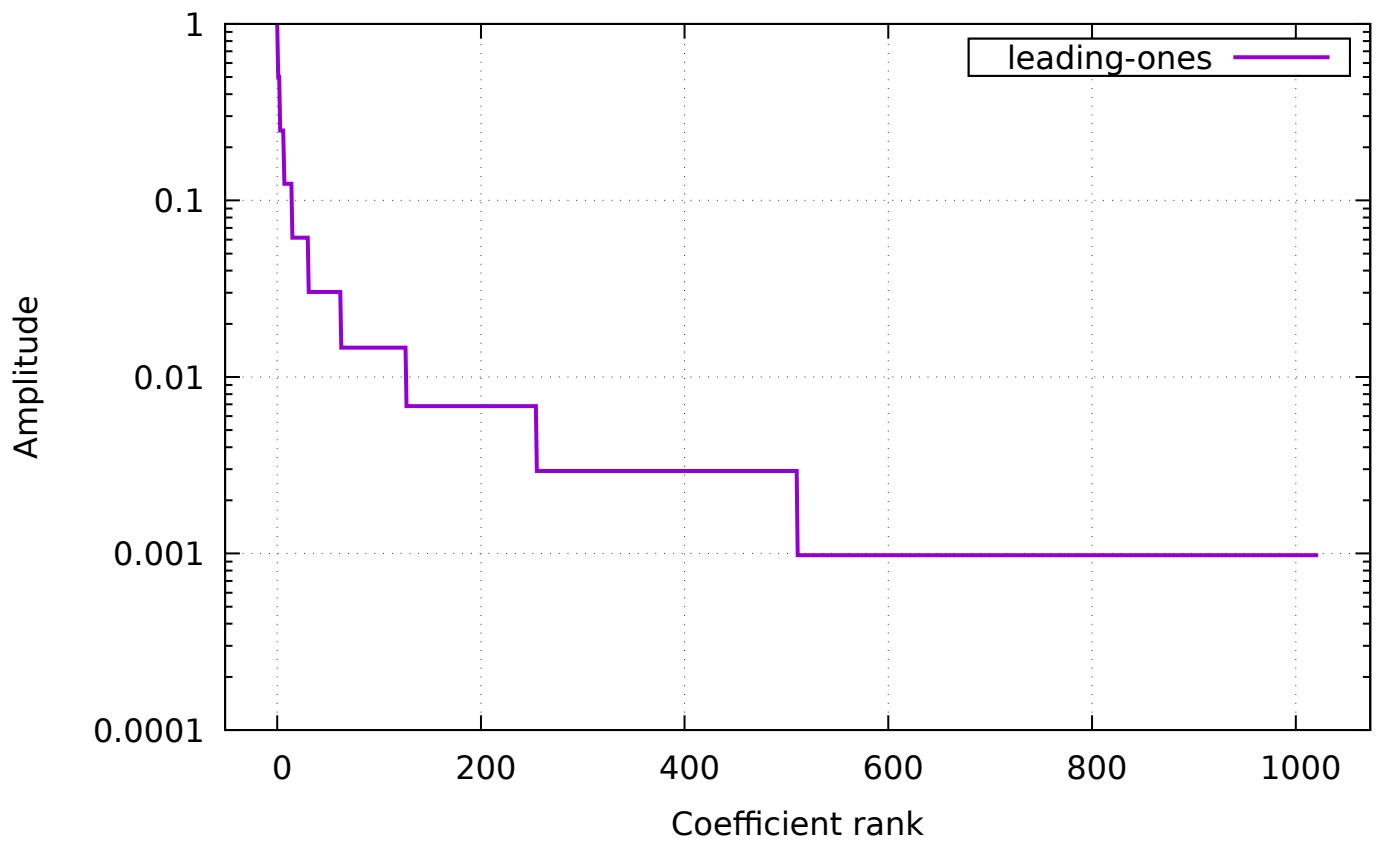
4 one-max



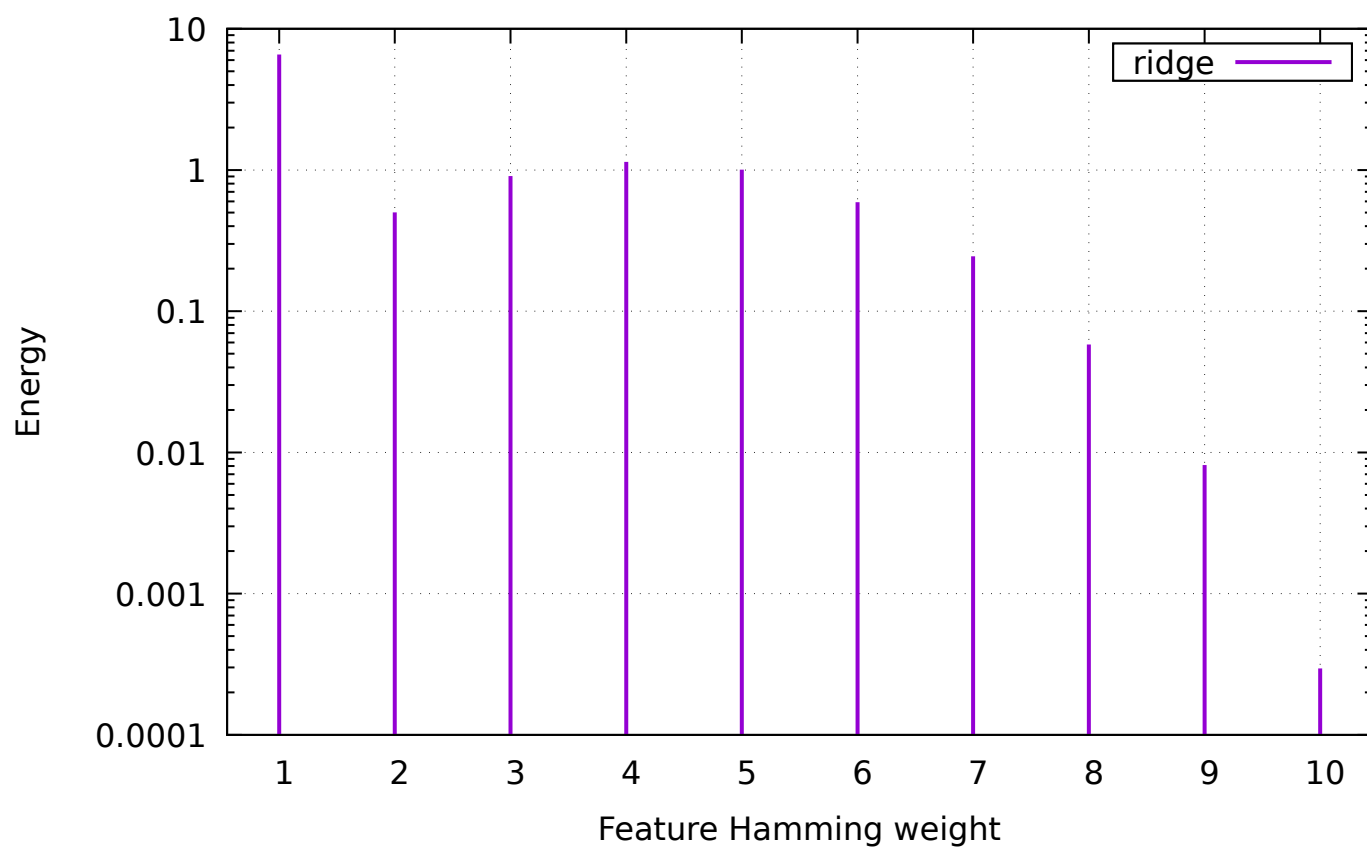
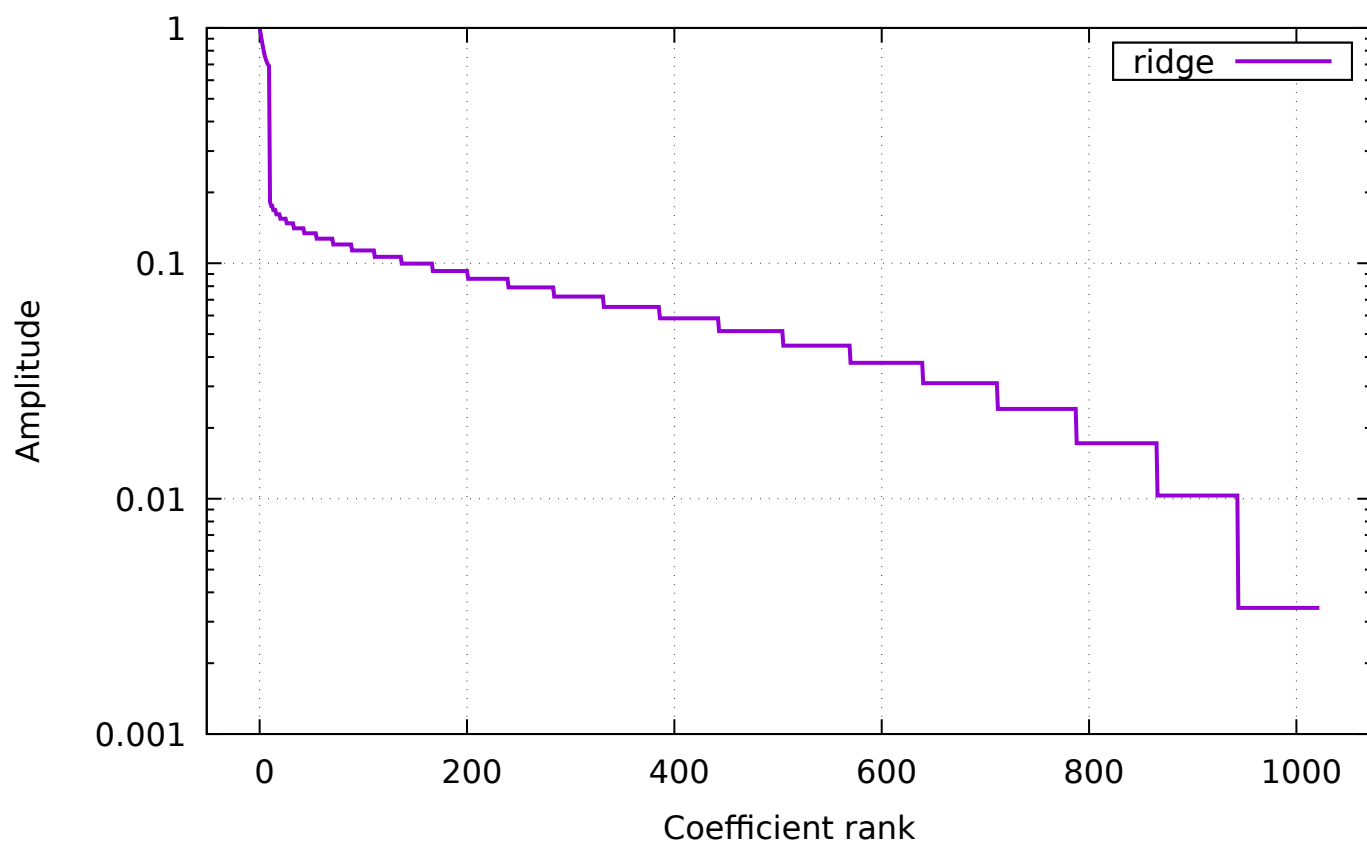
5 lin



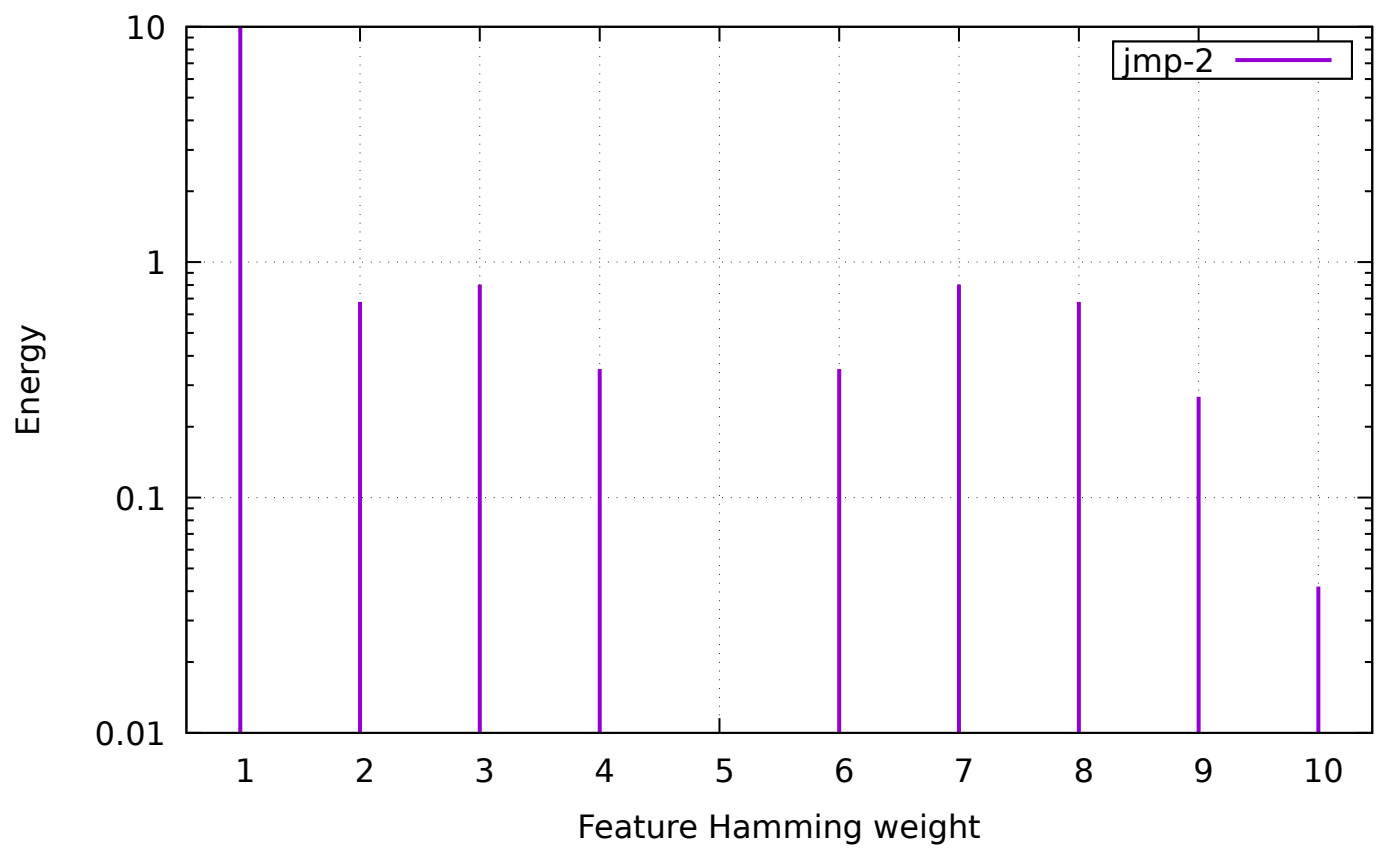
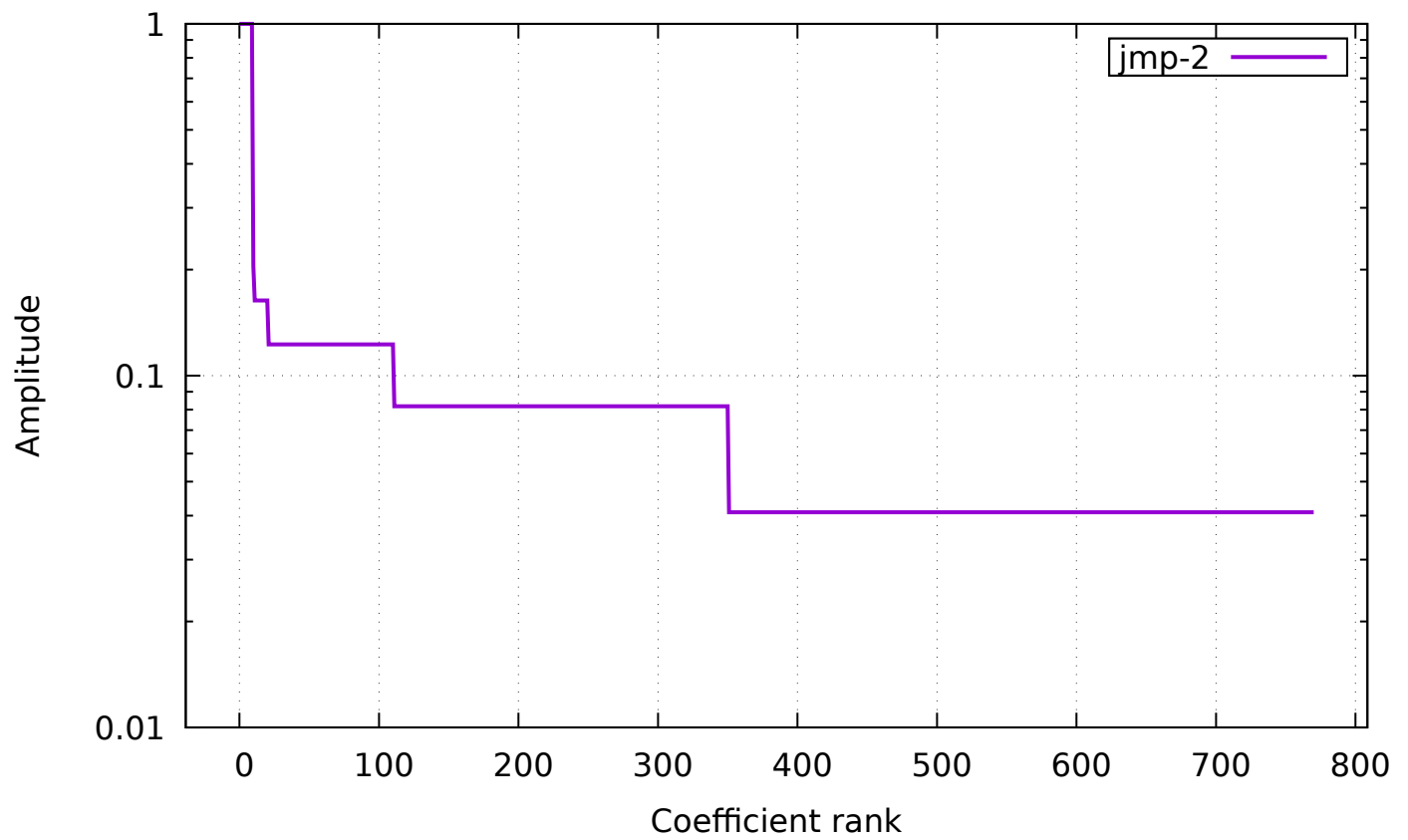
6 leading-ones



