MTH8408: Méthodes d'optimisation et contrôle optimal

Laboratoire 3: Optimisation sans contraintes et méthodes itératives

```
Travail réalisé par Julien Pallage
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        17 février 2024
In [ ]: using Pkg
        Pkg.activate(".") #Accède au fichier Project.toml
        Pkg.add("LDLFactorizations")
        Pkg.add("OptimizationProblems")
        Pkg.add("Plots")
        Pkg.add("SolverCore")
        Pkg.add("LinearOperators")
        Pkg.add("BenchmarkTools")
        Pkg.add("OptimizationProblems")
        Pkg.add("NLPModelsJuMP")
        Pkg.instantiate()
        Pkg.status()
         Activating project at `~/Documents/code/MTH8408-Hiv24/lab3_JP`
           Updating registry at `~/.julia/registries/General.toml`
          Resolving package versions...
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3 JP/Project.toml`
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Manifest.toml`
          Resolving package versions...
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Project.toml`
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Manifest.toml`
          Resolving package versions...
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Project.toml`
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3 JP/Manifest.toml`
          Resolving package versions...
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Project.toml`
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Manifest.toml`
          Resolving package versions...
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Project.toml`
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Manifest.toml`
          Resolving package versions...
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3 JP/Project.toml`
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Manifest.toml`
          Resolving package versions...
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Project.toml`
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Manifest.toml`
          Resolving package versions...
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3 JP/Project.toml`
         No Changes to `~/Documents/code/MTH8408-Hiv24/lab3_JP/Manifest.toml`
       Status `~/Documents/code/MTH8408-Hiv24/lab3_JP/Project.toml`
         [54578032] ADNLPModels v0.7.0
         [ecbce9bc] BenchmarkProfiles v0.4.4
         [6e4b80f9] BenchmarkTools v1.4.0
         [7073ff75] IJulia v1.24.2
         [10dff2fc] JSOSolvers v0.11.0
         [40e66cde] LDLFactorizations v0.10.1
         [5c8ed15e] LinearOperators v2.6.0
         [a4795742] NLPModels v0.20.0
         [792afdf1] NLPModelsJuMP v0.12.5
         [5049e819] OptimizationProblems v0.7.3
         [91a5bcdd] Plots v1.40.1
         [581a75fa] SolverBenchmark v0.6.0
         [ff4d7338] SolverCore v0.3.7
         [37e2e46d] LinearAlgebra
         [de0858da] Printf
In [ ]: using BenchmarkTools, SolverCore, LinearOperators
        using JSOSolvers, NLPModels, OptimizationProblems #
        using ADNLPModels
        using SolverBenchmark
        using LinearAlgebra, NLPModels, Printf
```

Exercice 1: Méthode quasi-Newton L-BFGS

using OptimizationProblems.ADNLPProblems

Compléter votre implémentation de la méthode L-BFGS et illustrer son utilisation sur un des problèmes sans contraintes de la collection OptimizationProblems.jl.

```
SOLUTION:
```

```
In []:
    Function that implements an armijo line search
    Obligatory inputs: xk, dk, fk, gk, slope, nlp.
    Outputs: armijo parameter t, new fk.
    """
    function armijo(xk, dk, fk, gk, slope, nlp :: AbstractNLPModel; \tau1 = 1.0e-4, t_update = 1.5)
        t = 1.0
        fk new = obj(nlp, xk + dk) # t = 1.0
        while fk_new > fk + \tau1 * t * slope
        t / t_update
        fk_new = obj(nlp, xk + t * dk)
        end
        return t, fk_new
    end

"""

Function that solves an unconstrained nlp object with a limited bfgs algorithm
Obligatory inputs: nlp object,
Outputs: Execution Stats
"""
```

```
function limited_bfgs(nlp
                            :: AbstractNLPModel;
          :: AbstractVector = nlp.meta.x0,
   atol
         :: Real = √eps(eltype(x)),
         :: Real = √eps(eltype(x)),
   rtol
   max_eval :: Int = -1,
   max_time :: Float64 = 30.0,
   f_{min} :: Float64 = -1.0e16,
   verbose :: Bool = true,
           :: Int = 5)
 start time = time()
 elapsed_time = 0.0
 T = eltype(x)
 n = Int(nlp.meta.nvar)
 xt = zeros(T, n)
 \nabla ft = zeros(T, n)
 f = obj(nlp, x)
 \nabla f = grad(nlp, x)
 H = InverseLBFGSOperator(n;mem=mem) ### Use InverseLBFGSOperator instead of I ###
 \nabla f Norm = norm(\nabla f) # nrm2(n, \nabla f)
 ∈ = atol + rtol * ∇fNorm
 iter = 0
 @info log header([:iter, :f, :dual, :slope, :bk], [Int, T, T, T, T],
 hdr\_override=\textbf{Dict}(:f=>"f(x)", :dual=>"\|\nabla f\|", :slope=>"\nabla f^{\intercal}d"))
 optimal = ∇fNorm ≤ ∈
 unbdd = f \leq f_min
 tired = neval_obj(nlp) > max_eval ≥ 0 || elapsed_time > max_time
 stalled = false
 status = :unknown
 while !(optimal || tired || stalled || unbdd)
   d = H*\nabla f ### Compute d
   d *= -1 ### Somehow fixes a bug to proceed like this
   slope = dot(d, \nabla f)
   if slope ≥ 0
     @error "not a descent direction" slope
     status = :not desc
     stalled = true
   continue
   end
   # Perform improved Armijo linesearch.
   t, ft = armijo(x, d, f, \nablaf, slope, nlp)
   @info log_row(Any[iter, f, ∇fNorm, slope, t])
   # Update L-BFGS approximation.
   xt = x + t * d
   \nabla ft = grad(nlp, xt) \# grad!(nlp, xt, \nabla ft)
   st = xt - x
   yt = \nabla ft - \nabla f
   push!(H, st, yt) ### Update H with a new st and yt
   # Move on.
   x = xt
   f = ft
   \nabla f = \nabla f t
   \nabla f Norm = norm(\nabla f) #nrm2(n, \nabla f)
   iter = iter + 1
   optimal = ∇fNorm ≤ ∈
   unbdd = f \leq f min
   elapsed_time = time() - start_time
   tired = neval_obj(nlp) > max_eval ≥ 0 || elapsed_time > max_time
 @info log_row(Any[iter, f, ∇fNorm])
 if optimal
   status = :first_order
 elseif tired
 if neval_obj(nlp) > max_eval ≥ 0
   status = :max_eval
 elseif elapsed_time > max_time
   status = :max_time
 end
 elseif unbdd
   status = :unbounded
 return GenericExecutionStats(
 status=status,
 solution=x,
 objective=f,
 dual feas=∇fNorm,
 iter=iter,
 elapsed_time=elapsed_time,
end
```

 ${\tt limited_bfgs}$

Nous illustrons son utilisation et sa performance sur le problème unconstrained Tridia de la collection OptimizationProblems.jl. Nous travaillerons avec 100 variables.

```
:nvar
                       => 100
       :is_feasible
                       => true
      :minimize
                        => true
      :ncon
                        => 0
      :name
                        => "tridia"
      :best_known_lower_bound => -Inf
       :objtype
                     => :other
       :best_known_upper_bound => 5049.0
      => :unconstrained
      :contype
In [ ]: n = 100
      nlp = tridia(n=n)
      stats = limited_bfgs(nlp)
```