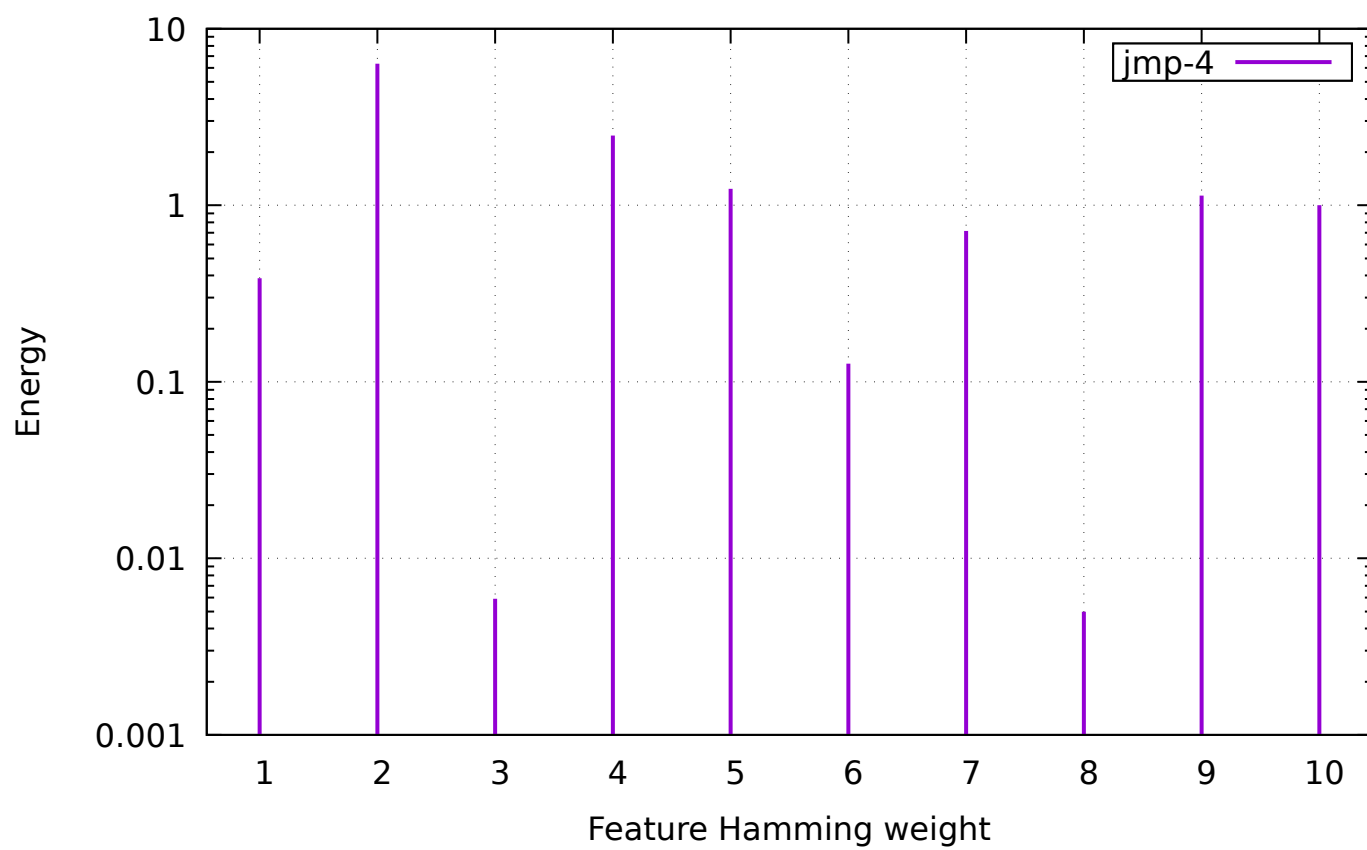
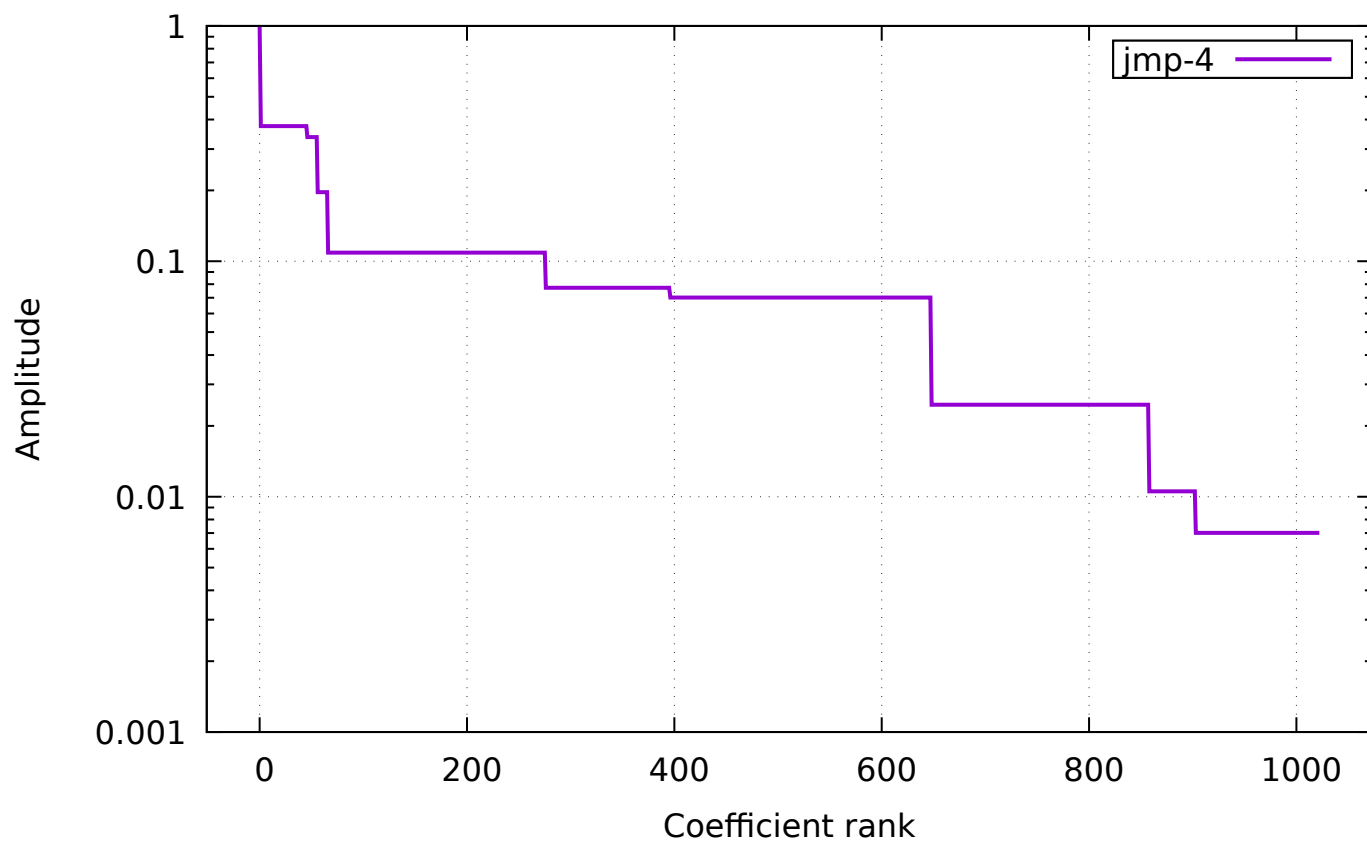
7 ridge



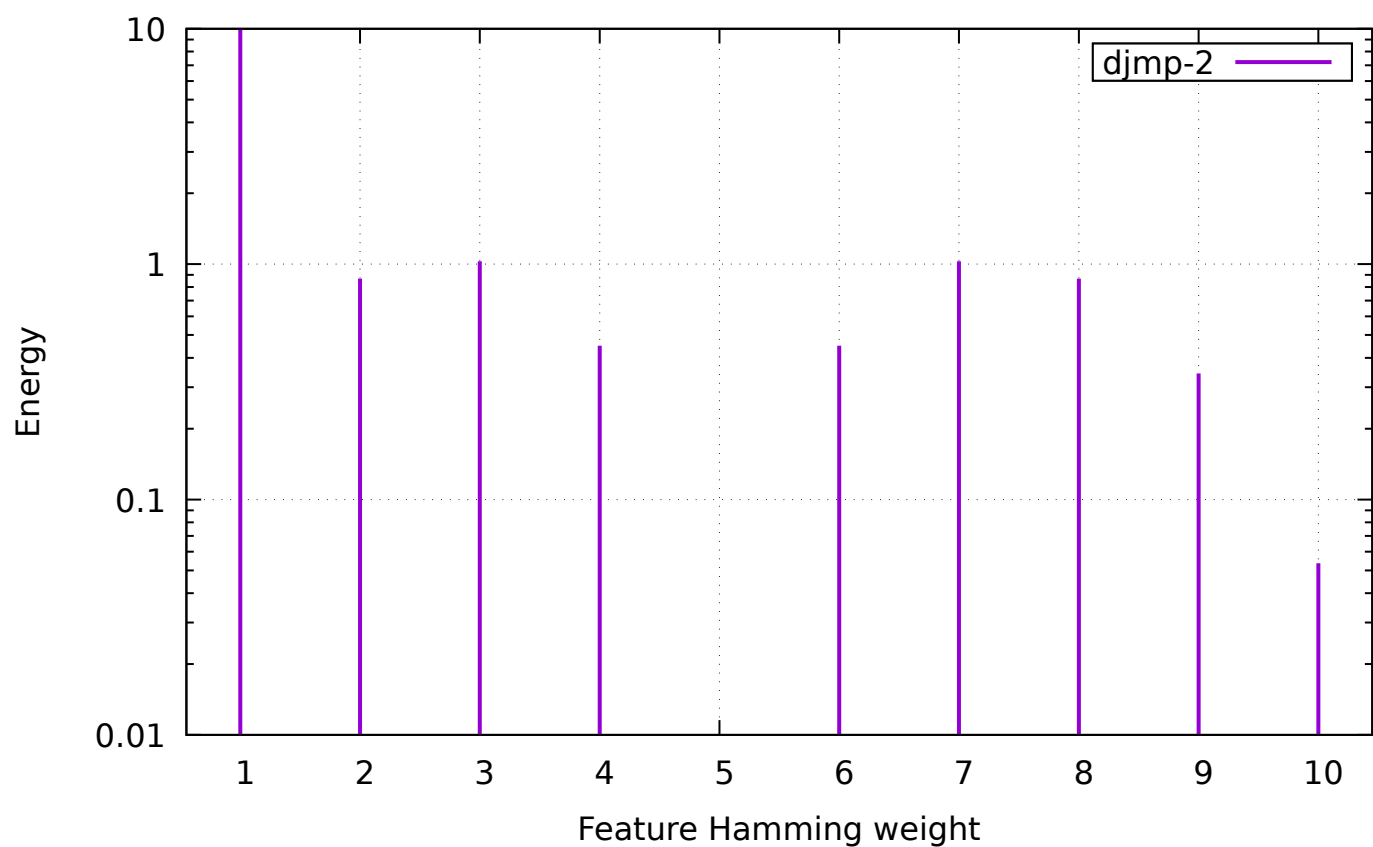
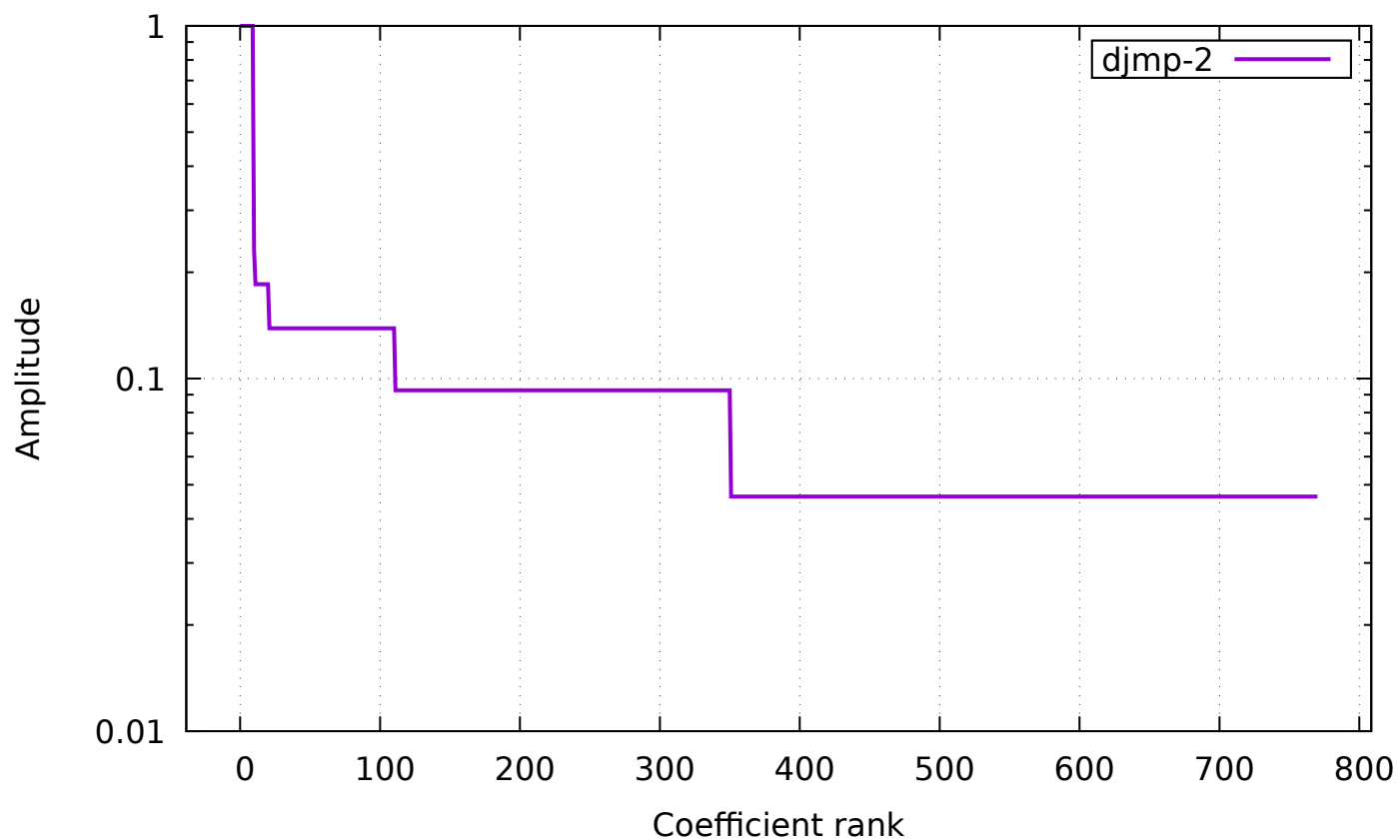
8 jmp-2



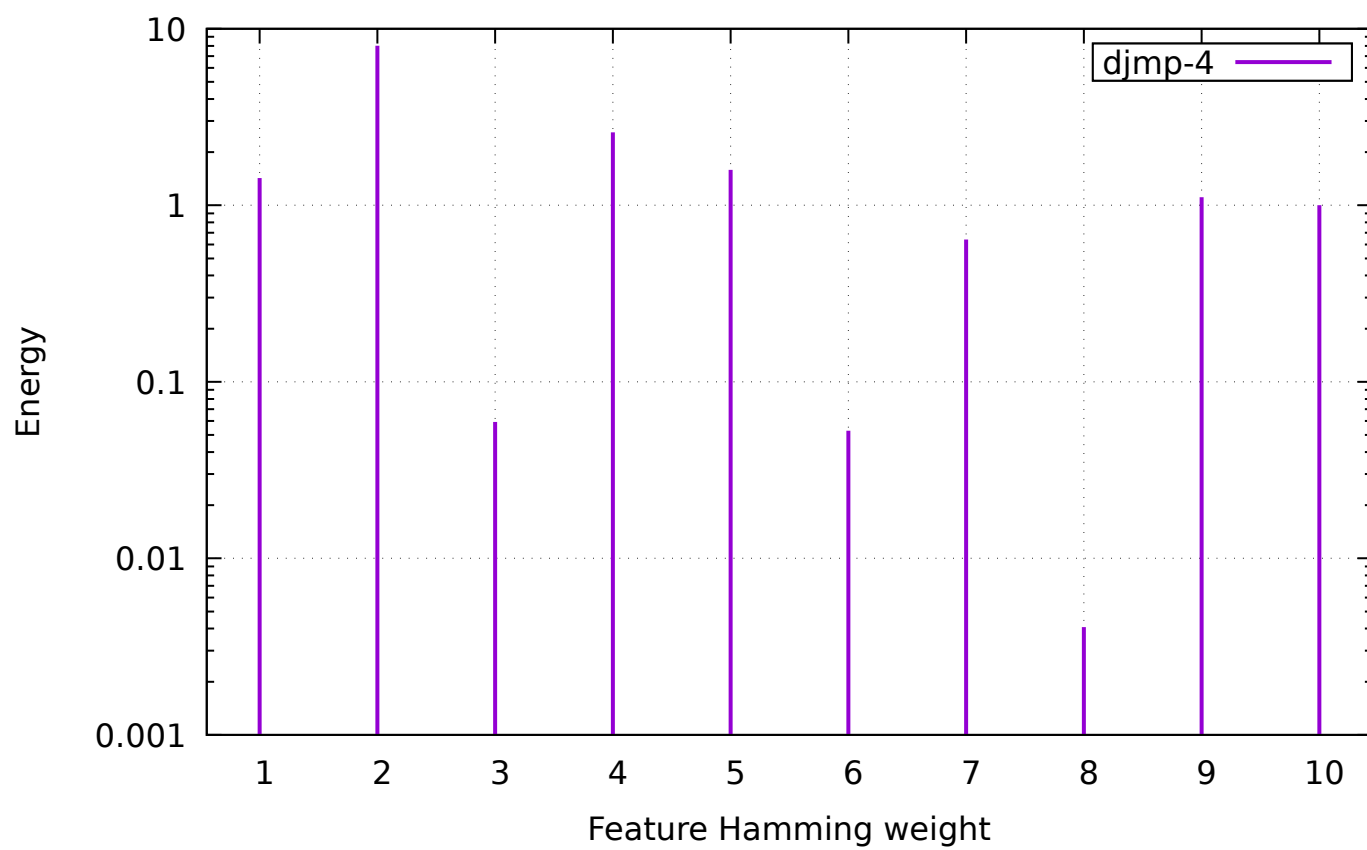
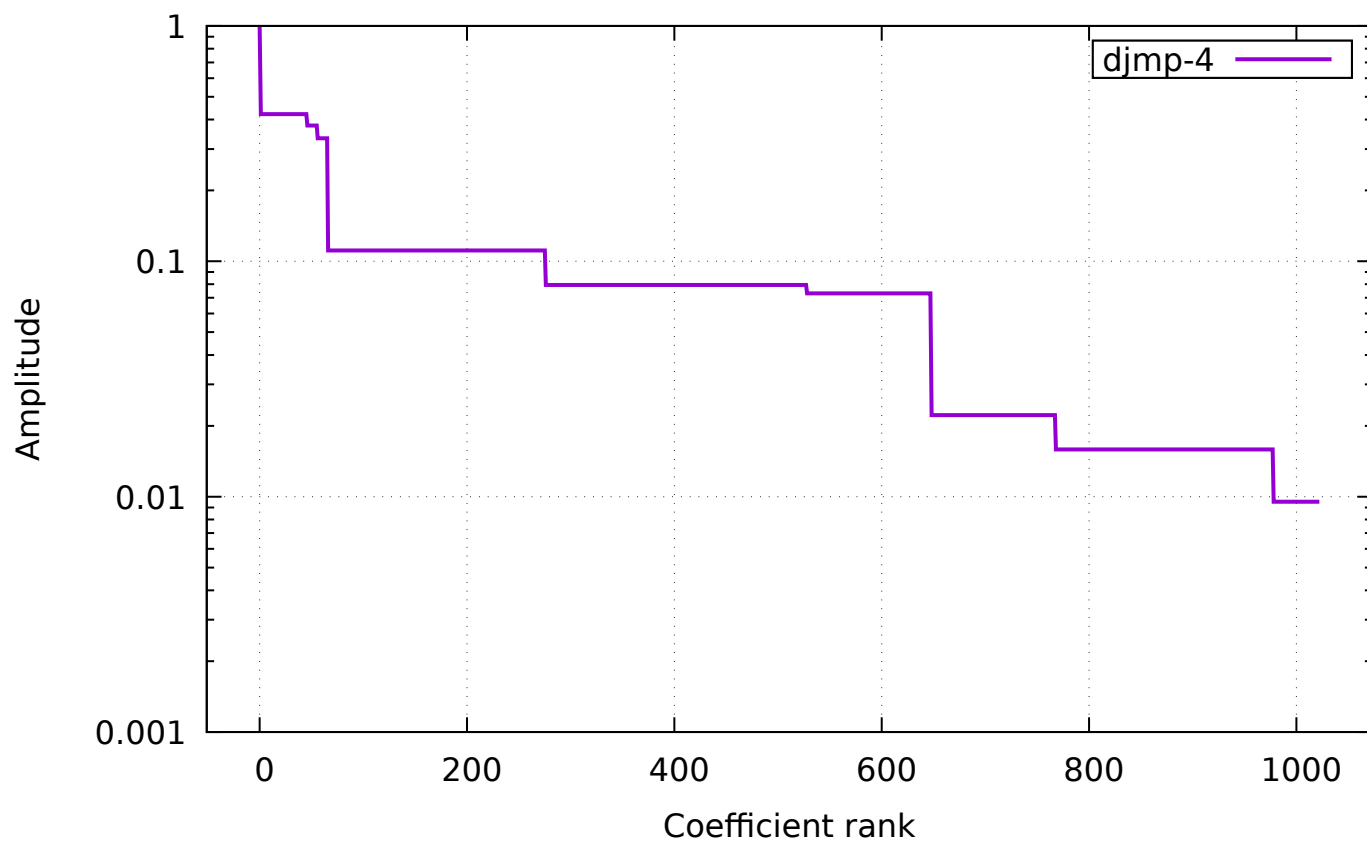
9 jmp-4

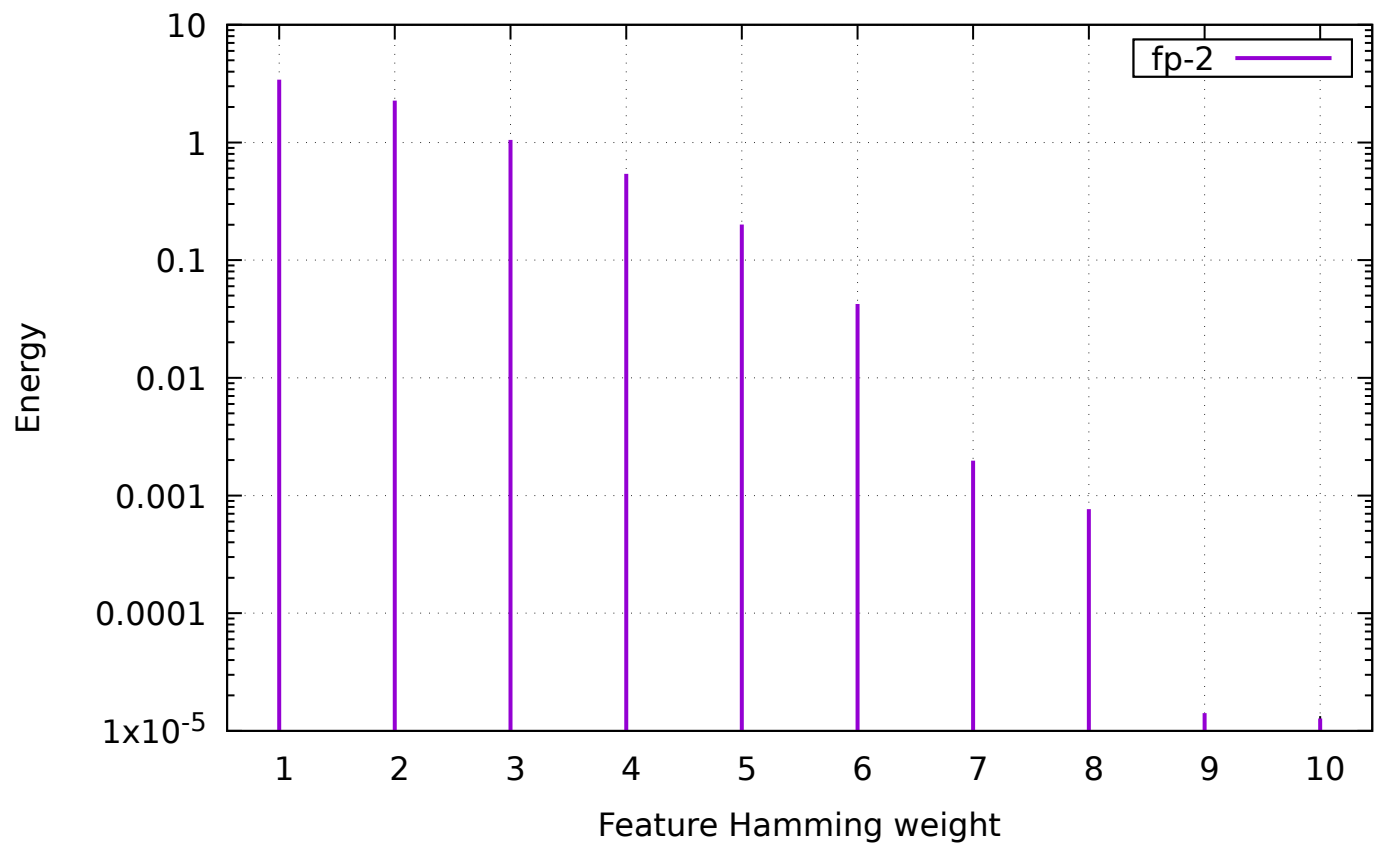
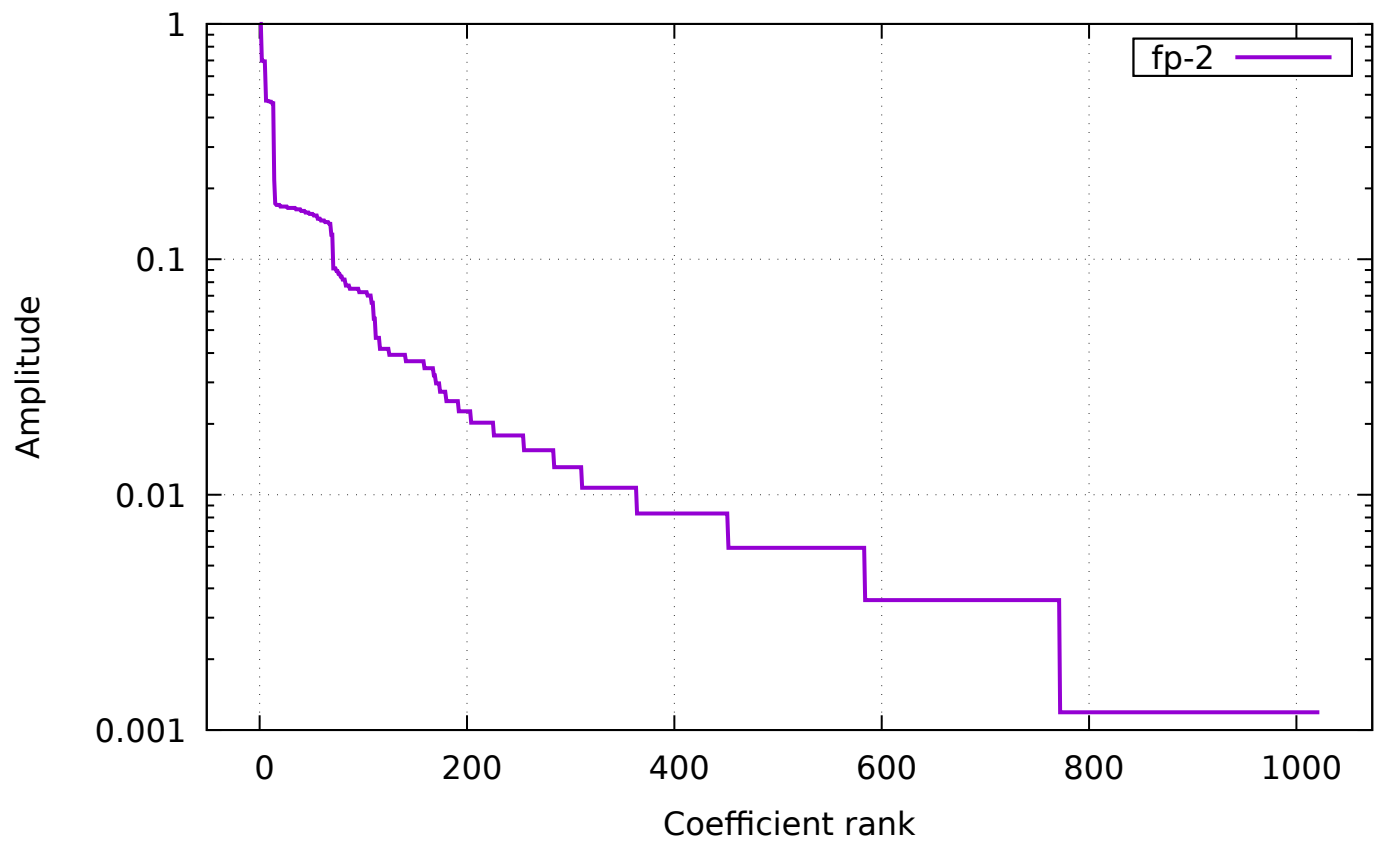