Dict{Symbol, Any} with 17 entries: :has_equalities_only => false

=> :unknown

```
||∇f||
                                      ∇f⊺d
                   f(x)
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:49
 Info:
            0 5.0e+03 1.2e+03 -1.4e+06 7.7e-03
@ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           1 2.0e+03 1.6e+03 -4.8e+03 6.7e-01
- Info:
L@ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
 Info:
            2 1.1e+03 1.2e+03 -1.3e+03 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
            3 4.5e+02 3.1e+02 -1.1e+02 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
┌ Info:
            4 3.5e+02 2.3e+02 -3.2e+02 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
- Info:
            5 1.7e+02 2.2e+02 -1.7e+02 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
            6 1.5e+02 4.3e+02 -1.0e+02 1.0e+00
 Info:
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
 Info:
            7 8.5e+01 1.3e+02 -1.9e+01 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
               7.1e+01 9.2e+01 -2.1e+01 1.0e+00
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
r Info:
            9 5.6e+01 1.0e+02 -2.8e+01 1.0e+00
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
           10 3.8e+01 1.0e+02 -3.3e+01 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
           11 3.7e+01 2.0e+02 -2.7e+01 1.0e+00
 Info:
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
r Info:
           12 2.2e+01 5.4e+01 -3.7e+00 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
           13 1.9e+01 3.8e+01 -6.2e+00 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
г Info:
           14 1.5e+01 4.4e+01 -7.6e+00 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
           15 1.1e+01 7.3e+01 -4.7e+00 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
           16 8.3e+00 3.6e+01 -1.9e+00 1.0e+00
@ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
- Info:
           17 6.9e+00 2.5e+01 -1.8e+00 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           18 5.7e+00 2.7e+01 -2.6e+00 1.0e+00
 Info:
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           19 4.6e+00 4.3e+01 -1.7e+00 1.0e+00
 Info:
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
r Info:
           20 3.6e+00 2.0e+01 -7.8e-01 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           21 3.0e+00 1.8e+01 -1.0e+00 1.0e+00
 Info:
i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
r Info:
           22 2.3e+00 2.0e+01 -1.3e+00 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           23 2.2e+00 4.0e+01 -9.3e-01 1.0e+00
 Info:
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           24 1.6e+00 1.3e+01 -2.7e-01 1.0e+00
 Info:
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Γ Info:
           25 1.4e+00 1.0e+01 -3.3e-01 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
           26 1.2e+00 1.1e+01 -4.7e-01 1.0e+00
<sup>i</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           27 9.1e-01 1.8e+01 -4.6e-01 1.0e+00
- Info:
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
           28 7.1e-01 1.1e+01 -1.3e-01 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
 Info:
           29 6.1e-01 6.8e+00 -1.7e-01 1.0e+00
i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           30 5.0e-01 6.3e+00 -1.3e-01 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 · Info:
           31 4.1e-01 7.4e+00 -2.0e-01 1.0e+00
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
- Info:
           32 3.7e-01 1.2e+01 -1.1e-01 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
           33 3.1e-01 4.2e+00 -2.7e-02 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
           34 2.9e-01 3.7e+00 -4.9e-02 1.0e+00
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
┌ Info:
           35 2.5e-01 3.9e+00 -6.5e-02 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           36 2.4e-01 9.9e+00 -5.4e-02 1.0e+00
 Info:
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
           37 2.1e-01 3.2e+00 -1.3e-02 1.0e+00
 Info:
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
 Info:
           38 2.0e-01 2.1e+00 -1.3e-02 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
           39 1.9e-01 2.2e+00 -1.8e-02 1.0e+00
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info: 40 1.8e-01 2.7e+00 -2.9e-02 1.0e+00
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
┌ Info:
           41 1.7e-01 5.2e+00 -2.0e-02 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           42 1.6e-01 1.7e+00 -4.9e-03 1.0e+00
- Info:
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
┌ Info:
           43 1.6e-01 1.6e+00 -1.1e-02 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           44 1.5e-01 1.9e+00 -1.5e-02 1.0e+00
 Info:
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
┌ Info:
           45 1.5e-01 4.7e+00 -1.2e-02 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
<sub>「</sub> Info:
           46 1.4e-01 1.8e+00 -4.5e-03 1.0e+00
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
_{\Gamma} Info:
           47 1.4e-01 1.4e+00 -5.4e-03 1.0e+00
i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
           48 1.3e-01 1.7e+00 -9.0e-03 1.0e+00
r Info:
@ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
           49 1.2e-01 1.9e+00 -2.0e-02 1.0e+00
6 Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
┌ Info:
           50 1.2e-01 5.9e+00 -2.1e-02 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
_{\Gamma} Info:
           51 1.1e-01 1.9e+00 -6.3e-03 1.0e+00
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Γ Info:
           52 1.1e-01 1.5e+00 -1.1e-02 1.0e+00
i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
┌ Info:
           53 9.7e-02 2.0e+00 -1.6e-02 1.0e+00
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           54 8.6e-02 3.3e+00 -2.4e-02 1.0e+00
 Info:
```

L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75

```
55 7.4e-02 3.2e+00 -1.3e-02 1.0e+00
 Info:
<sup>i</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
             56 6.5e-02 1.9e+00 -1.6e-02 1.0e+00
┌ Info:
<sup>i</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 · Info:
             57 5.4e-02 2.2e+00 -1.3e-02 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Γ Info:
            58 4.6e-02 2.9e+00 -1.5e-02 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 59 3.6e-02 2.1e+00 -1.4e-02 1.ve+vv @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 60 2.6e-02 1.9e+00 -2.2e-02 6.7e-01 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 61 2.2e-02 3.9e+00 -1.0e-02 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 · Info:
             62 1.6e-02 1.4e+00 -3.0e-03 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
            63 1.3e-02 1.1e+00 -4.5e-03 1.0e+00
 · Info:
i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 64 1.0e-02 1.2e+00 -5.0e-03 1.0e+00
@ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 65 7.9e-03 2.0e+00 -4.3e-03 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
ŗ Info:
             66 5.5e-03 9.1e-01 -1.2e-03 1.0e+00
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
             67 4.5e-03 6.1e-01 -1.6e-03 1.0e+00
i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
            68 3.6e-03 7.3e-01 -1.6e-03 1.0e+00
┌ Info:
<sup>i</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 69 3.3e-03 1.3e+00 -9.8e-04 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 70 2.6e-03 5.1e-01 -5.0e-04 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 71 2.3e-03 3.9e-01 -4.1e-04 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Γ Info:
             72 2.0e-03 4.2e-01 -8.2e-04 1.0e+00
i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
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73 1.5e-03 6.5e-01 -8.7e-04 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
           74 1.4e-03 8.3e-01 -4.7e-04 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           75 1.1e-03 2.8e-01 -1.2e-04 1.0e+00
- Info:
L@ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
 Info:
           76 9.7e-04 2.4e-01 -2.5e-04 1.0e+00
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[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
┌ Info:
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- Info:
           79 4.4e-04 3.9e-01 -1.4e-04 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           80 3.3e-04 2.0e-01 -1.2e-04 1.0e+00
 Info:
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
 Info:
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 Info:
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[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
r Info:
           83 1.3e-04 1.7e-01 -5.8e-05 1.0e+00
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 · Info:
           84 8.6e-05 1.2e-01 -7.6e-05 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
 Info:
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 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
- Info:
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 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
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L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           88 1.8e-05 7.5e-02 -2.1e-05 6.7e-01
г Info:
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
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 Info:
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
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 Info:
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
┌ Info:
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           95 3.9e-06 1.7e-02 -1.4e-06 1.0e+00
<sup>i</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
r Info:
           96 3.3e-06 2.3e-02 -7.5e-07 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
           97 3.0e-06 1.7e-02 -2.2e-07 1.0e+00
 Info:
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
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Γ Info:
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                                           1.0e+00
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- Info:
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
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Γ Info:
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- Info:
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 Info:
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┌ Info:
                                            1.0e+00
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 Info:
                                           1.0e+00
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 Info:
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<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info: 114 1.2e-06 7.1e-03 -1.3e-07 1.0e+00
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┌ Info:
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- Info:
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┌ Info:
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 Info:
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┌ Info:
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ŗ Info:
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i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
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r Info:
@ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
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L@ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
Γ Info:
          124 3.0e-07 5.3e-03 -1.9e-07 6.7e-01
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
_{\Gamma} Info:
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Γ Info:
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r Info:
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[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
          128 1.3e-07 4.3e-03 -6.9e-08 1.0e+00
 Info:
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L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75

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129 9.2e-08 7.0e-03 -6.7e-08 1.0e+00
 Info:
<sup>i</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
┌ Info:
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[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 · Info:
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L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Γ Info:
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L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 133 3.0e-08 2.2e-03 -1.7e-08 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 134 2.4e-08 3.1e-03 -7.6e-09 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 135 2.0e-08 1.2e-03 -2.5e-09 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 · Info:
            136 1.8e-08 9.7e-04 -2.9e-09 1.0e+00
L@ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
 · Info:
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i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 138 1.6e-08 2.5e-03 -3.7e-09 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 139 1.3e-08 7.1e-04 -6.3e-10 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
ŗ Info:
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 Info:
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
┌ Info:
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<sup>i</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 143 1.0e-08 5.5e-04 -6.0e-10 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 144 9.9e-09 4.3e-04 -9.6e-10 1.0e+00 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Info: 145 9.3e-09 6.3e-04 -7.8e-10 1.0e+00
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Γ Info:
            146 9.1e-09 7.5e-04 -3.5e-10 1.0e+00
i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
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147 8.8e-09 4.2e-04 -5.1e-10 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
          148 8.5e-09 3.4e-04 -2.8e-10 1.0e+00
Info:
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
          149 8.2e-09 3.6e-04 -8.1e-10 6.7e-01
- Info:
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
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┌ Info:
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 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
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 Info:
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 Info:
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r Info:
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<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
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- Info:
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
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[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
- Info:
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L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
г Info:
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L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
· Info:
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 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
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i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
- Info:
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<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
          167 9.4e-10 4.3e-04 -3.7e-10 1.0e+00
 Info:
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
_{\Gamma} Info:
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 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
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i @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
r Info:
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L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
r Info:
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                                           1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
          174 1.4e-10 1.5e-04 -4.2e-11 1.0e+00
<sup>i</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
- Info:
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 Info:
          177 8.0e-11 2.7e-04 -3.7e-11 1.0e+00
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
          178 5.6e-11 8.4e-05 -1.1e-11 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
Γ Info:
          179 4.9e-11 5.7e-05 -1.0e-11 1.0e+00
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
          180 4.1e-11 6.2e-05 -1.6e-11 1.0e+00
- Info:
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
          181 3.2e-11 1.0e-04 -1.7e-11 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
 Info:
          182 2.6e-11 7.5e-05 -5.0e-12 1.0e+00
L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
          183 2.2e-11 4.1e-05 -4.9e-12
┌ Info:
                                           1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
          184 1.9e-11 3.8e-05 -4.2e-12 1.0e+00
 Info:
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:75
          185  1.6e-11  4.5e-05  -4.2e-12  1.0e+00
 Info:
6 Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
 Info:
          186 1.5e-11 3.9e-05 -1.4e-12 1.0e+00
 @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
          187 1.4e-11 1.9e-05 -1.1e-12 1.0e+00
<sup>L</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:75
 Info: 188 1.3e-11 1.5e-05
[ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:99
"Execution stats: first-order stationary"
```

In []: print(stats)

```
Generic Execution stats
status: first-order stationary
objective value: 1.2824360088337822e-11
primal feasibility: 0.0
dual feasibility: 1.533229397405431e-5
solution: [0.9999965771090676 0.4999983282656731 0.24999917035173627 0.12499953412164919 - 4.3035947366902296e-10]
iterations: 188
elapsed time: 0.01155400276184082
```

As we see, it took 188 iterations to converge to a local mimimum of approximately 0.