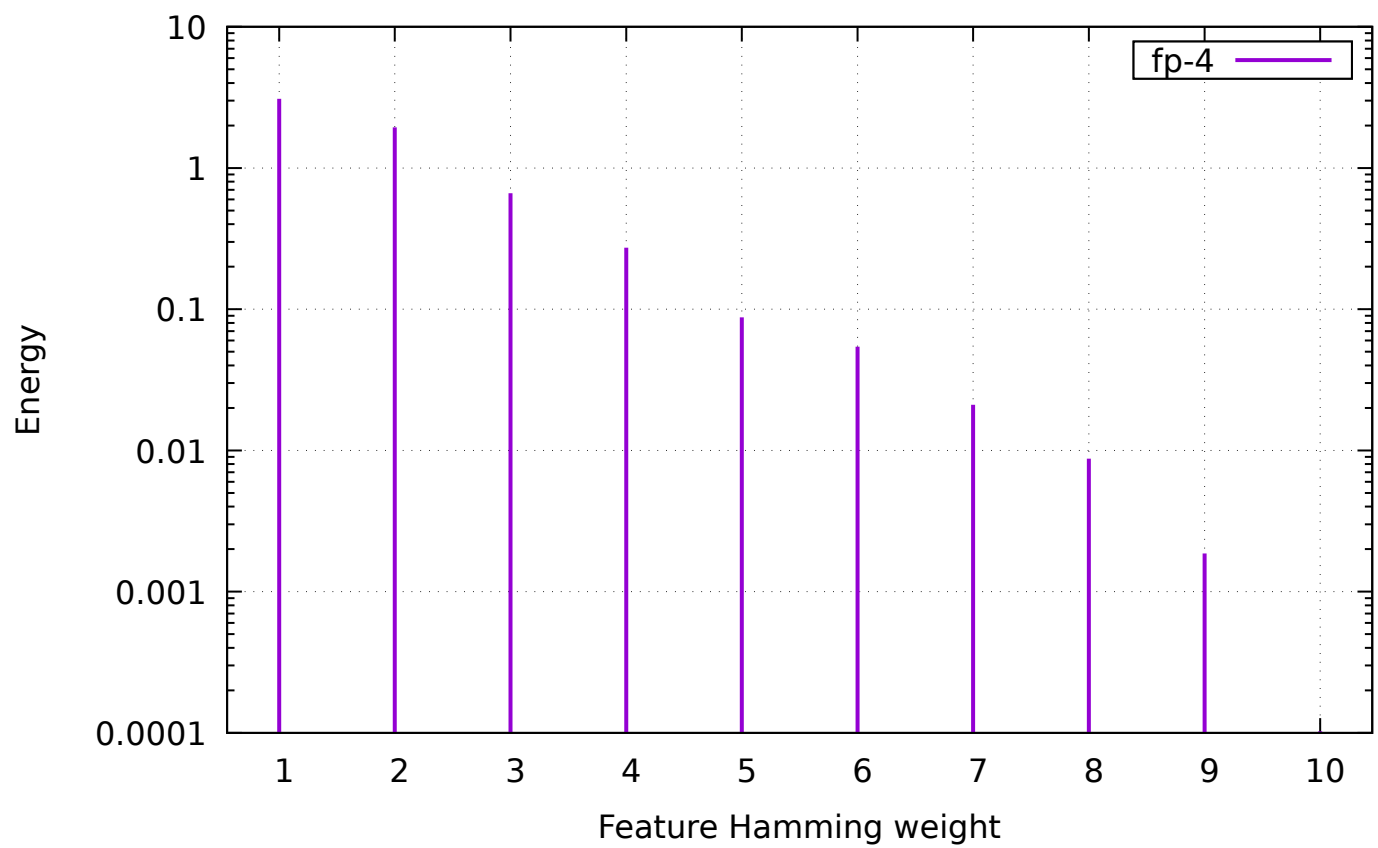
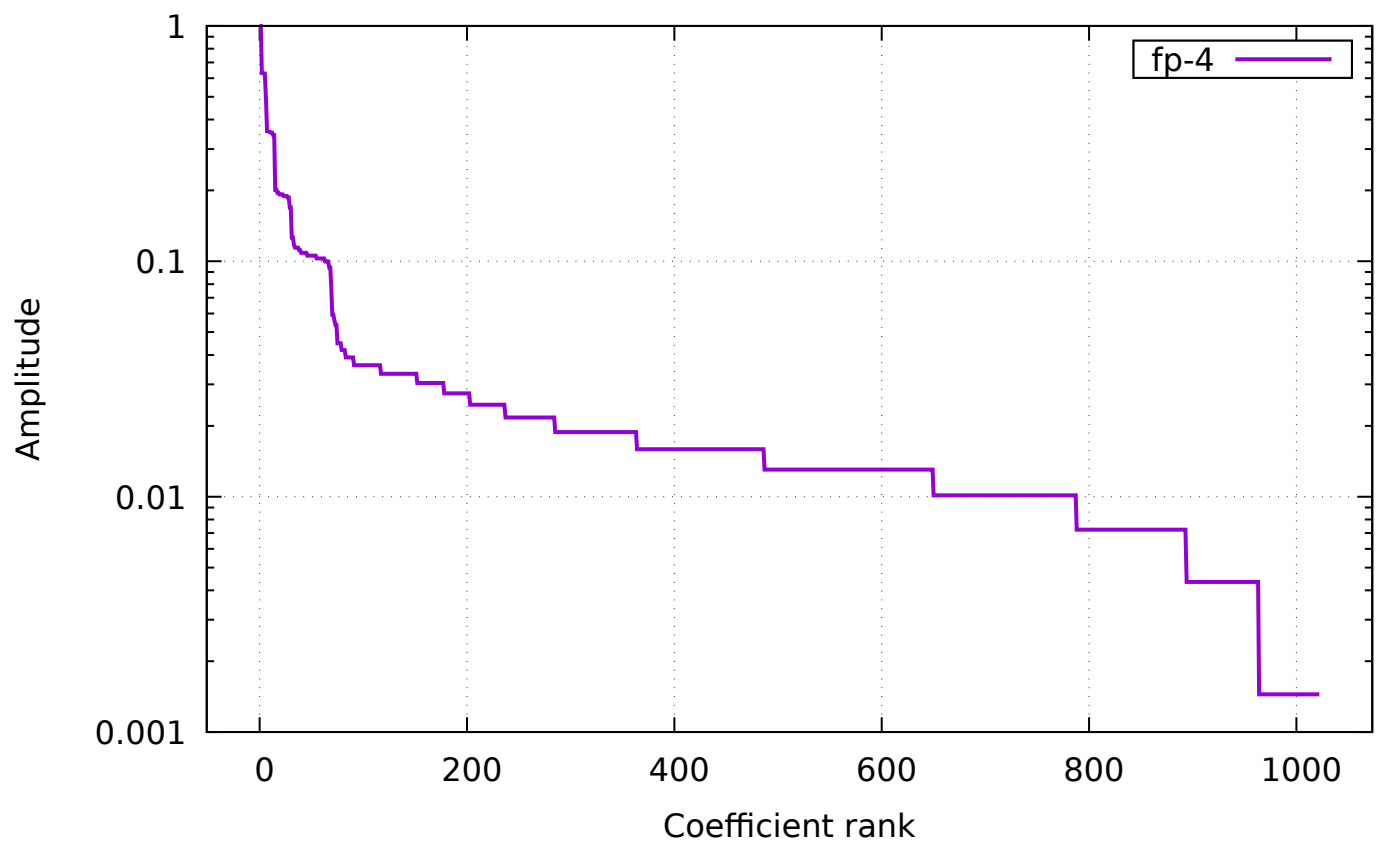
10 djmp-2



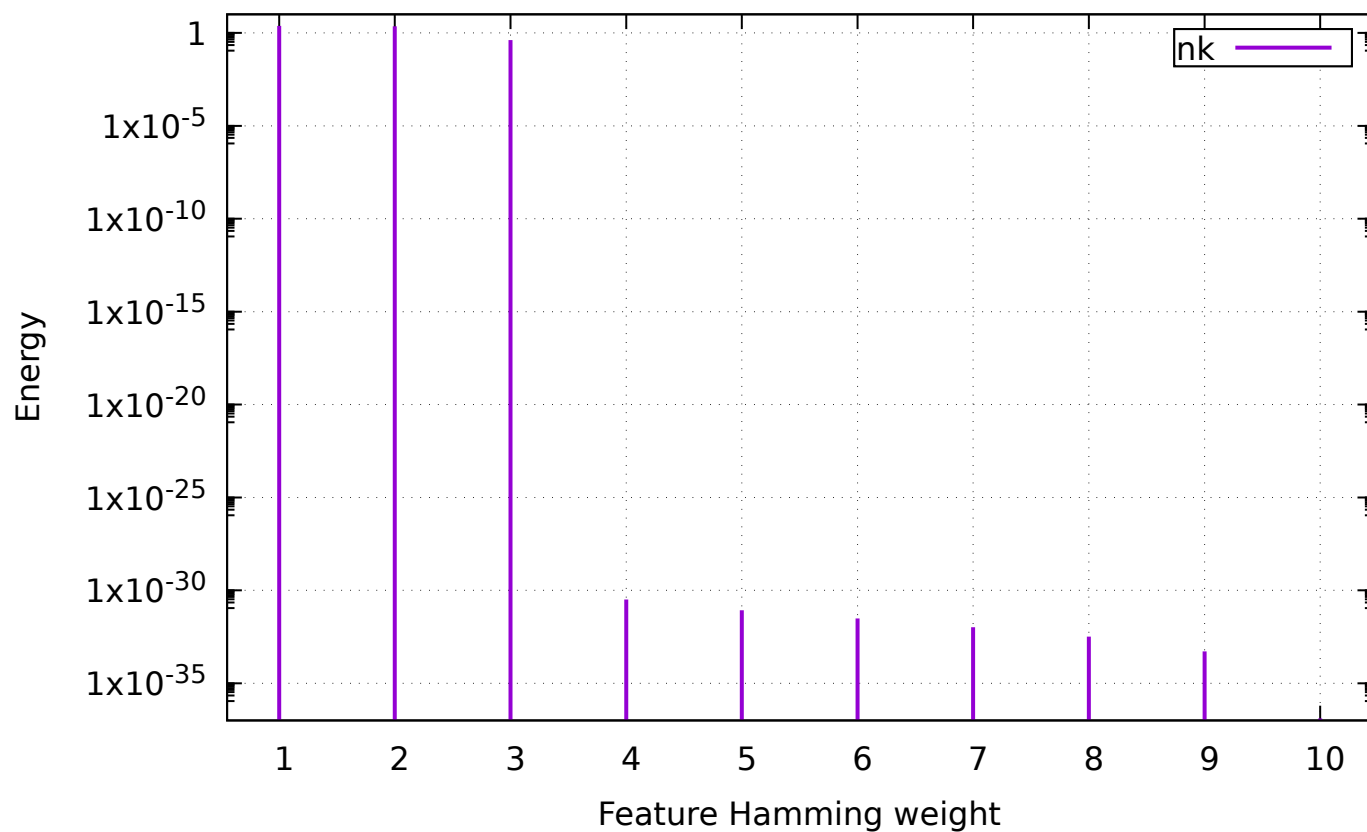
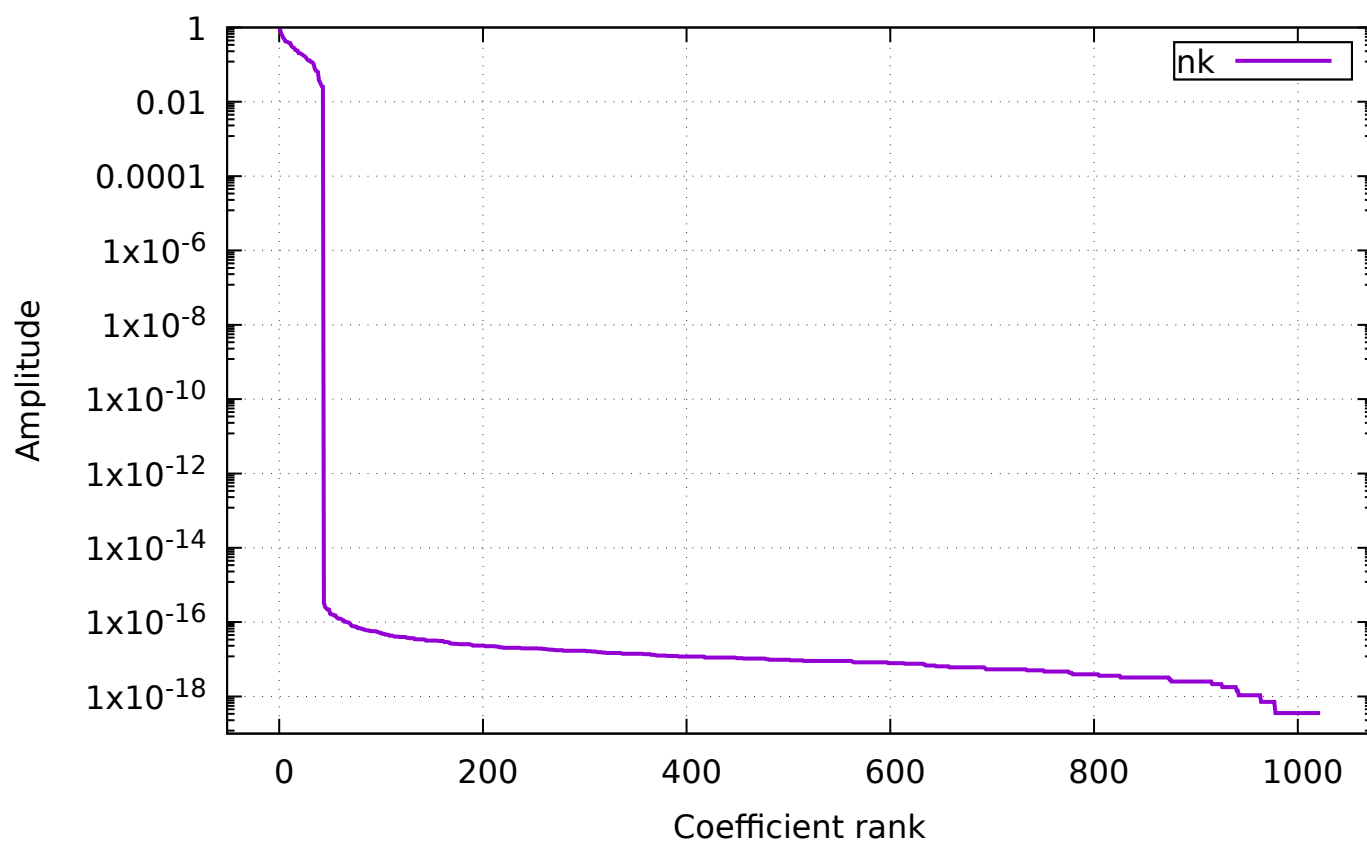
11 djmp-4