Exercice 2: Méthode Newton-CG

Compléter votre implémentation de la méthode Newton-CG et illustrer son utilisation sur un des problèmes sans contraintes de la collection OptimizationProblems.jl.

SOLUTION:

```
function cg_optim(H, \nabla f)
   #setup the tolerance:
   n\nabla f = norm(\nabla f)
\epsilon k = \min(0.5, \operatorname{sqrt}(n\nabla f)).*n\nabla f \# added
n = length(\nabla f)
   z = zeros(n)
   r = ∇f
   d = -r
   j = 0
   while norm(r) \ge \epsilon k \& j < 3 * n
if dot(d, H * d) \leq 0
           pk = (j == 0) ? - \nabla f : z # added
        end
\alpha = dot(r,r)./(dot(d, H * d)) # added
z += \alpha * d
       nrr2 = dot(r, r)
        r += \alpha * H * d
\beta = dot(r,r)./nrr2 \# added
d = -r + \beta.*d
       j += 1
   end
   return z # or return d?
end
Function that uses an armijo linesearch, with a Newton algorithm while using a conjugate gradient direction each step
Inputs: An NLP object and other mandatory parameters.
Ouptut: Execution stats.
function armijo_Newton_cg(nlp
                                  :: AbstractNLPModel;
                                   :: AbstractVector = nlp.meta.x0,
                          Х
                                  :: Real = \sqrt{\text{eps}(\text{eltype}(x))},
                          atol
                                  :: Real = √eps(eltype(x)),
                          max_eval :: Int = -1,
                          max\_time :: Float64 = 30.0,
                                 :: Float64 = -1.0e16)
                          f_min
 start time = time()
 elapsed_time = 0.0
 T = eltype(x)
 n = nlp.meta.nvar
 f = obj(nlp, x)
 \nabla f = grad(nlp, x)
H = hess_op(nlp, x) ### Initialize H as linear operator representing the Hessian matrix
\nabla f Norm = norm(\nabla f) # nrm2(n, \nabla f)
 ∈ = atol + rtol * ∇fNorm
 iter = 0
 @info log_header([:iter, :f, :dual, :slope, :bk], [Int, T, T, T],
                   \label{eq:continuous_def} \begin{aligned} & \mathsf{hdr}\_\mathsf{override} = & \mathsf{Dict}(:\mathsf{f=}\mathsf{>}^{\mathsf{"}}\mathsf{f}(\mathsf{x})^{\mathsf{"}}, \; :\mathsf{dual} = \mathsf{>}^{\mathsf{"}}\|\nabla\mathsf{f}\|^{\mathsf{"}}, \; :\mathsf{slope} = \mathsf{>}^{\mathsf{"}}\nabla\mathsf{f}^{\mathsf{T}}\mathsf{d}^{\mathsf{"}})) \end{aligned}
 optimal = ∇fNorm ≤ ∈
 unbdd = f \leq f_min
 tired = neval_obj(nlp) > max_eval ≥ 0 || elapsed_time > max_time
 stalled = false
 status = :unknown
 while !(optimal || tired || stalled || unbdd)
   d = cg_{optim}(H, \nabla f)
   slope = dot(d, \nabla f)
   if slope ≥ 0
     @error "not a descent direction" slope
      status = :not_desc
     stalled = true
      continue
   # Perform improved Armijo linesearch.
   t, f = armijo(x, d, f, \nabla f, slope, nlp)
   @info log row(Any[iter, f, ∇fNorm, slope, t])
   # Update L-BFGS approximation.
   x += t * d
   \nabla f = grad(nlp, x)
H = hess_op(nlp, x) ### Update H!
\nabla f \text{Norm} = \text{norm}(\nabla f) \# nrm2(n, \nabla f)
   iter = iter + 1
   optimal = ∇fNorm ≤ ∈
   unbdd = f \leq f_min
   elapsed time = time() - start_time
   tired = neval_obj(nlp) > max_eval ≥ 0 || elapsed_time > max_time
 end
 @info log_row(Any[iter, f, ∇fNorm])
 if optimal
   status = :first order
  elseif tired
   if neval_obj(nlp) > max_eval ≥ 0
      status = :max_eval
```

armijo_Newton_cg

Une deuxième fois, illustrons sa performance sur le problème tridia avec 100 variables.

```
In [ ]: | n = 100
       nlp = tridia(n=n)
       stats = armijo_Newton_cg(nlp)
        Info: iter
                                   ||∀f||
                                            ∇f⊺d
       [ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:69
                 0 6.3e+02 1.2e+03 -8.8e+03 1.0e+00
       r Info:
       [ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
        Info:
               1 1.2e+02 5.1e+02 -1.0e+03 1.0e+00
       L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
       - Info: 2 2.7e+01 2.0e+02 -1.8e+02 1.0e+00
       L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
        Info:
                 3 1.5e+01 9.7e+01 -2.3e+01 1.0e+00
        @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
       ┌ Info:
                 4 2.2e+00 4.4e+01 -2.5e+01 1.0e+00
       <sup>i</sup> @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
       ┌ Info:
                5 4.9e-01 1.7e+01 -3.5e+00 1.0e+00
       [ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
                6 2.4e-01 7.7e+00 -5.1e-01 1.0e+00
        Info:
       L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
               7 9.9e-02 3.8e+00 -2.8e-01 1.0e+00
       · Info:
       [ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
       ┌ Info:
                 8 1.4e-03 1.6e+00 -1.9e-01 1.0e+00
        @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:93
                9 2.6e-04 7.3e-01 -2.2e-03 1.0e+00
       · Info:
       [ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
       - Info: 10 1.1e-04 2.9e-01 -3.0e-04 1.0e+00
       L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
        Info: 11 4.0e-05 1.4e-01 -1.5e-04 1.0e+00
        @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3 JP/lab3 pallage.ipynb:93
                12 1.8e-07 4.1e-02 -7.9e-05 1.0e+00
        Info:
       [ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
       ┌ Info:
                 13 2.6e-09 6.8e-03 -3.5e-07 1.0e+00
        @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
       Γ Info:
                 14 3.4e-13 5.3e-04 -5.2e-09 1.0e+00
       [ @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:93
       Γ Info:
                15 3.4e-13 1.1e-05
       L @ Main /home/julien/Documents/code/MTH8408-Hiv24/lab3_JP/lab3_pallage.ipynb:110
       "Execution stats: first-order stationary"
```

In []: print(stats)

```
Generic Execution stats
status: first-order stationary
objective value: 3.37580889992935e-13
primal feasibility: 0.0
dual feasibility: 1.1199496148809964e-5
solution: [0.9999999912018402 0.5000000300459599 0.2500000476635215 0.12499997802900703 - 2.570225077445835e-9]
iterations: 15
elapsed time: 0.026151180267333984
```

Ici, on remarque que ça a pris seulement 15 itérations pour converger à un minimum local de valeur similaire l'exercice 1 et ce deux fois plus rapidement!

Exercice 3: Benchmark LBFGS vs Taille mémoire

Comparer LBFGS avec mémoire m = 1, m = 5 et m = 20 sur une collection de problèmes sans contraintes de OptimizationProblems.jl. Préciser combien de problèmes sont utilisés, inclure des profils de performance, et mentionner un/des problèmes qui ne sont pas résolus par l'algorithme.

SOLUTION:

In []: OptimizationProblems.meta

372×17 DataFrame 347 rows omitted

| Row | nvar | variable_nvar | ncon | variable_ncon | minimize | name | has_equalities_only | has_inequalities_only | has_bounds | has_fixed_variables | objtype | • |
|-----|-------|---------------|-------|---------------|----------|-----------------|---------------------|-----------------------|------------|---------------------|---------------|---|
| | Int64 | Bool | Int64 | Bool | Bool | String | Bool | Bool | Bool | Bool | Symbol | ! |
| 1 | 1 | false | 0 | false | true | AMPGO02 | false | false | false | false | other | ι |
| 2 | 1 | false | 0 | false | true | AMPGO03 | false | false | false | false | other | ι |
| 3 | 1 | false | 0 | false | true | AMPGO04 | false | false | false | false | other | ι |
| 4 | 1 | false | 0 | false | true | AMPGO05 | false | false | false | false | other | ι |
| 5 | 1 | false | 0 | false | true | AMPGO06 | false | false | false | false | other | ι |
| 6 | 1 | false | 0 | false | true | AMPGO07 | false | false | false | false | other | ι |
| 7 | 1 | false | 0 | false | true | AMPGO08 | false | false | false | false | other | ι |
| 8 | 1 | false | 0 | false | true | AMPGO09 | false | false | false | false | other | ι |
| 9 | 1 | false | 0 | false | true | AMPGO10 | false | false | false | false | other | ι |
| 10 | 1 | false | 0 | false | true | AMPGO11 | false | false | false | false | other | ι |
| 11 | 1 | false | 0 | false | true | AMPGO12 | false | false | false | false | other | ι |
| 12 | 1 | false | 0 | false | true | AMPGO13 | false | false | false | false | other | ι |
| 13 | 1 | false | 0 | false | true | AMPGO14 | false | false | false | false | other | ι |
| ÷ | : | i | ÷ | ÷ | : | : | : | : | ÷ | i i | : | |
| 361 | 100 | true | 0 | false | true | tointgss | false | false | false | false | other | ι |
| 362 | 100 | true | 0 | false | true | tquartic | false | false | false | false | least_squares | ι |
| 363 | 8 | false | 3 | false | true | triangle | false | true | true | true | other | į |
| 364 | 2244 | false | 1896 | false | true | triangle_deer | false | true | true | true | other | į |
| 365 | 1366 | false | 1182 | false | true | triangle_pacman | false | true | true | true | other | į |
| 366 | 4444 | false | 4025 | false | true | triangle_turtle | false | true | true | true | other | ţ |
| 367 | 100 | true | 0 | false | true | tridia | false | false | false | false | other | ι |
| 368 | 100 | true | 0 | false | true | vardim | false | false | false | false | other | ι |
| 369 | 8 | false | 0 | false | true | vibrbeam | false | false | false | false | least_squares | ι |
| 370 | 31 | false | 0 | false | true | watson | false | false | false | false | least_squares | ι |
| 371 | 100 | true | 0 | false | true | woods | false | false | false | false | other | ι |
| 372 | 3 | false | 3 | false | true | zangwil3 | true | false | false | false | other | l |

Ici, on utilise la documentation de la librairie OptimizationProblems https://jso.dev/OptimizationProblems.jl/dev/benchmark/ pour obtenir les problèmes à résoudre et déclarer les solveurs dans un dictionnaire.

On initialise la mémoire à 5,10,20 avec limited_bfgs afin de voir l'impact de la mémoire sur la performance.

Info:

clplatec

100

0

L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175

```
In [ ]: | ad_problems = (eval(Meta.parse(problem))() for problem € OptimizationProblems.meta[!, :name])
        solvers = Dict(
          :lbfgs_5 => model -> limited_bfgs(model; mem=5),
          :lbfgs_10 => model -> limited_bfgs(model; mem=10),
          :lbfgs 20 => model -> limited bfgs(model; mem=20),
        stats = bmark_solvers(
          solvers, ad_problems,
          skipif=prob -> (!unconstrained(prob) || get_nvar(prob) > 150 || get_nvar(prob) < 5),</pre>
       r Info:
                          Name
                                  nvar
                                          ncon
                                                         status
                                                                     Time
                                                                               f(x)
                                                                                         Dual
                                                                                                 Primal
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:127
                                                    first_order
                                                                 3.0e-01 2.1e+04 3.7e-05
        Info:
                          NZF1
                                    91
       [ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                                   100
                                             0
                                                    first order
                                                                  2.8e-01 5.0e+01 7.8e-15
                       aralina
                                                                                                0.0e + 00
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                                   100
                                                   first_order 2.1e-01 2.5e+01 3.3e-04 0.0e+00
                       arglinb
                                             0
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                       arglinc
                                   100
                                                    first order
                                                                 2.1e-01 5.1e+01 4.4e-03
       <sup>i</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                       argtrig
                                   100
                                                    first_order 2.2e-01 -9.9e+03 5.5e-08 0.0e+00
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                                  1 80-01
                                                    first order
                                                                            0.0e + 00
       ^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first order 2.3e-01 1.9e+02 2.1e-04 0.0e+00
        Info:
                       bdqrtic
                                  100
                                          0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
       ┌ Info:
                                                     unbounded 2.2e-05 -3.2e+22 4.1e+22 0.0e+00
                        biggs6
                                     6
                                             0
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                    first order 2.3e-01 1.9e-09 6.8e-04 0.0e+00
       Γ Info:
                       brownal
                                   100
                                             0
       [ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       ŗ Info:
                     broyden3d
                                   100
                                             0
                                                    first order 2.1e-01 3.6e-01 1.4e-07
                                                                                               0.0e+00
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                    first_order 3.0e-01 3.6e+01 7.6e-07 0.0e+00
        · Info:
                      broydn7d
                                   100
                                             0
       i @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       ┌ Info:
                                                    first order 3.0e-01 1.3e+00 1.4e-05 0.0e+00
                        brybnd
                                   100
       © SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       _{	extsf{\Gamma}} Warning: catenary: number of variables adjusted to be a multiple of 3
       @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/catenary.jl:4
        Warning: catenary: number of variables adjusted to be greater or equal to 6
       L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/catenary.jl:6
       ┌ Info:
                                                  first_order 2.3e-01 1.0e+00 7.8e-04 0.0e+00
                                  100
                                            0
                      chainwoo
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                      chnrosnb
        Info:
                                   100
                                                    first order 2.3e-01 2.3e-10 7.4e-05
       <sup>i</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first order 4.5e-01 -9.1e-03 1.3e-08 0.0e+00
       r Info:
                      clplatea
                                   100
                                             0
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       _{\Gamma} Info:
                                   100
                                             0
                                                    first order 4.8e-01 -6.2e-03 1.5e-08 0.0e+00
                      clplateb
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
```