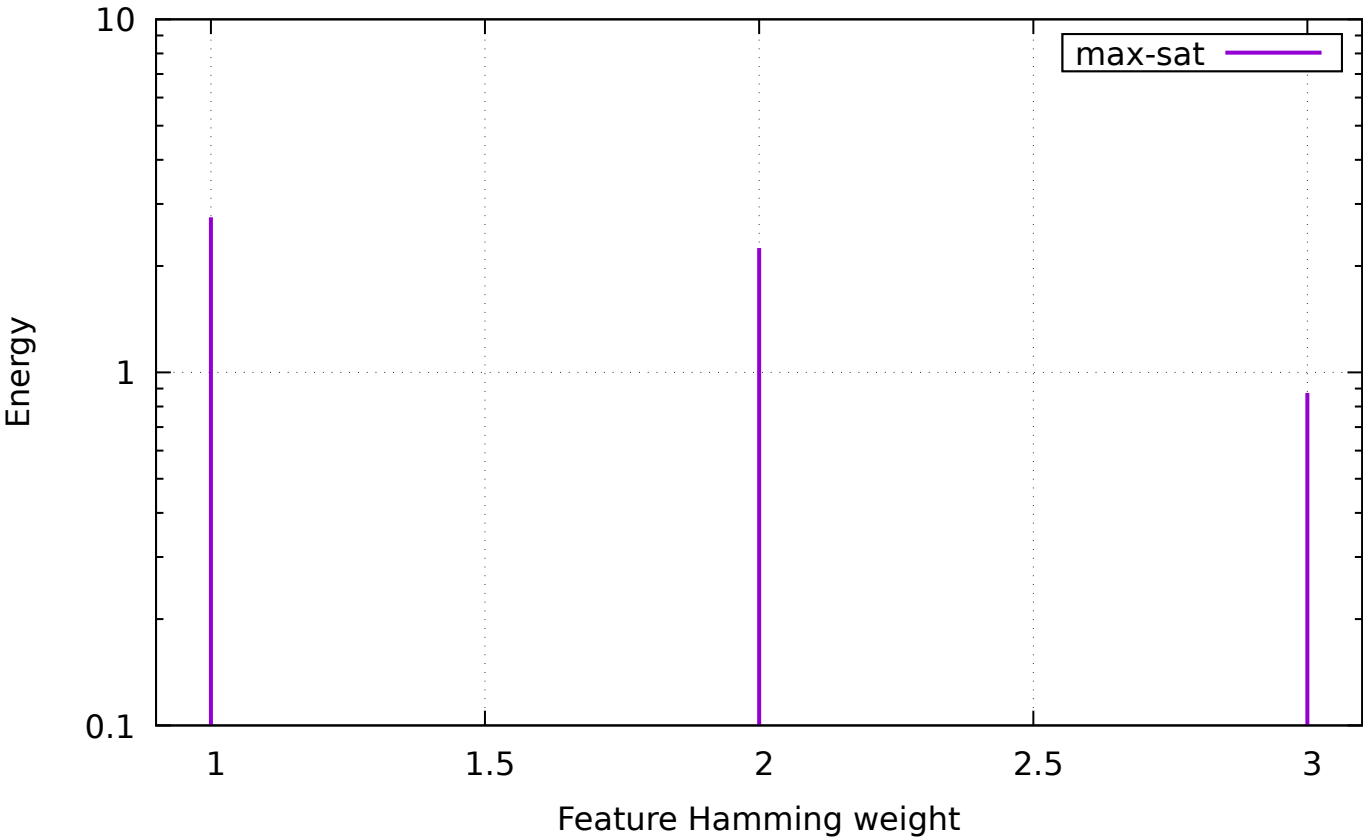
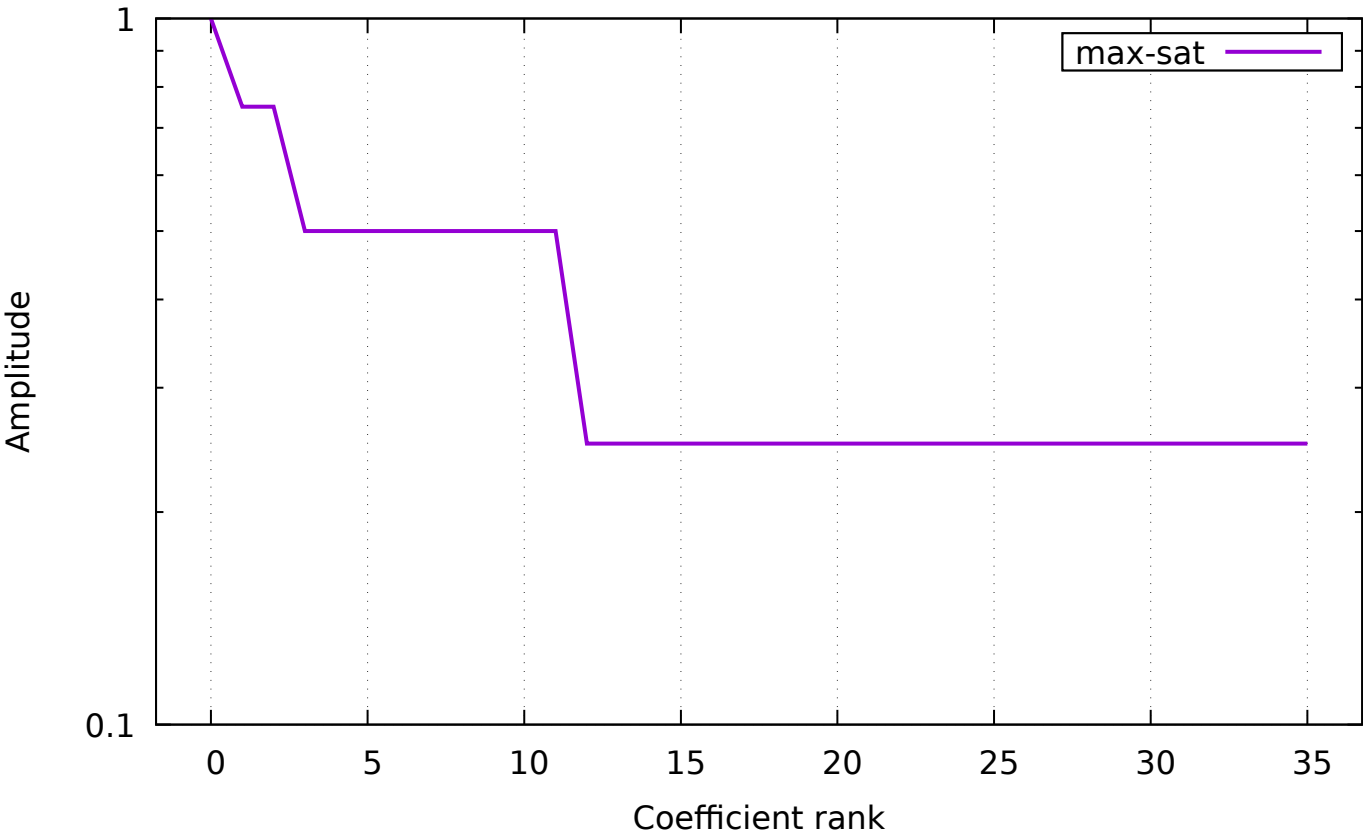




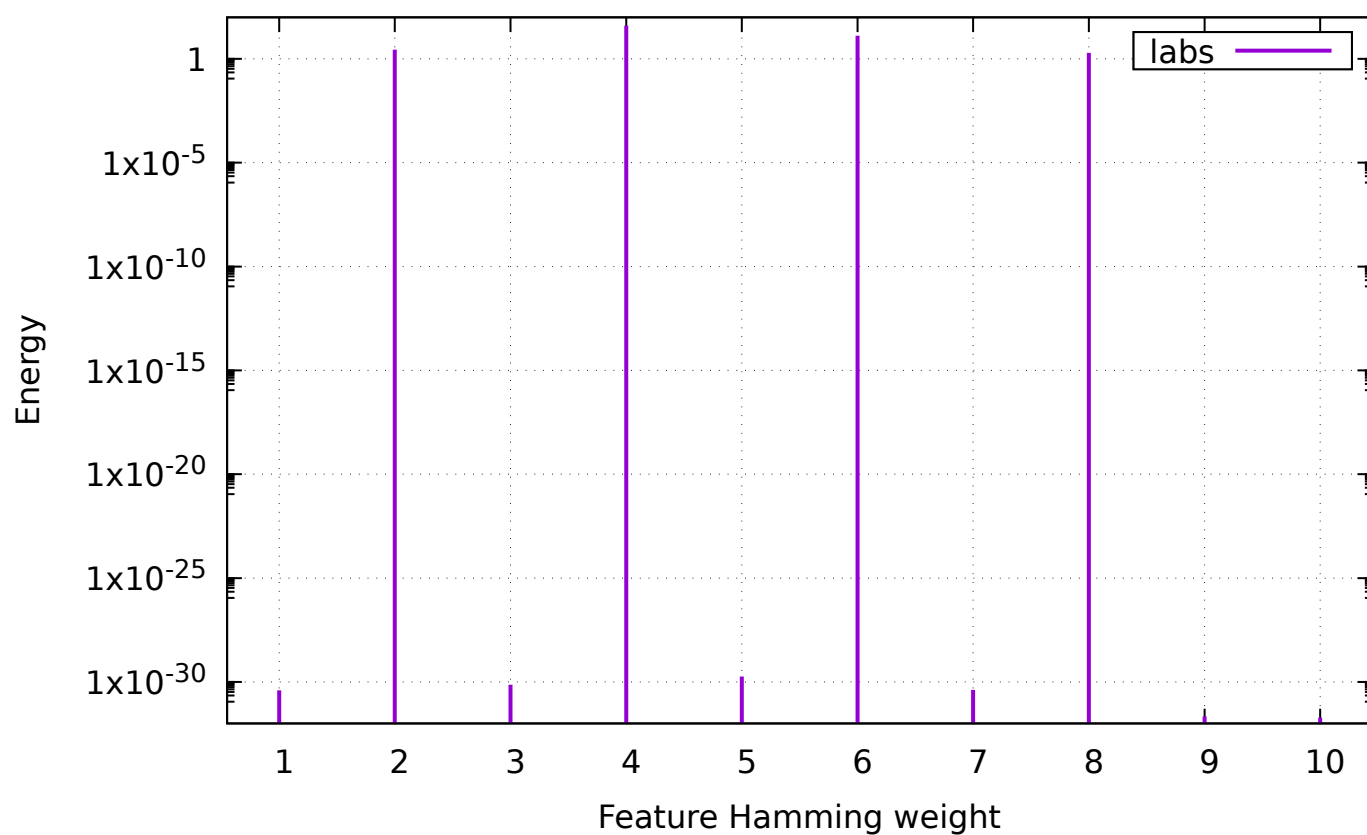
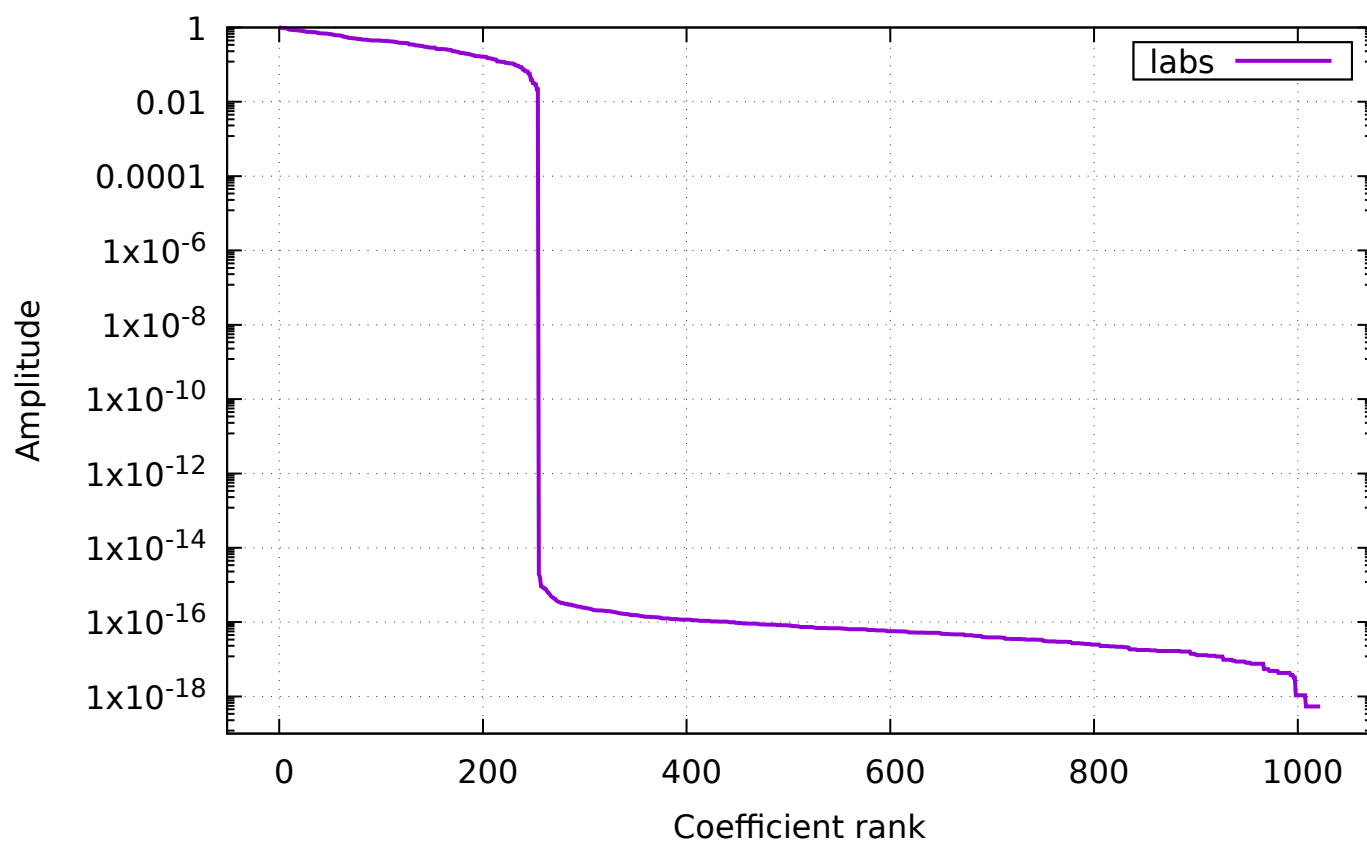


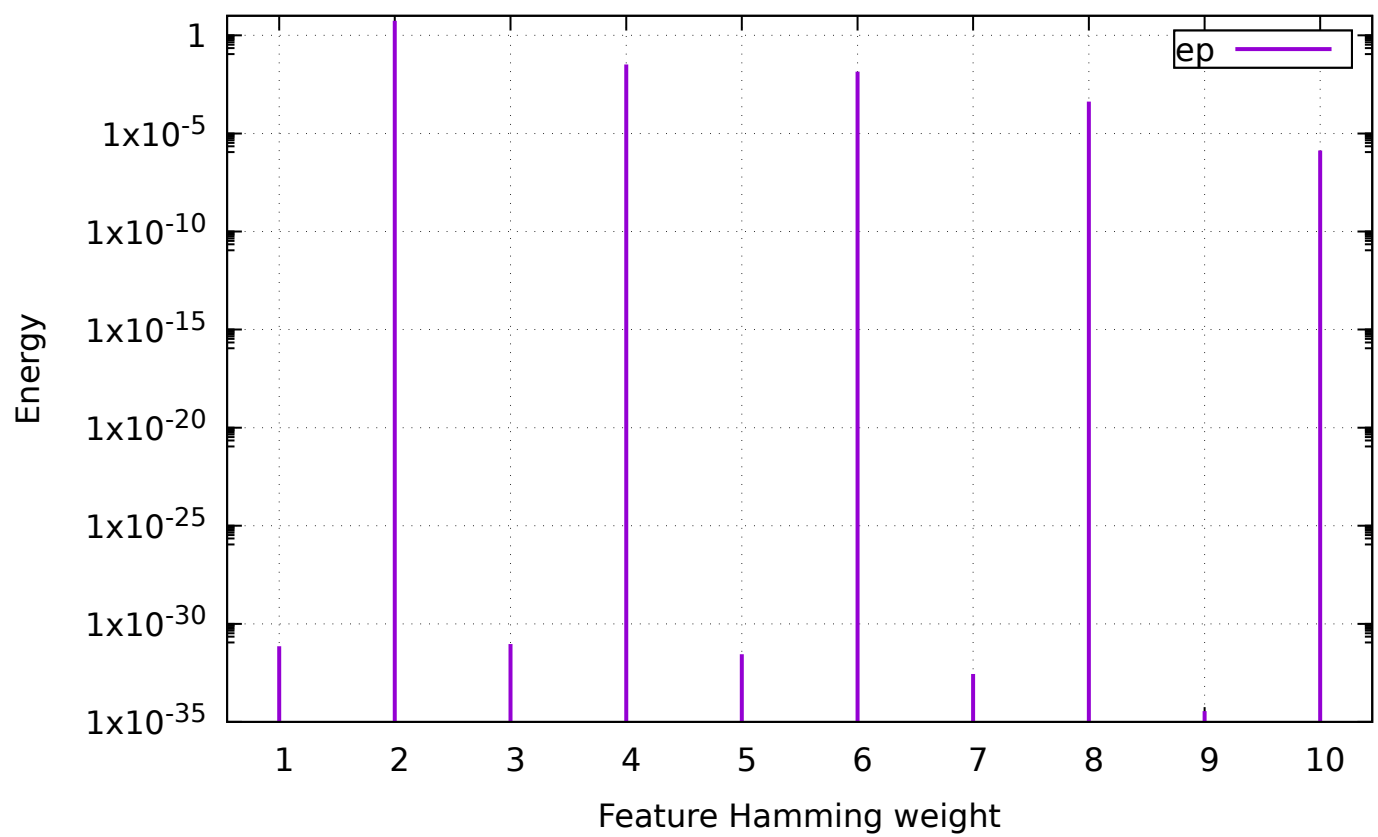
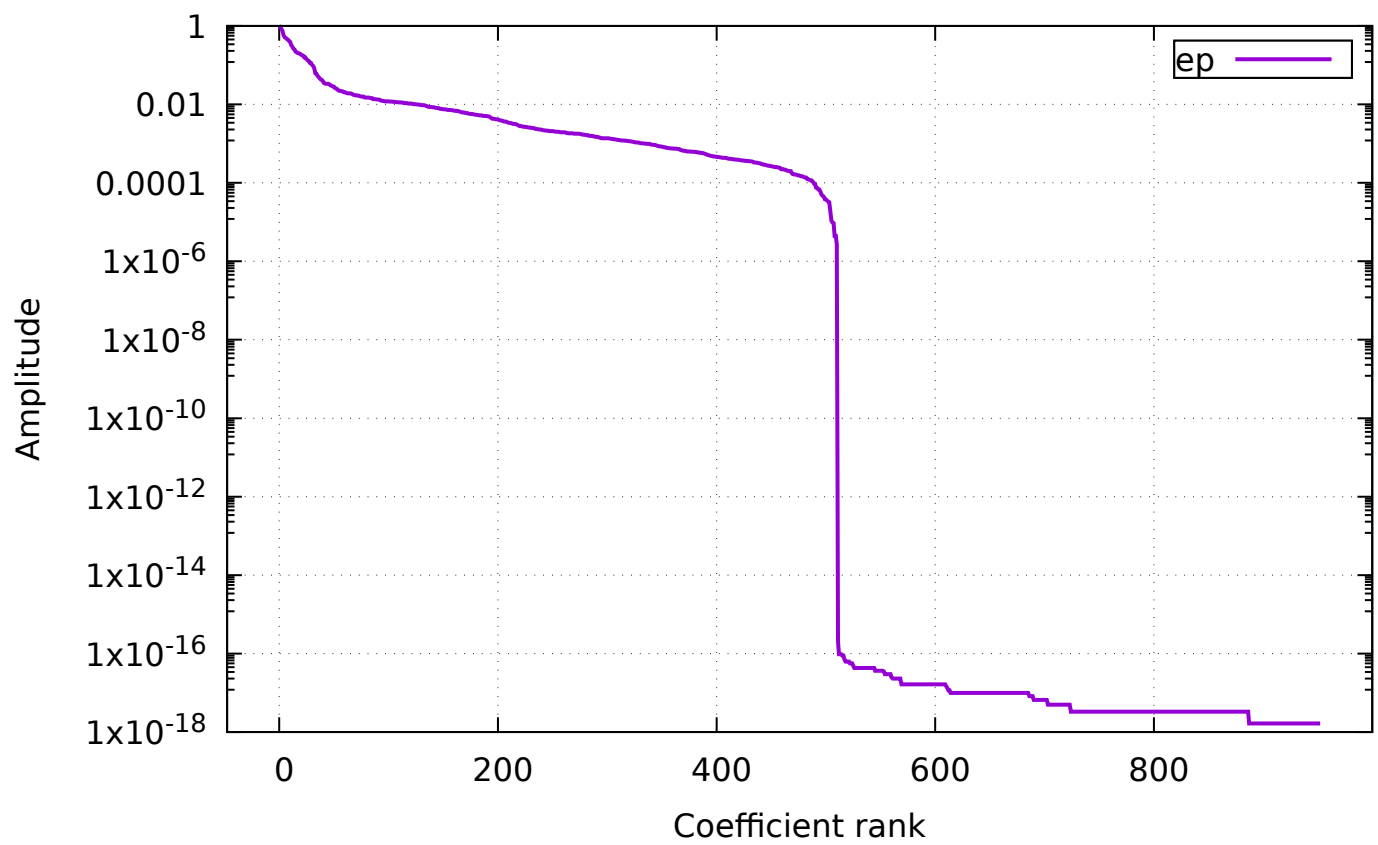
14 nk



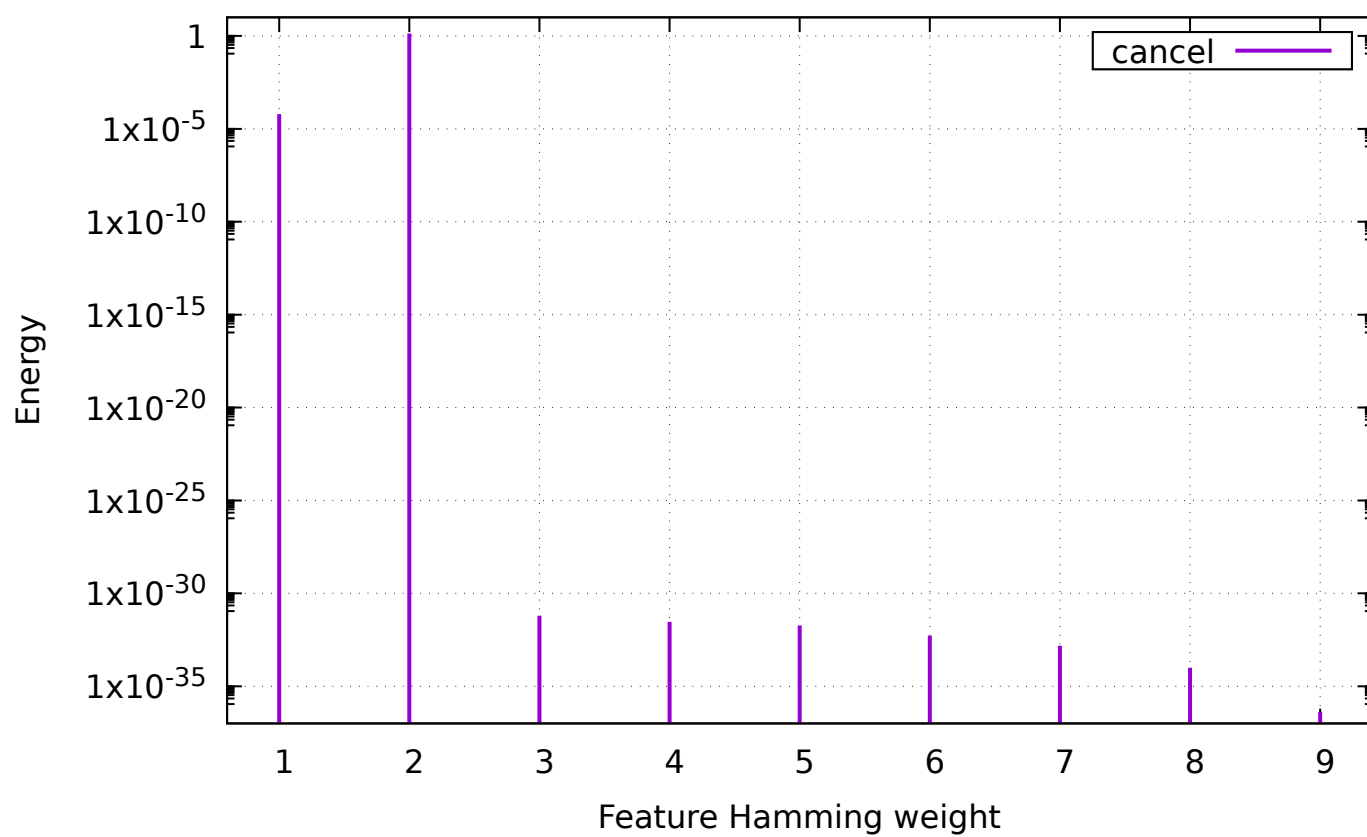
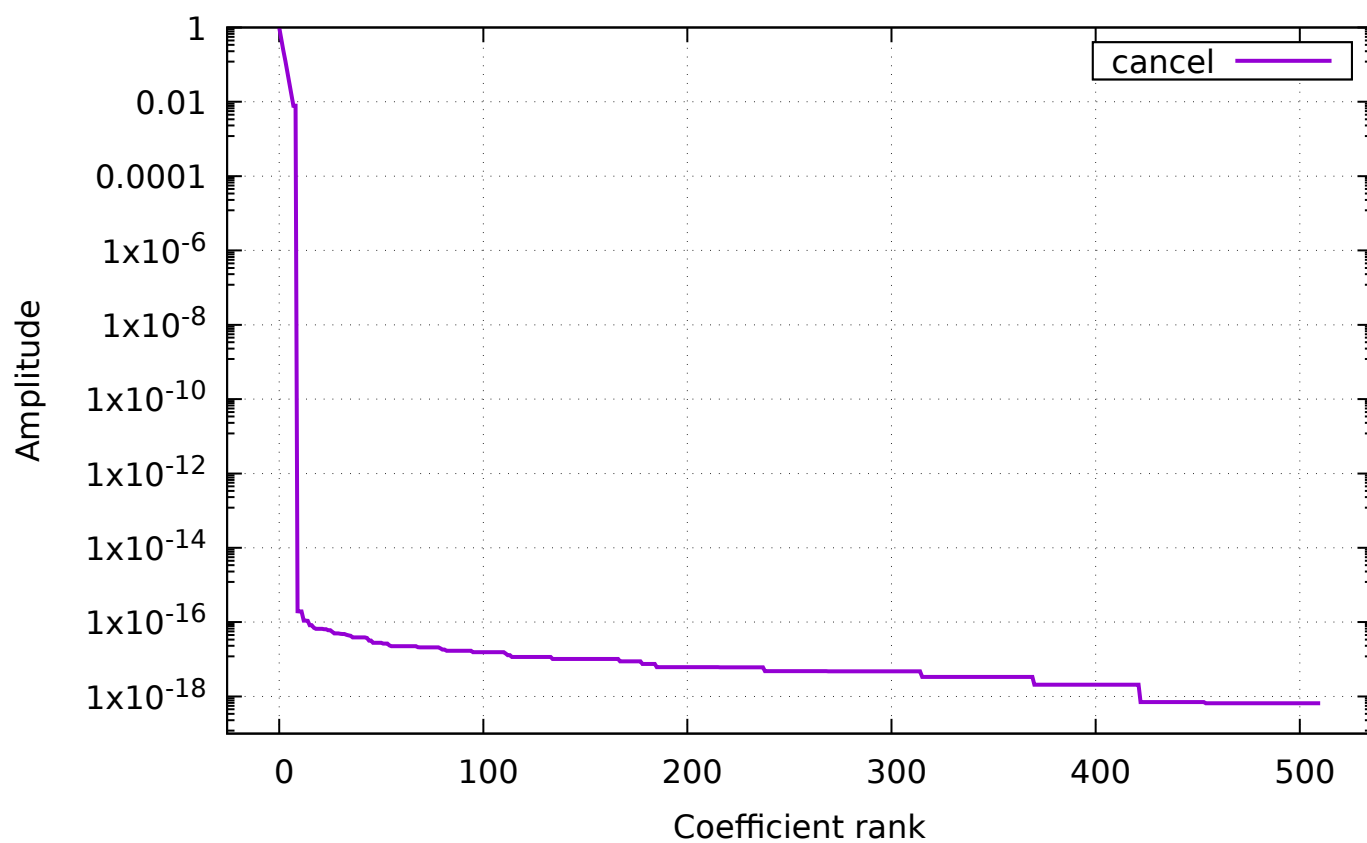