first_order 5.2e-01 -5.1e-03 1.6e-08 0.0e+00

```
r Info:
                           100
                                    0
                                           first_order 1.9e-01 -9.9e+01 5.2e-08
                cosine
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              cragglvy
 Info:
                          100
                                    0
                                           first order 2.4e-01 3.2e+01 5.7e-04 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
             cragglvy2
                          100
                                    0
                                           first order 2.1e-01 2.5e+01 5.0e-04
                                                                                      0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                              max_time 3.0e+01 -1.0e+04 3.6e-05
 Info:
                 curly
                          100
                                    0
                                                                                      0.0e+00
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               curly10
                           100
                                    0
                                              max_time
                                                         3.0e+01 -1.0e+04 3.6e-05
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               curly20
                           100
                                    0
                                              max time 3.0e+01 -1.0e+04 9.4e-05 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               curlv30
                           100
                                              max time 3.0e+01 -1.0e+04 7.7e-05 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
- Info:
              dixmaane
                            99
                                           first order 3.1e-01 1.0e+00 2.4e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
                                           first order 2.6e-01 1.0e+00 4.6e-06 0.0e+00
 Info:
              dixmaanf
                           99
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>Ĺ</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan efgh.jl:12
                           99
                                    0
                                           first_order 4.4e-03 1.0e+00 8.4e-06 0.0e+00
              dixmaanq
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
© OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
                                           first order 4.2e-03 1.0e+00 2.0e-05 0.0e+00
              dixmaanh
                           99
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
              dixmaani
                           99
                                           first_order 3.4e-01 1.0e+00 2.1e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
              dixmaanj
                                           first order 3.1e-01 1.0e+00 4.9e-06 0.0e+00
 Info:
                           99
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
Γ Info:
              dixmaank
                            99
                                    0
                                           first order 1.6e-02 1.0e+00 9.3e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
@ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
                                    0
                                           first order 1.3e-02 1.0e+00 1.7e-05 0.0e+00
- Info:
              dixmaanl
                            99
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
┌ Info:
              dixmaanm
                            99
                                           first order 3.3e-01 1.0e+00 1.2e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
                                           first order 3.4e-01 1.0e+00 2.7e-06 0.0e+00
 Info:
              dixmaann
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
              dixmaano
                           99
                                    0
                                           first order 3.3e-02 1.0e+00 4.7e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
@ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
              dixmaanp
                           99
                                    0
                                           first order 4.3e-02 1.0e+00 9.6e-06 0.0e+00
 Info:
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                                           first_order 2.0e-01 5.2e-14 5.0e-08 0.0e+00
              dixon3da
                           100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
               dqdrtic
                          100
                                           first_order 1.8e-01 3.8e-11 7.3e-05
 Info:
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                           first_order
                                                        2.1e-01 6.1e-02 1.6e-01
 Info:
                dqrtic
                           100
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               edensch
                          100
                                    0
                                           first order
                                                        1.9e-01 6.0e+02 3.5e-06
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first_order 1.8e-01 -9.7e+01 8.5e-08 0.0e+00
 Info:
                          100
                                    0
                   eg2
L @ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
               engval1
                           100
                                    0
                                           first order 2.1e-01 1.1e+02 1.4e-05
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                  enso
                            9
                                    0
                                           first_order 1.3e-03 3.9e+02 4.0e-07 0.0e+00
^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                          100
                                    0
                                           first order 2.2e-01 3.9e+01 1.2e-03 0.0e+00
              errinros
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              extrosnb 100
 Info:
                                    0 first_order 1.8e-01 1.2e-11 1.5e-04 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                           first order 2.6e-01 -5.1e-01 1.3e-08 0.0e+00
              fletcbv2
                          100
                                    0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 2.3e-01 -2.0e+00 2.1e-09 0.0e+00
r Info:
              fletcbv3
                          100
                                    0
i @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
┌ Info:
                                           first order 2.2e-01 3.4e-13 4.0e-06 0.0e+00
              fletchcr
                          100
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first_order 2.7e-01 1.0e+02 4.6e-07 0.0e+00
· Info:
              fminsrf2
                          100
                                   0
i @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              freuroth
                                           first order 2.6e-01 6.0e+03 2.2e-05
· Info:
                           100
                                    0
                                                                                      0.0e + 00
<sup>i</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
г Info:
                gauss1
                            8
                                    0
                                              max time 3.0e+01 6.6e+02 6.5e-03 0.0e+00
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 7.4e-02 6.2e+02 6.2e-03 0.0e+00
r Info:
                gauss2
                            8
                                    0
L@ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                              max time 3.0e+01 6.2e+02 5.8e-03 0.0e+00
                gauss3
 Info:
                            8
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 2.7e-01 6.6e-13 5.0e-07 0.0e+00
r Info:
              genhumps
                           100
                                    0
L @ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
               genrose
                          100
                                   0
                                           first order 2.0e-01 1.0e+00 7.5e-07 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
· Info:
          genrose nash
                          100
                                    0
                                           first order 2.4e-01 1.0e+00 6.3e-07 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                        max_time 3.0e+01 2.7e+04 5.2e+06 0.0e+00
· Info:
          hahn1
                           7
                                0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
```

```
max_time 3.0e+01 -9.8e+03 8.4e-07
г Info:
                           100
                                    0
                 indef
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              integreq
                          100
                                    0
                                           first order 4.4e-01 5.9e-17 1.1e-08 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                             5
                                            first_order 2.6e-03 1.5e+01 5.4e+02
 Info:
                kirby2
                                    0
                                                                                     0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first_order 2.8e-04 2.1e-06 4.4e-07
 Info:
              lanczos1
                             6
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first_order 3.0e-04 2.1e-06 5.8e-07
              lanczos2
                             6
                                    0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 3.1e-04 2.2e-06 4.8e-07 0.0e+00
 Info:
              lanczos3
                            6
                                    0
└ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                                    0
               liarwhd
                           100
                                           first order 1.9e-01 8.8e-12 1.0e-04 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                           first_order 5.6e-05 5.5e-02 8.7e-07 0.0e+00
 Info:
                 mgh17
                            5
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                           100
                                    0
                                           first_order 1.3e+00 2.4e-12 3.7e-08
                morebv
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                             max time 3.0e+01 1.6e+02 1.4e-06 0.0e+00
 Info:
                 ncb20
                           100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                              max_time 3.0e+01 2.0e+02 3.1e-06
                           100
                                    0
 Info:
                ncb20b
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              noncvxu2
                           100
                                    0
                                           first_order 2.4e-01 2.3e+02 1.3e-04 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                           100
                                    0
                                            first order 2.1e-01 2.3e+02 1.2e-04
              noncvxun
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                nondia
                           100
                                    0
                                           first order 1.9e-01 1.4e-12 5.8e-05 0.0e+00
^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order 2.8e-01 1.3e-06 5.9e-06
 Info:
                           100
                                    0
                                                                                     0.0e+00
              nondquar
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                              max_time 3.0e+01 2.3e-02 3.1e-01 0.0e+00
 Info:
              osborne1
                            5
                                    0
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              osborne2
                            11
                                    0
                                            first_order 2.9e-03 2.0e-02 5.5e-08
[ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order 3.6e-01 8.4e+01 3.5e+00 0.0e+00
              palmer1c
 Info:
                             8
                                    0
^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first_order 3.1e-01 1.4e+01 3.0e-01
 Info:
                             7
                                    0
              palmer1d
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
              palmer2c
                             8
                                    0
                                            first_order 9.5e-02 2.2e+00 2.2e-01 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first order 7.1e-02 1.7e+00 8.4e-02 0.0e+00
              palmer3c
                             8
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              palmer4c
                             8
                                    0
                                           first order 6.3e-02 2.4e+00 8.4e-02 0.0e+00
 Info:
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                           first order 4.5e-04 1.1e+00 3.1e-06 0.0e+00
 Info:
                                    0
              palmer5c
                             6
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order 2.8e-01 4.8e-02 7.1e-03 0.0e+00
 Info:
              palmer6c
                             8
                                    0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
              palmer7c
                             8
                                    0
                                            first_order 2.8e-01 2.2e+00 2.8e-02
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
                            8
                                    0
                                           first order 1.7e-01 3.0e-01 8.4e-03 0.0e+00
              palmer8c
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                           100
                                    0
                                            first_order 2.5e-01 1.2e+00 4.0e+00
              penalty1
                                                                                      0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first_order 2.7e-01 9.7e+04 1.6e-02 0.0e+00
 Info:
              penalty2
                           100
                                    0
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                        3.8e-01 1.0e+00 3.6e-03
 Info:
                           100
                                    0
              penalty3
                                            first_order
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                    0
                                            first order 2.1e-01 6.1e-10 2.0e-05 0.0e+00
 Info:
              powellsq
                           100
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first_order 2.3e-01 2.7e-03 7.2e-02 0.0e+00
 Info:
                 power
                           100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                quartc
                           100
                                    0
                                            first_order 1.9e-01 6.1e-02 1.6e-01 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                           100
                                            first_order 1.7e+00 1.4e+01 4.0e-04 0.0e+00
               sbrybnd
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                           100
                                    0
                                           first_order 2.0e-01 -2.9e+02 1.0e-07 0.0e+00
 Info:
              schmvett
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
                           100
                                    0
                                              max time 3.0e+01 -7.4e+01 1.6e+04 0.0e+00
               scosine
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                           first_order 2.1e-01 1.8e-15 4.3e-08 0.0e+00
 Info:
               sinquad
                           100
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              sparsine
                           100
                                    0
                                            first order
                                                        2.6e-01 3.5e-10 1.2e-04
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 2.1e-01 2.9e-08 9.5e-06 0.0e+00
 Info:
              sparsdur
                           100
                                    0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first_order 4.8e-01 4.2e-15 6.1e-08 0.0e+00
              spmsrtls
                           100
 Info:
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
Info: srosenbr 100 0 first order 2.0e-01 8.2e-15 2.1e-06 0.0e
                                           first_order 2.0e-01 8.2e-15 2.1e-06 0.0e+00
 Info:
              srosenbr
                         100
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 9.9e-02 2.8e+03 1.4e+00 0.0e+00
                           7
                                  0
<sup>i</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
┌ Info:
              tointass
                          100
                                 0
                                          first order 2.0e-01 9.7e+00 2.5e-07 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
┌ Info:
                                           first order 1.9e-01 1.7e-20 8.2e-10 0.0e+00
                           100
                                  0
              tquartic
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
┌ Info:
                                           first order 2.0e-03 1.3e-11 1.5e-05 0.0e+00
                tridia
                          100
                                   0
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
Info: vardim 100 0 first_order 2.7e-01 2.5e+03 8.2e+05 0.0e
© SolverBenchmark /home/julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order 2.7e-01 2.5e+03 8.2e+05 0.0e+00
_{\Gamma} Info:
                                           first order 4.4e-03 4.6e+00 5.3e+00 0.0e+00
              vibrbeam
                                  0
                           8
L@ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                             unbounded 3.2e-03 -3.8e+90 8.1e+90 0.0e+00
                           31 0
 Info:
               watson
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
          woods
                                0 first order 2.1e-01 2.6e-09 3.9e-04 0.0e+00
 · Info:
                         100
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
```

```
Info:
                  Name
                          nvar
                                 ncon
                                                 status
                                                             Time
                                                                       f(x)
                                                                                Dual
                                                                                        Primal
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:127
 Info:
                  NZF1
                            91
                                     0
                                            first order 1.1e-03 2.1e+04 2.6e-05
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                                            first order 1.3e-04 5.0e+01 7.8e-15
               arqlina
                           100
                                     0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first order 1.4e-04 2.5e+01 3.3e-04
 Info:
               arglinb
                           100
                                     0
                                                                                      0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               arglinc
                           100
                                     0
                                            first order
                                                         1.0e-04 5.1e+01 4.4e-03
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order
                                                         3.1e-03 -9.9e+03 5.6e-08 0.0e+00
- Info:
               argtrig
                           100
                                     0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order 1.6e-04 0.0e+00 2.9e-06
 Info:
               arwhead
                           100
                                     0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               bdqrtic
                           100
                                     0
                                            first_order 5.9e-04 1.9e+02 1.3e-04
                                                                                       0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                biggs6
                                     0
                                              unbounded 1.8e-05 -3.2e+22 4.1e+22
                             6
[ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               brownal
                           100
                                     0
                                            first order
                                                         9.4e-05 1.9e-09 6.8e-04
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
             broyden3d
                           100
                                     0
                                            first order 1.3e-03 3.6e-01 3.1e-07
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
                                     0
                                           first_order 1.6e-02 3.6e+01 6.6e-07 0.0e+00
              broydn7d
                           100
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first order 1.2e-02 1.3e+00 1.4e-05
r Info:
                brybnd
                           100
                                     0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: catenary: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/catenary.jl:4
 Warning: catenary: number of variables adjusted to be greater or equal to 6
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/catenary.jl:6
                                            first_order 4.2e-03 1.0e+00 9.9e-04 0.0e+00
              chainwoo
                           100
                                     0
 Info:
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first_order 1.7e-02 5.8e-11 7.8e-05 0.0e+00
 Info:
              chnrosnb
                           100
                                     0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              clplatea
                           100
                                     0
                                            first order
                                                        2.8e-03 -9.1e-03 1.6e-08
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              clplateb
 Info:
                           100
                                     0
                                            first order
                                                         3.0e-03 -6.2e-03 1.4e-08
[ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                               max time 3.0e+01 -5.1e-03 2.4e-08 0.0e+00
 Info:
              clplatec
                           100
                                     0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                cosine
 Info:
                           100
                                     0
                                            first order 3.6e-04 -9.9e+01 2.8e-08
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              cragglvy
 Info:
                           100
                                            first order 1.7e-03 3.2e+01 3.8e-04
                                     0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                         1.7e-03 2.5e+01 5.6e-04
 Info:
             cragglvy2
                           100
                                     0
                                            first_order
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
- Info:
                 curly
                           100
                                     0
                                               max time 3.0e+01 -1.0e+04 3.5e-05 0.0e+00