16 labs

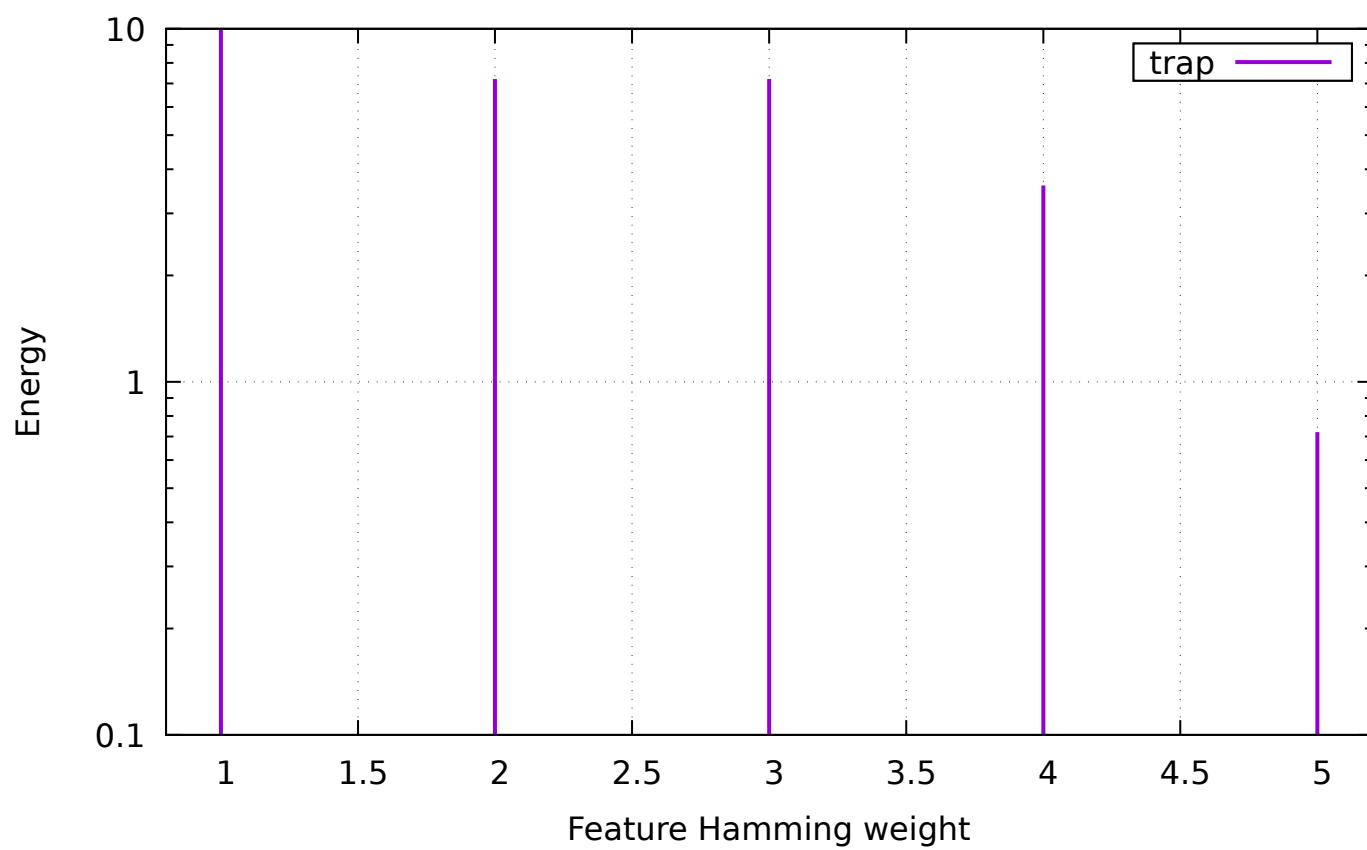
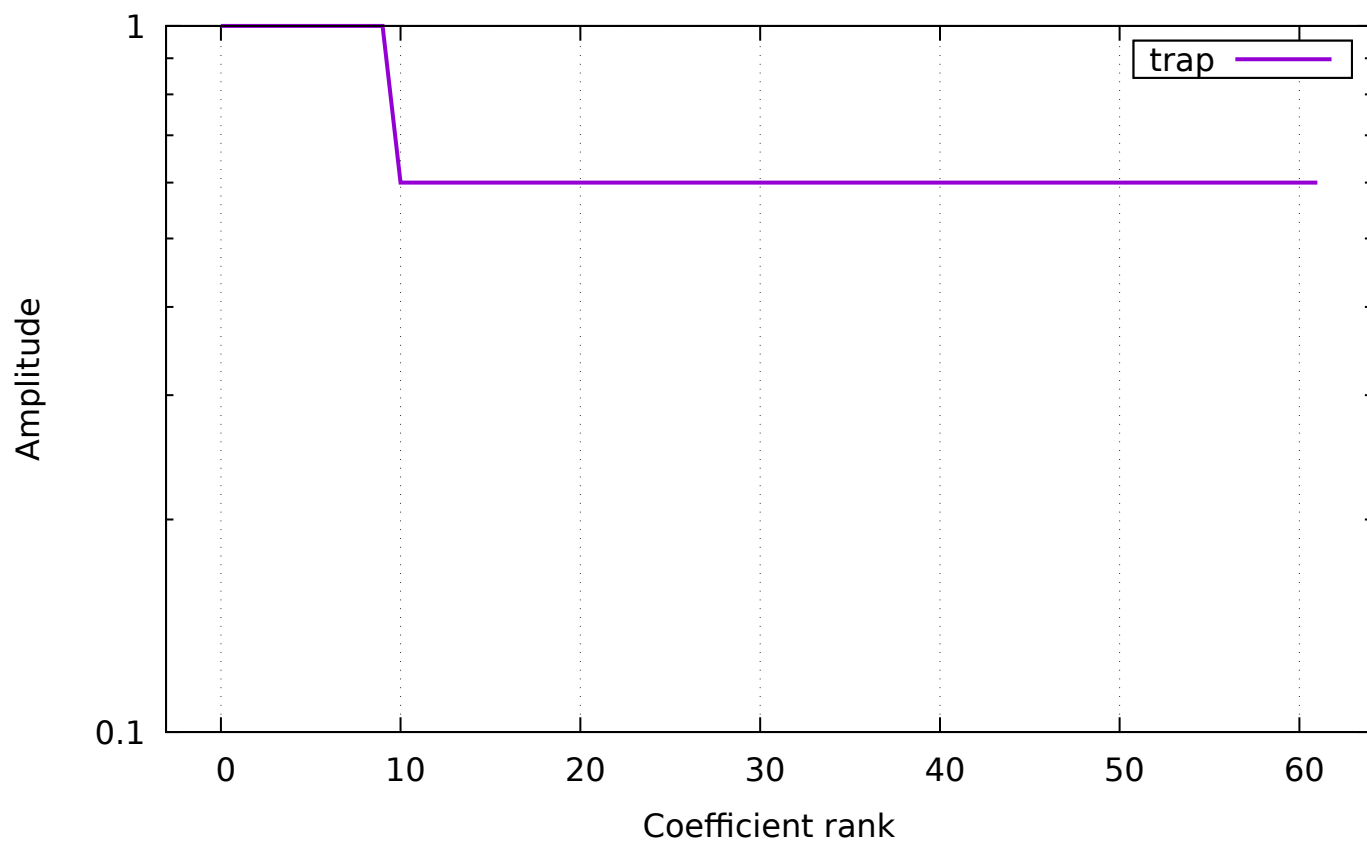


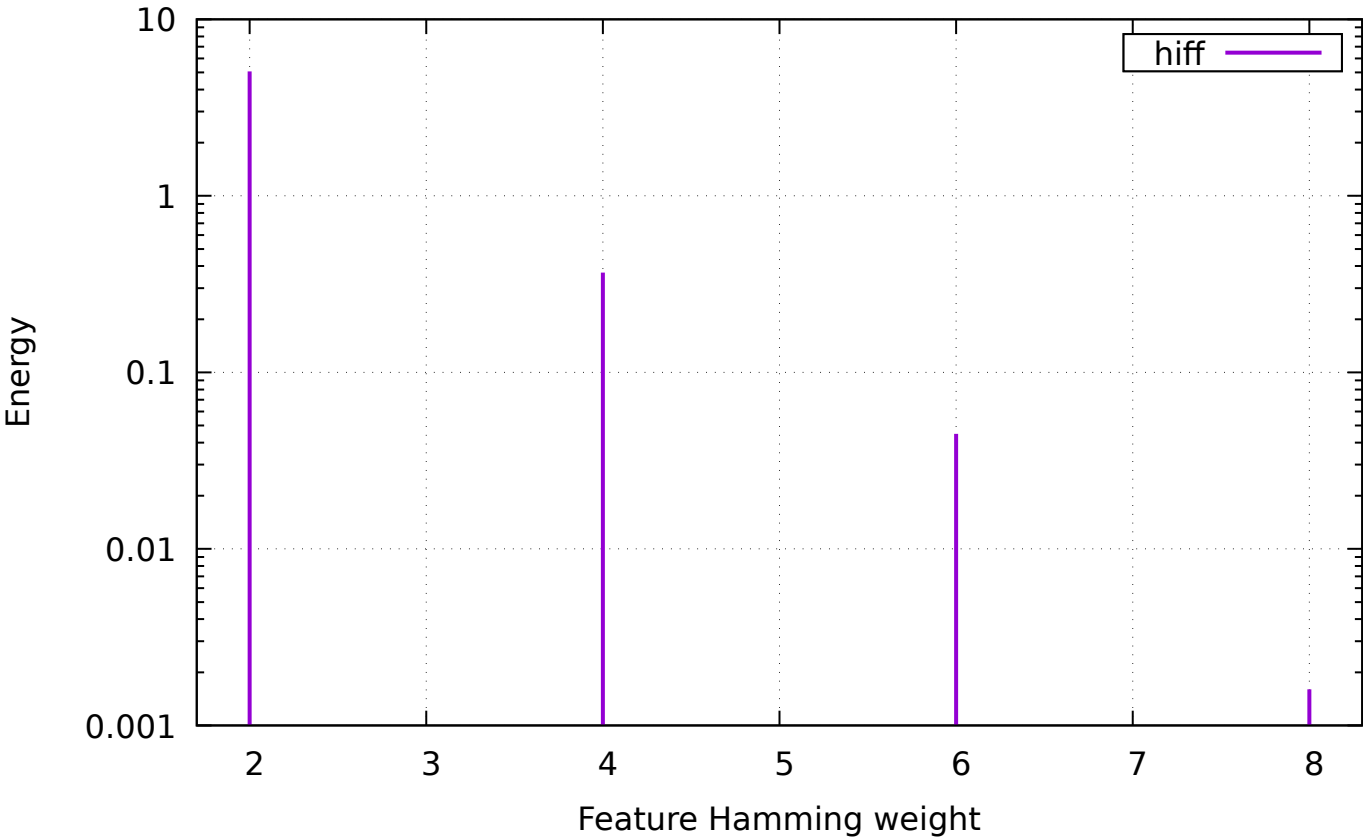
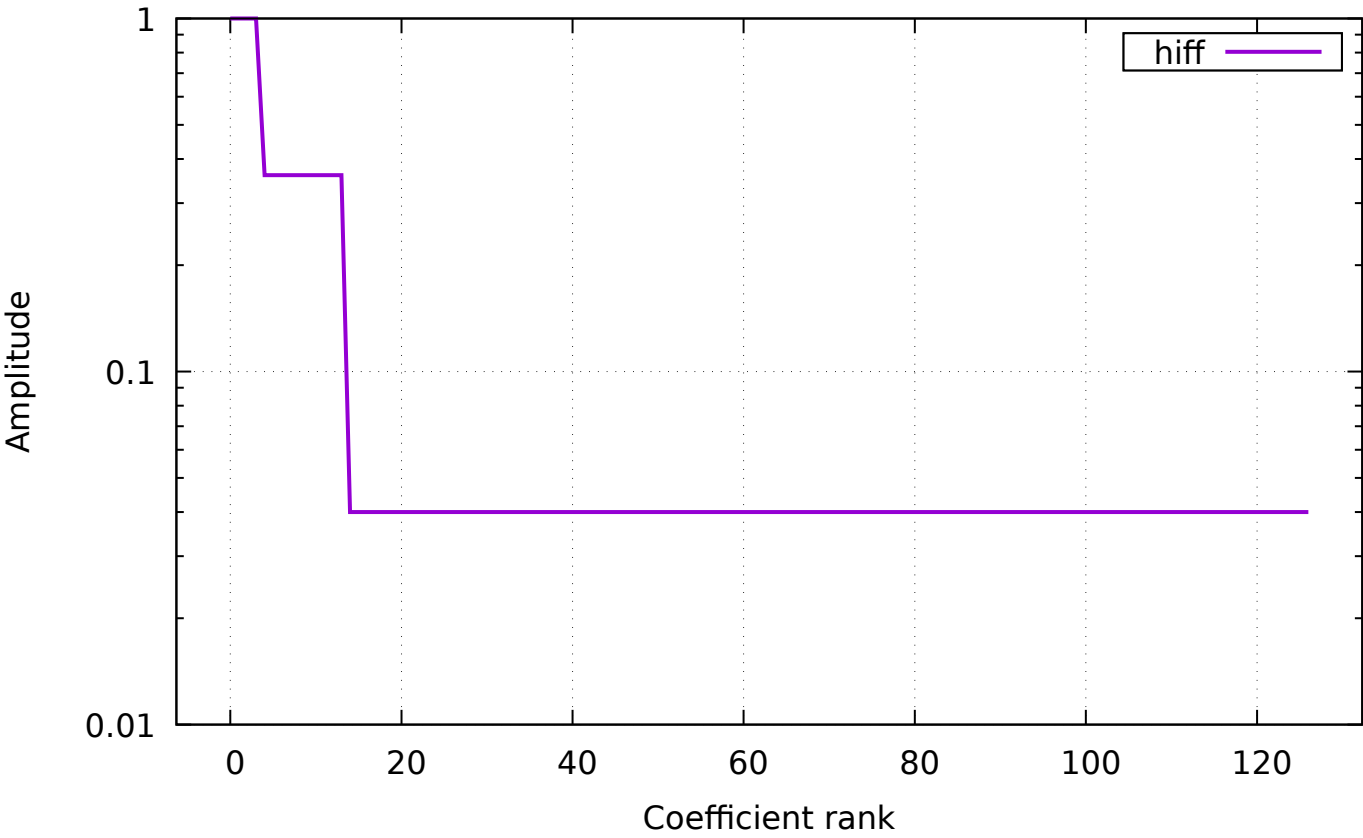


18 cancel

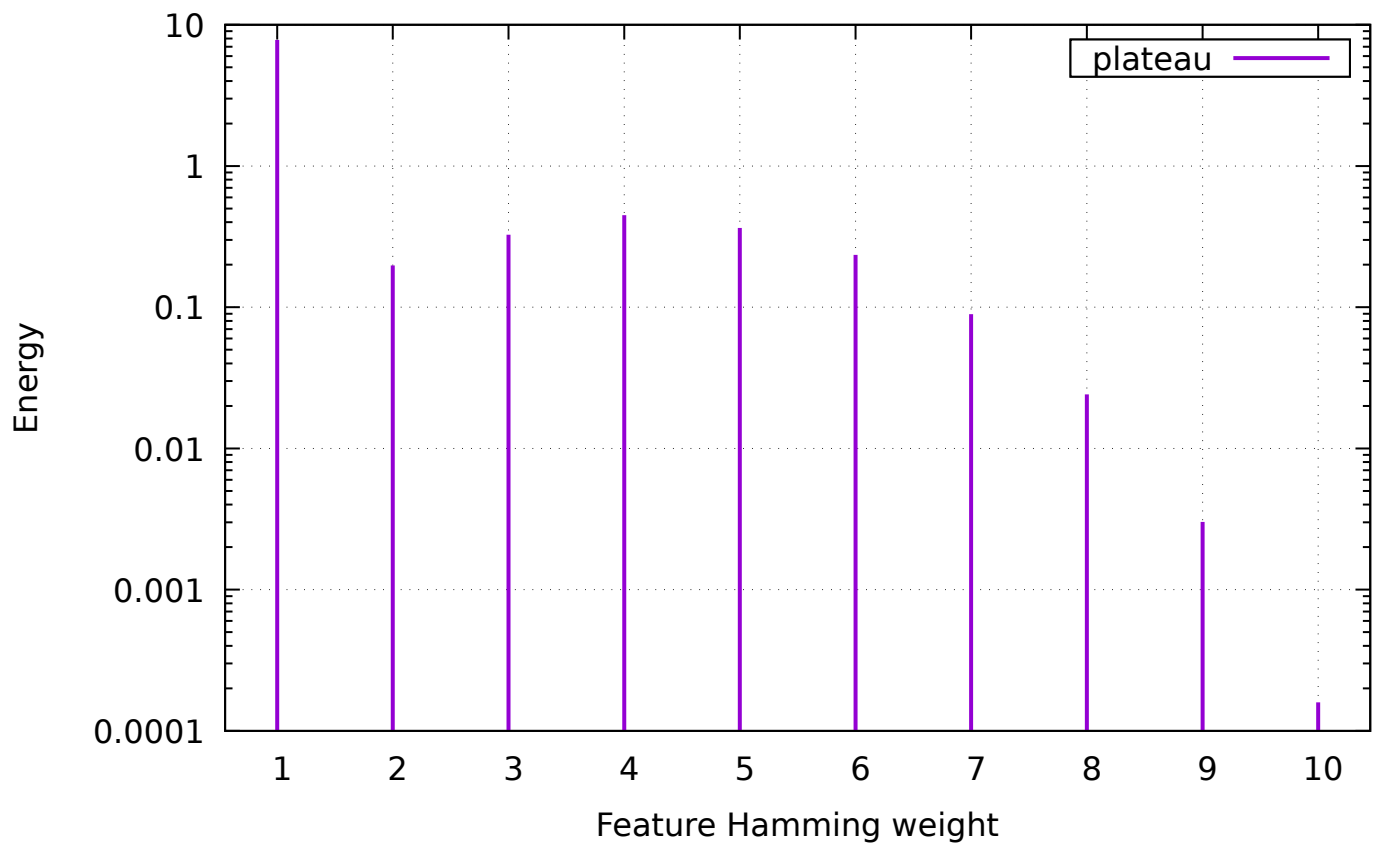
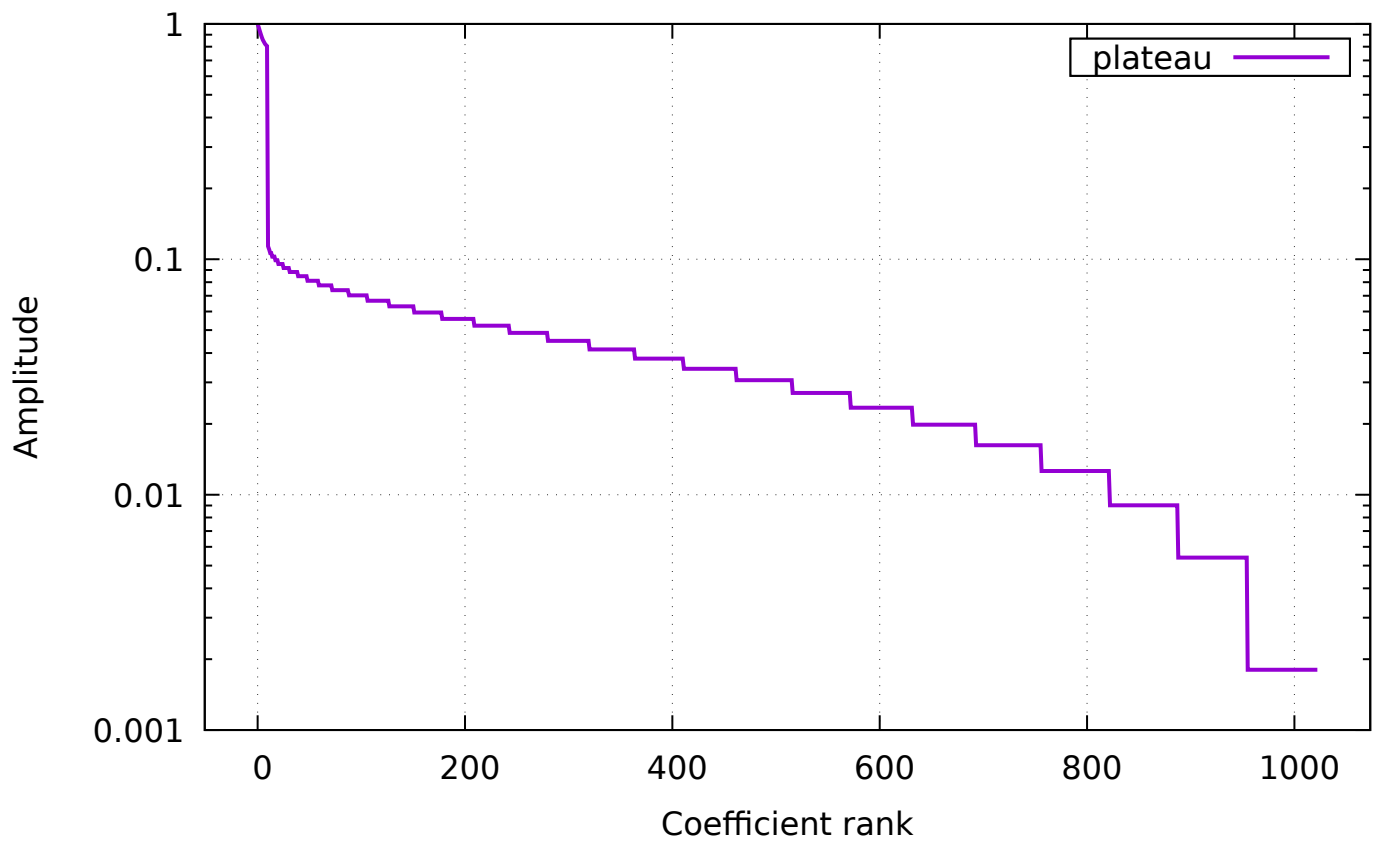