^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               curly10
                           100
                                     0
                                               max time
                                                         3.0e+01 -1.0e+04 3.5e-05
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                               max time 3.0e+01 -1.0e+04 5.0e-05
 Info:
               curly20
                           100
                                     0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
               curly30
                           100
                                               max time 3.0e+01 -1.0e+04 3.7e-05
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
© OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
                                            first_order 3.9e-03 1.0e+00 1.7e-06 0.0e+00
 Info:
                                     0
              dixmaane
                            99
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan efgh.jl:12
                                           first_order 4.2e-03 1.0e+00 3.4e-06 0.0e+00
 Info:
              dixmaanf
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
 Info:
              dixmaana
                            99
                                     0
                                            first order 3.9e-03 1.0e+00 9.1e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan efgh.jl:12
              dixmaanh
                            99
                                     0
                                            first order 4.1e-03 1.0e+00 6.7e-06 0.0e+00
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
                                           first order 3.0e-02 1.0e+00 2.6e-06 0.0e+00
r Info:
              dixmaani
                            99
                                     0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan ijkl.jl:12
                                            first order 2.5e-02 1.0e+00 3.9e-06 0.0e+00
 Info:
              dixmaanj
                                     0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ \ Optimization Problems. ADNL PProblems \ / home/julia/packages/Optimization Problems/fiJkh/src/ADNL PProblems/dixmaan_ijkl.jl: 12 \\
 Info:
              dixmaank
                            99
                                     0
                                           first order 1.7e-02 1.0e+00 9.2e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of {\tt 3}
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan ijkl.jl:12
 Info:
                                            first_order 1.4e-02 1.0e+00 1.5e-05 0.0e+00
              dixmaanl
                            99
                                     0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
\Gamma Warning: dixmaan: number of variables adjusted to be a multiple of 3
© OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
Info: dixmaanm 99 0 first_order 5.0e-02 1.0e+00 1.1e-06 0.0 @ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order 5.0e-02 1.0e+00 1.1e-06 0.0e+00
- Warning: dixmaan: number of variables adjusted to be a multiple of 3
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
              dixmaann
                            99
                                     0
                                            first_order 3.2e-02 1.0e+00 2.7e-06 0.0e+00
 Info:
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
Q OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
```

```
first_order 3.2e-02 1.0e+00 4.4e-06
              dixmaano
                            99
                                     0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan mnop.jl:12
                                           first order 3.4e-02 1.0e+00 8.0e-06 0.0e+00
                            99
                                    0
· Info:
              dixmaanp
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
              dixon3dq
                           100
                                    0
                                            first order 4.0e-03 3.4e-14 4.8e-08 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                           100
                                    0
                                            first order 2.0e-04 4.0e-12 4.3e-05
 Info:
               dgdrtic
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
г Info:
                dqrtic
                           100
                                    0
                                            first order 6.7e-04 2.9e-02 1.1e-01 0.0e+00
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                    0
· Info:
               edensch
                           100
                                            first order 7.4e-04 6.0e+02 2.2e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first_order 1.9e-04 -9.7e+01 8.5e-08
 Info:
                   eg2
                           100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
               engval1
                           100
                                    0
                                            first_order 3.3e-04 1.1e+02 6.7e-06
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first_order 9.9e-04 3.9e+02 9.7e-07
                  enso
                             9
                                    0
[ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                    0
                                            first order 6.2e-03 3.9e+01 5.6e-04 0.0e+00
- Info:
              errinros
                           100
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
              extrosnb
                                    0
                           100
                                            first order 4.4e-04 3.2e-11 1.5e-04 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first_order 4.4e-03 -5.1e-01 1.4e-08 0.0e+00
 Info:
              fletcbv2
                           100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
              fletcbv3
                           100
                                    0
                                            first order 3.6e-03 -2.0e+00 5.6e-09
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              fletchcr
                           100
                                    0
                                            first order 5.6e-03 3.5e-13 3.9e-06 0.0e+00
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 3.7e-03 1.0e+02 8.4e-07 0.0e+00
                                    0
- Info:
              fminsrf2
                           100
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              freuroth
                           100
                                    0
                                            first_order 1.2e-03 6.0e+03 2.3e-05 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                                                       0.0e+00
 Info:
                gauss1
                             8
                                    0
                                            first_order 3.2e-03 6.6e+02 9.7e-05
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order
                gauss2
                             8
                                    0
                                                         4.2e-03 6.2e+02 4.3e-03
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                             8
                                    0
                                            first order 4.1e-03 6.2e+02 5.3e-05 0.0e+00
                gauss3
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                    0
                                                         6.5e-02 3.5e-11 3.7e-06
 Info:
              genhumps
                           100
                                            first order
                                                                                      0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
               genrose
                                           first_order 4.0e-03 1.0e+00 1.8e-06
 Info:
                           100
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
г Info:
          genrose_nash
                           100
                                    0
                                            first_order 1.9e-02 1.0e+00 1.2e-06
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 hahn1
                             7
                                    0
                                              max time 3.0e+01 2.7e+04 5.2e+06 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                              max time 3.0e+01 -9.8e+03 6.6e-07
. Info:
                 indef
                                    0
                           100
                                                                                       0.0e + 00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first_order 2.0e-02 5.8e-17 1.1e-08
 Info:
              integreq
                           100
                                    0
                                                                                       0.0e + 00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first_order 2.5e-03 1.5e+01 5.5e+02
                kirby2
                             5
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              lanczos1
                             6
                                    0
                                           first order 2.0e-04 2.1e-06 5.8e-07
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                    0
                                           first order 2.2e-04 2.1e-06 3.1e-07 0.0e+00
- Info:
              lanczos2
                             6
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              lanczos3
                             6
                                    0
                                            first_order 2.1e-04 2.2e-06 7.1e-07
                                                                                      0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                           100
                                    0
                                            first order 3.0e-04 1.1e-10 1.3e-04
               liarwhd
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 mgh17
                             5
                                    0
                                            first order
                                                         5.9e-05 5.5e-02 1.2e-06
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                moreby
                           100
                                    0
                                            first order
                                                         4.7e-01 2.7e-11 3.7e-08
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 ncb20
                           100
                                    0
                                              max_time 3.0e+01 1.7e+02 6.6e-07 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                ncb20b
                           100
                                    0
                                              max time 3.0e+01 2.0e+02 2.4e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              noncvxu2
                           100
                                    0
                                           first order 1.3e-02 2.3e+02 1.3e-04 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                    0
                                           first order 4.7e-03 2.3e+02 1.5e-04 0.0e+00
- Info:
              noncvxun
                           100
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first_order 3.8e-04 3.4e-15 7.8e-06 0.0e+00
 Info:
                nondia
                           100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first_order 2.5e-02 7.4e-07 5.6e-06
 Info:
              nondquar
                           100
                                    0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                             5
                                    0
                                              max_time 3.0e+01 2.3e-02 4.1e+04 0.0e+00
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
```

```
first order 7.3e-04 2.0e-02 2.6e-08
                                             0
                 osborne2
                                  11
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
                                   8
                                             0
                                                     first order 6.1e-03 8.4e+01 1.8e+00 0.0e+00
                 palmer1c
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                 palmer1d
                                                      first order 6.0e-03 1.4e+01 2.5e-01 0.0e+00
 Info:
                                   7
                                             0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
                 palmer2c
                                   8
                                             0
                                                      first_order 3.8e-03 2.2e+00 9.1e-02 0.0e+00
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 palmer3c
                                   8
                                             0
                                                      first order 2.1e-03 1.7e+00 7.8e-02
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
- Info:
                                                      first order 3.3e-03 1.8e-01 6.4e-02 0.0e+00
                 palmer4c
                                   8
                                             0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                      first order 3.2e-04 1.1e+00 1.4e-06 0.0e+00
 Info:
                 palmer5c
                                   6
                                             0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                      first_order 3.7e-03 4.8e-02 1.8e-03
 Info:
                 palmer6c
                                   8
                                             0
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
                 palmer7c
                                   8
                                             0
                                                      first_order 2.8e-03 2.7e+00 2.5e-02 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                 palmer8c
                                   8
                                             0
                                                      first_order 2.9e-03 3.0e-01 4.2e-03
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                 penaltv1
                                             0
                                                      first order 4.6e-04 1.2e+00 4.0e+00 0.0e+00
- Info:
                                 100
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                      first_order 2.9e-03 9.7e+04 2.0e-02 0.0e+00
 Info:
                 penalty2
                                 100
                                             0
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                      first_order 2.7e-03 1.0e+00 5.2e-03 0.0e+00
 Info:
                 penalty3
                                 100
                                             0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                 powellsg
                                 100
                                             0
                                                      first order 4.8e-04 1.4e-09 1.9e-05
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                     power
                                 100
                                             0
                                                     first order 3.5e-04 1.6e-03 7.1e-02 0.0e+00
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                   quartc
                                             0
                                                     first order 5.9e-04 2.9e-02 1.1e-01 0.0e+00
 Info:
                                 100
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                      first order 3.2e+00 7.6e+00 3.7e-04
 Info:
                  sbrybnd
                                 100
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                 100
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                                                      first order 6.5e-04 -2.9e+02 1.1e-07
                 schmvett
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                         max time 3.0e+01 -7.8e+01 2.8e+04
                  scosine
                                 100
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                                 100
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                                                      first order 2.8e-03 9.8e-16 3.9e-08 0.0e+00
                  singuad
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                      first_order 1.9e-02 4.3e-10 9.1e-05 0.0e+00
 Info:
                 sparsine
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                                             0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
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                                                      first order 6.4e-04 4.7e-08 1.6e-05
 Info:
                 sparsqur
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                 spmsrtls
                                 100
                                             0
                                                     first_order 8.0e-03 7.7e-15 7.3e-08
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                             0
                                                      first order 2.6e-04 4.0e-13 2.0e-05 0.0e+00
- Info:
                 srosenbr
                                 100
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                  thurber
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                                             0
                                                      first_order 1.8e-03 2.8e+03 3.7e-02 0.0e+00
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                      first order 6.6e-04 9.7e+00 1.9e-07
 Info:
                 tointgss
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Least described in a contract of the contract 
                                                      first_order 2.9e-04 4.2e-20 3.4e-09
                 tquartic
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                   tridia
                                 100
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                                                     first order 1.7e-03 1.8e-12 1.4e-05 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                 100
                                             0
                                                     first order 2.3e-04 2.5e+03 8.2e+05 0.0e+00
- Info:
                   vardim
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 vibrbeam
                                   8
                                             0
                                                      first_order 6.4e-04 5.3e+00 1.9e+00 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                                  31
                                             0
                                                        unbounded 3.0e-03 -3.8e+90 8.1e+90
                    watson
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                     woods
                                 100
                                             0
                                                      first order 2.8e-04 1.7e-09 1.1e-03
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                      Name
                                                           status
                                                                          Time
                                                                                      f(x)
                                                                                                  Dual
                                nvar
                                         ncon
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:127
 Info:
                      NZF1
                                  91
                                             0
                                                      first_order 1.6e-03 2.1e+04 3.0e-05 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                 100
                                                      first order 1.3e-04 5.0e+01 7.8e-15
 Info:
                  arglina
                                             0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                      first_order 1.2e-04 2.5e+01 3.3e-04 0.0e+00
                  arglinb
                                 100
                                             0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                 100
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                                                      first order 9.0e-05 5.1e+01 4.4e-03 0.0e+00
 Info:
                  arglinc
L@ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                      first_order 8.8e-03 -9.9e+03 1.0e-07
                                             0
 Info:
                  argtrig
                                 100
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                  arwhead
                                 100
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                                                      first_order 1.5e-04 0.0e+00 2.9e-06
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                     first_order 5.9e-04 1.9e+02 1.5e-04
                  bdqrtic
                                 100
                                             0
 @\ Solver Benchmark / home/julien/.julia/packages/Solver Benchmark/YM13z/src/run\_solver.jl:175\\
                   biggs6
                                   6
                                             0
                                                      unbounded 1.7e-05 -3.2e+22 4.1e+22 0.0e+00
 Info:
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
- Info:
                                 100
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                                                      first order 9.2e-05 1.9e-09 6.8e-04
                                                                                                         0.0e+00
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<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                      first_order 1.3e-03 3.6e-01 5.7e-07 0.0e+00
 Info:
                broyden3d
                                 100
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
┌ Info:
                 broydn7d
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                                                      first order 1.9e-02 3.6e+01 6.4e-07
L @ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                   brybnd
                                                     first order 1.4e-02 1.3e+00 1.8e-05 0.0e+00
 Info:
                                 100
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
r Warning: catenary: number of variables adjusted to be a multiple of 3
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/catenary.jl:4
_{\Gamma} Warning: catenary: number of variables adjusted to be greater or equal to 6
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/catenary.jl:6
                                                     first_order 3.8e-03 1.0e+00 1.0e-03 0.0e+00
 · Info:
                 chainwoo
                                 100
                                            0
i @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                      first order 1.6e-02 1.1e-10 5.1e-05
г Info:
                 chnrosnb
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© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 clplatea
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                                                     first order 4.1e-03 -9.1e-03 1.6e-08 0.0e+00
[ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                     first order 5.0e-03 -6.2e-03 1.5e-08 0.0e+00
г Info:
                 clolateb
                                 100
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L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
                 clplatec
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                                                         max_time 3.0e+01 -5.1e-03 2.0e-08 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
```

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first order 4.1e-04 -9.9e+01 2.9e-08
┌ Info:
                                100
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                   cosine
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 cradalvv
                                100
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                                                     first order
                                                                    1.7e-03 3.2e+01 5.3e-04
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                                                     first order 2.2e-03 2.5e+01 3.6e-04 0.0e+00
                cragglvy2
                                100
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L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                    curly
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 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                  curly10
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                        max time 3.0e+01 -1.0e+04 5.7e-05 0.0e+00
 Info:
                  curly20
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
                  curly30
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                                                        max time 3.0e+01 -1.0e+04 1.2e-04 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
                 dixmaane
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                                                                     4.6e-03 1.0e+00 2.7e-06 0.0e+00
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
© OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
                                                    first order 4.2e-03 1.0e+00 3.6e-06 0.0e+00
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L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
                                                                                                        0.0e+00
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                                                    first_order 4.1e-03 1.0e+00 9.4e-06
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
Info: dixmaanh 99 0 first_order 4.1e-03 1.0e+00 9.0e-06 0.0e @ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                     first order 4.1e-03 1.0e+00 9.0e-06 0.0e+00
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan ijkl.jl:12
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                 dixmaani
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
                 dixmaanj
                                                     first order 2.3e-02 1.0e+00 4.9e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
                                                    first_order 1.6e-02 1.0e+00 9.7e-06 0.0e+00
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
                                                    first order 1.4e-02 1.0e+00 2.0e-05 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
                                                    first order 5.4e-02 1.0e+00 1.2e-06 0.0e+00
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                 dixmaanm
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan mnop.jl:12
 Info:
                                                     first_order 4.2e-02 1.0e+00 2.7e-06 0.0e+00
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<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
Q OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
                                                     first order 4.1e-02 1.0e+00 4.4e-06 0.0e+00
 Info:
                 dixmaano
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan mnop.jl:12
                                                    first_order
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 Info:
                 dixmaanp
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L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
- Info:
                 dixon3dq
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                                                                     4.7e-03 2.2e-14 5.5e-08 0.0e+00
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                     first order 1.9e-04 4.0e-12 4.3e-05
 · Info:
                  dqdrtic
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L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                     first_order 4.9e-04 3.4e-02 1.3e-01
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
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 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                     first order
 Info:
                                100
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                                                                    1.8e-04 -9.7e+01 8.5e-08
                       eg2
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                100
                                            0
                                                     first order
                                                                    3.3e-04 1.1e+02 6.3e-06 0.0e+00
- Info:
                  engval1
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                                     1.0e-03 3.9e+02 2.2e-06
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 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                 errinros
                                                     first order
                                                                     5.8e-03 3.9e+01 1.3e-03
 Info:
                                100
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<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                     first order
                                                                     4.4e-04 2.6e-11 1.2e-04
                 extrosnb
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 fletcbv2
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                                                    first order 2.1e-02 -5.1e-01 1.4e-08 0.0e+00
  @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info: fletcbv3 100 0 first_order 3.3e-03 -2.0e+00 3.5e-09 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                               100 0 first_order 5.4e-03 2.2e-13 3.8e-06 0.0e+00
 Info:
                 fletchcr
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                    first_order 4.3e-03 1.0e+02 1.3e-06 0.0e+00
┌ Info:
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Leave the control of 
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                 freuroth
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© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                  gauss1
                                 8
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                                                 max_time 3.0e+01 6.6e+02 2.6e-03 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                   max time 3.0e+01 6.2e+02 2.1e-02 0.0e+00
                                          0
 · Info:
                                   8
                   gauss2
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                   max_time 3.0e+01 6.2e+02 7.8e-03 0.0e+00
 Info:
                  gauss3
                                  8
                                          0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
- Tnfo:
                 genhumps
                                100
                                         0
                                                   first order 5.6e-02 4.0e-10 1.1e-05 0.0e+00
@ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
┌ Info:
               genrose
                                                  first order 3.2e-03 1.0e+00 1.9e-06 0.0e+00
                                100
                                         0
L@ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 · Info: genrose nash
                                100 0 first_order 3.7e-03 1.0e+00 1.5e-06 0.0e+00
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                7 0 max time 3.0e+01 2.7e+04 5.2e+06 0.0e+00
                    hahn1
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
```