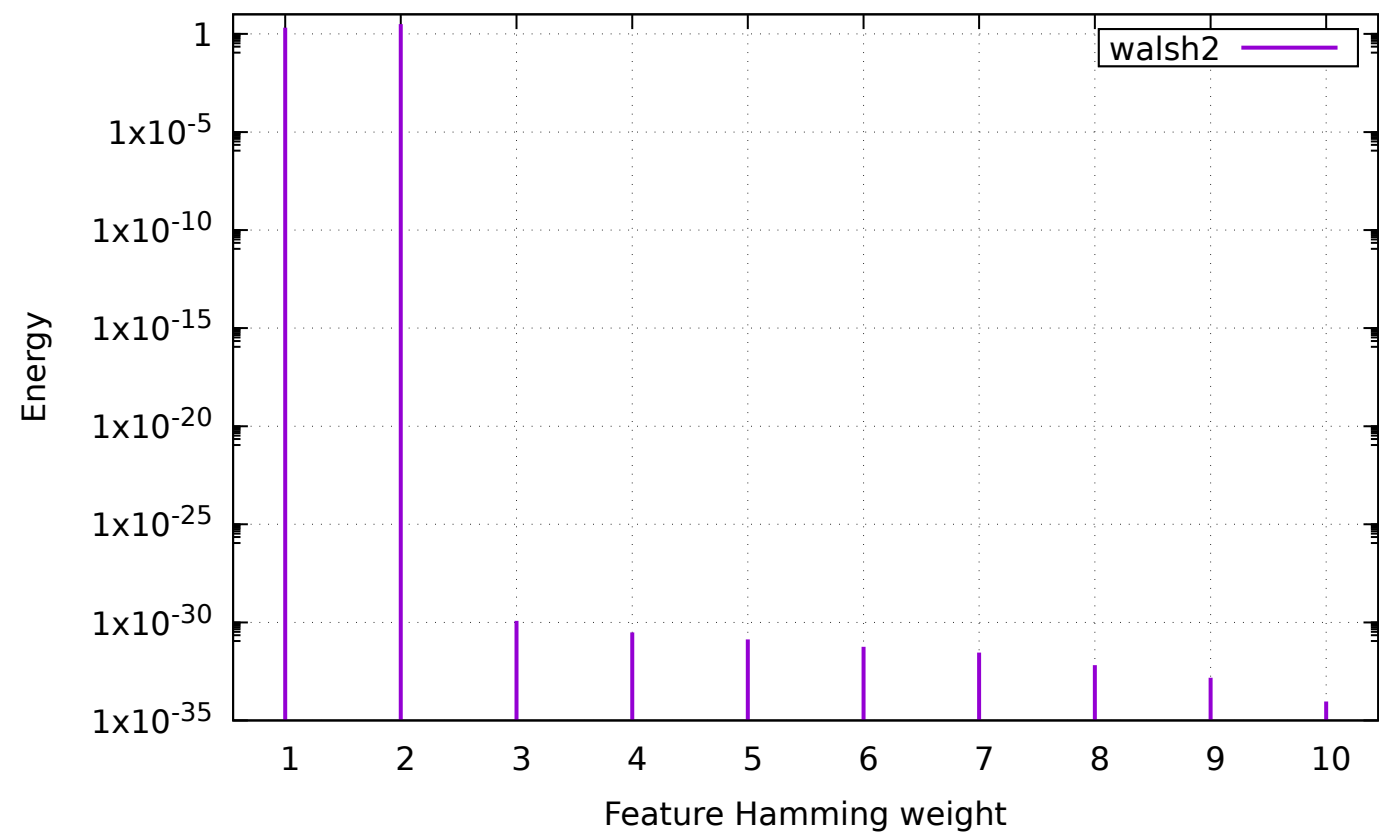
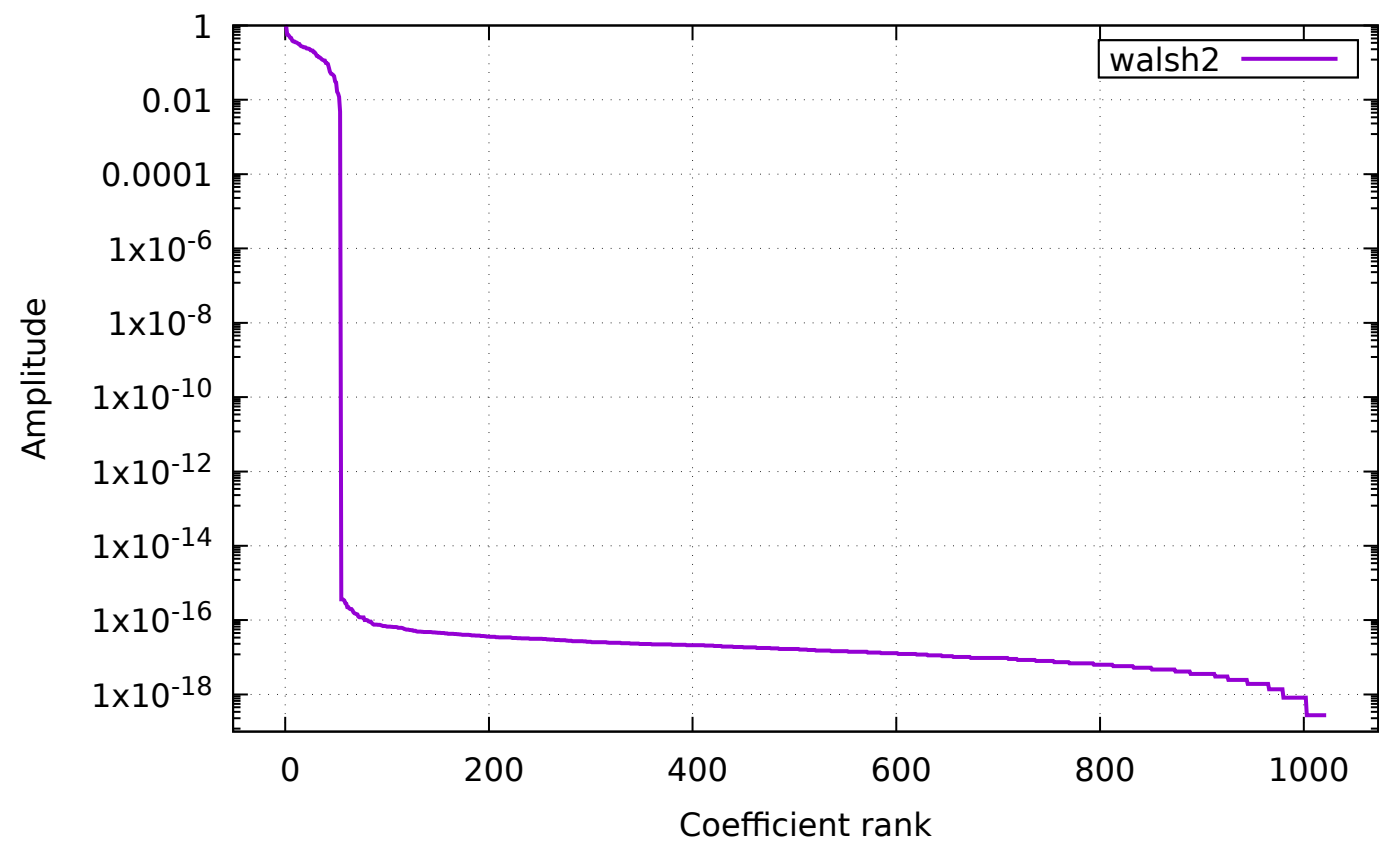
19 trap





21 plateau





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",
    "col": ">{\{\nprouddigits{0}\}\}N{3}{0}"
  },
  {
    "id": "lin",
    "opt": "-F 1 -p instances/lin.10",
    "col": ">{\{\nprouddigits{2}\}\}N{2}{2}"
  },
  {
    "id": "leading-ones",
    "opt": "-F 10",
    "col": ">{\{\nprouddigits{0}\}\}N{3}{0}"
  },
  {
    "id": "ridge",
    "opt": "-F 11",
    "col": ">{\{\nprouddigits{0}\}\}N{3}{0}"
  },
  {
    "id": "jmp-2",
    "opt": "-F 30 -t 2",
    "col": ">{\{\nprouddigits{0}\}\}N{3}{0}"
  },
  {
    "id": "jmp-4",
    "opt": "-F 30 -t 4",
    "col": ">{\{\nprouddigits{0}\}\}N{3}{0}"
  },
  {
    "id": "djmp-2",
    "opt": "-F 31 -t 2",
    "col": ">{\{\nprouddigits{0}\}\}N{3}{0}"
  },
  {
    "id": "djmp-4",
    "opt": "-F 31 -t 4",
    "col": ">{\{\nprouddigits{0}\}\}N{3}{0}"
  },
  {
    "id": "fp-2",
    "opt": "-F 40 -t 2",
    "col": ">{\{\nprouddigits{0}\}\}N{3}{0}"
  },
  {
    "id": "fp-4",
    "opt": "-F 40 -t 4",
    "col": ">{\{\nprouddigits{0}\}\}N{3}{0}"
  },
  {
    "id": "nk",
    "opt": "-F 60 -p instances/nk.10.2",
    "col": ">{\{\nprouddigits{2}\}\}N{1}{2}"
  },
  {
    "id": "max-sat",
    "opt": "-F 70 -p instances/ms.10.3.10",

```

```

    "col": ">{{\\nprouddigits{0}}}N{3}{0}"
  },
  {
    "id": "labs",
    "opt": "-F 80",
    "col": ">{{\\nprouddigits{2}}}N{1}{2}"
  },
  {
    "id": "ep",
    "opt": "-F 90 -p instances/ep.10",
    "reverse": true,
    "logscale": true,
    "col": ">{{\\nprouddigits{2}}}N{1}{2}"
  },
  {
    "id": "cancel",
    "opt": "-F 100 -s 9",
    "reverse": true,
    "col": ">{{\\nprouddigits{2}}}N{1}{2}"
  },
  {
    "id": "trap",
    "opt": "-F 110 --fn-num-traps 2",
    "col": ">{{\\nprouddigits{0}}}N{3}{0}"
  },
  {
    "id": "hiff",
    "opt": "-F 120 -s 8",
    "col": ">{{\\nprouddigits{0}}}N{3}{0}"
  },
  {
    "id": "plateau",
    "opt": "-F 130",
    "col": ">{{\\nprouddigits{0}}}N{3}{0}"
  },
  {
    "id": "walsh2",
    "opt": "-F 162 -p instances/walsh2.10",
    "col": ">{{\\nprouddigits{2}}}N{3}{2}"
  }
],
"groups": [
  {
    "id": "group1",
    "functions": [
      {
        "id": "one-max",
        "opt": "-F 0",
        "col": ">{{\\nprouddigits{0}}}N{3}{0}"
      },
      {
        "id": "leading-ones",
        "opt": "-F 10",
        "col": ">{{\\nprouddigits{0}}}N{3}{0}"
      },
      {
        "id": "ridge",
        "opt": "-F 11",
        "col": ">{{\\nprouddigits{0}}}N{3}{0}"
      },
      {
        "id": "jmp-2",
        "opt": "-F 30 -t 2",

```



```

        "col": ">{\\nprouddigits{0}}N{3}{0}"
    },
    {
        "id": "jmp-4",
        "opt": "-F 30 -t 4",
        "col": ">{\\nprouddigits{0}}N{3}{0}"
    },
    {
        "id": "djmp-2",
        "opt": "-F 31 -t 2",
        "col": ">{\\nprouddigits{0}}N{3}{0}"
    },
    {
        "id": "djmp-4",
        "opt": "-F 31 -t 4",
        "col": ">{\\nprouddigits{0}}N{3}{0}"
    },
    {
        "id": "fp-2",
        "opt": "-F 40 -t 2",
        "col": ">{\\nprouddigits{0}}N{3}{0}"
    },
    {
        "id": "fp-4",
        "opt": "-F 40 -t 4",
        "col": ">{\\nprouddigits{0}}N{3}{0}"
    },
    {
        "id": "max-sat",
        "opt": "-F 70 -p instances/ms.10.3.10",
        "col": ">{\\nprouddigits{0}}N{3}{0}"
    },
    {
        "id": "trap",
        "opt": "-F 110 --fn-num-traps 2",
        "col": ">{\\nprouddigits{0}}N{3}{0}"
    },
    {
        "id": "hiff",
        "opt": "-F 120 -s 8",
        "col": ">{\\nprouddigits{0}}N{3}{0}"
    },
    {
        "id": "plateau",
        "opt": "-F 130",
        "col": ">{\\nprouddigits{0}}N{3}{0}"
    }
]
},
{
    "id": "group2",
    "functions": [
        {
            "id": "lin",
            "opt": "-F 1 -p instances/lin.10",
            "col": ">{\\nprouddigits{2}}N{2}{2}"
        },
        {
            "id": "nk",
            "opt": "-F 60 -p instances/nk.10.2",
            "col": ">{\\nprouddigits{2}}N{1}{2}"
        }
    ]
}

```

```

        "id": "labs",
        "opt": "-F 80",
        "col": ">{{\\nprounddigits{2}}}N{1}{2}"
    },
    {
        "id": "ep",
        "opt": "-F 90 -p instances/ep.10",
        "reverse": true,
        "logscale": true,
        "col": ">{{\\nprounddigits{2}}}N{1}{2}"
    },
    {
        "id": "cancel",
        "opt": "-F 100 -s 9",
        "reverse": true,
        "col": ">{{\\nprounddigits{2}}}N{1}{2}"
    },
    {
        "id": "walsh2",
        "opt": "-F 162 -p instances/walsh2.10",
        "col": ">{{\\nprounddigits{2}}}N{3}{2}"
    }
]
}
]
}

```

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
```