```
first_order 3.4e-03 -9.8e+03 5.3e-08
                                 100
                                           0
                        indef
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                     integreg
                                 100
                                           0
                                                  first order 2.0e-02 5.8e-17 1.1e-08 0.0e+00
        Info:
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first order 2.5e-03 1.5e+01 6.1e+02 0.0e+00
        Info:
                       kirby2
                                   5
                                           0
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                     lanczos1
                                   6
                                           0
                                                  first_order 2.0e-04 2.1e-06 8.8e-07 0.0e+00
        @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                   6
                                           0
                                                  first order 2.2e-04 2.1e-06 3.9e-07
        Info:
                     lanczos2
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       - Info:
                                   6
                                           0
                                                  first order 2.4e-04 2.2e-06 8.0e-08 0.0e+00
                     lanczos3
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                                 100
                                           0
                                                  first order 2.5e-04 3.7e-10 1.2e-04 0.0e+00
                      liarwhd
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first_order 5.6e-05 5.5e-02 2.6e-06 0.0e+00
        Info:
                        mgh17
                                   5
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                       morebv
                                 100
                                           0
                                                  first order 5.6e-01 1.8e-12 3.4e-08
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                        ncb20
                                 100
                                           0
                                                     max time 3.0e+01 1.6e+02 8.3e-07 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                       ncb20b
                                 100
                                           0
                                                     max time 3.0e+01 2.0e+02 4.2e-06
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                     noncvxu2
                                 100
                                           0
                                                  first_order 1.0e-02 2.3e+02 1.3e-04 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     noncvxun
                                 100
                                           0
                                                  first_order
                                                              6.6e-03 2.3e+02 8.9e-05
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first_order 3.5e-04 1.0e-13 1.1e-05 0.0e+00
                      nondia
                                 100
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                     nondquar
                                 100
                                           0
                                                  first order 3.2e-02 7.9e-07 5.6e-06 0.0e+00
        Info:
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                    max_time 3.0e+01 2.3e-02 1.4e+02 0.0e+00
                                           0
        Info:
                     osborne1
                                   5
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first_order 1.2e-03 2.0e-02 5.5e-08
                                           0
        Info:
                     osborne2
                                  11
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first_order 1.2e-02 8.4e+01 1.4e+00
                     palmer1c
                                   8
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                     palmer1d
                                   7
                                          0
                                                  first order 1.9e-02 1.4e+01 2.1e-01 0.0e+00
        Info:
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first_order 1.1e-02 2.2e+00 8.6e-02 0.0e+00
        Info:
                                   8
                                           0
                     palmer2c
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     palmer3c
                                   8
                                           0
                                                  first_order 2.2e-02 1.7e+00 8.4e-02 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     palmer4c
                                   8
                                           0
                                                  first_order 2.4e-02 1.8e-01 1.4e-02
       <sup>i</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       - Info:
                     palmer5c
                                   6
                                           0
                                                  first order 3.7e-04 1.1e+00 1.0e-06 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                     palmer6c
                                   8
                                           0
                                                  first_order 7.6e-03 4.8e-02 6.8e-03 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first order 4.2e-03 2.7e+00 2.1e-02 0.0e+00
        Info:
                     palmer7c
                                   8
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     palmer8c
                                   8
                                           0
                                                  first order 4.7e-03 3.0e-01 1.3e-03 0.0e+00
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       г Info:
                     penalty1
                                 100
                                           0
                                                  first order 4.7e-04 1.2e+00 4.0e+00 0.0e+00
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     penalty2
                                 100
                                           0
                                                  first order 2.9e-03 9.7e+04 2.2e-02 0.0e+00
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first_order 3.1e-03 1.0e+00 5.2e-03 0.0e+00
        Info:
                     penalty3
                                 100
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                     powellsg
                                 100
                                           0
                                                  first_order 5.1e-04 7.9e-11 2.2e-05 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                  first_order 3.5e-04 2.8e-03 6.6e-02
        Info:
                       power
                                 100
                                           0
       [ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           0
                                                  first order 4.5e-04 3.4e-02 1.3e-01 0.0e+00
        Info:
                       quartc
                                 100
       ^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                                 100
                                           0
                                                  first_order 1.1e+00 1.4e+01 3.8e-04
                      sbrybnd
        @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                     schmvett
                                 100
                                           0
                                                  first_order 6.4e-04 -2.9e+02 2.2e-07
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                 100
                                           0
                                                     max_time 3.0e+01 -7.5e+01 2.2e+04
                      scosine
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                      singuad
                                 100
                                           0
                                                  first order 3.5e-03 6.1e-16 5.7e-08 0.0e+00
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                  first_order 2.4e-02 4.5e-10 1.1e-04 0.0e+00
        Info:
                     sparsine
                                 100
                                           0
        @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                     sparsqur
        Info:
                                 100
                                           0
                                                  first_order 5.2e-04 5.1e-08 1.5e-05 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first order 8.1e-03 8.1e-15 8.3e-08
                                 100
                     spmsrtls
                                           0
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                    srosenbr
                                 100
                                           0
                                                  first order 2.6e-04 4.0e-13 2.0e-05 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                      thurber
                                           0
                                                  first_order 2.7e-03 2.8e+03 1.2e+00 0.0e+00
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                first_order 7.2e-04 9.7e+00 1.8e-07 0.0e+00
        · Info:
                     tointgss
                                100
                                       0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first order 3.5e-04 2.2e-20 2.4e-09
       ┌ Info:
                     tquartic
                                 100
                                         0
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        · Info:
                                 100
                                                first_order 2.0e-03 1.9e-11 1.7e-05
                      tridia
                                        0
       <sup>[</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       ┌ Info:
                                 100 0
                     vardim
                                              first order 3.2e-04 2.5e+03 8.2e+05 0.0e+00
       L@ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       ŗ Info:
                     vibrbeam
                                 8
                                        0
                                              first_order 9.3e-04 5.3e+00 1.4e+00 0.0e+00
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
       ┌ Info:
                                                  unbounded 4.0e-03 -3.8e+90 8.1e+90 0.0e+00
                       watson
                                  31
                                        0
       i @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                        woods
                                 100
                                           0
                                                 first order 3.7e-04 2.7e-11 2.2e-04 0.0e+00
       [ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       Dict{Symbol, DataFrames.DataFrame} with 3 entries:
         :lbfgs 5 => 105×39 DataFrame...
         :lbfgs 20 => 105×39 DataFrame...
         :lbfgs_10 => 105×39 DataFrame...
In [ ]: # this code was found as is @ https://jso.dev/OptimizationProblems.jl/dev/benchmark/
```

cols = [:id, :name, :nvar, :objective, :dual_feas, :neval_obj, :neval_grad, :neval_hess, :iter, :elapsed_time, :status]
header = Dict(
 :nvar => "n",
 :objective => "f(x)",
 :dual_feas => "||∇f(x)||",
 :neval_obj => "# f",
 :neval_grad => "# ∇f",

```
:neval_hess => "# ∇²f",
:elapsed_time => "t",
)
for solver ∈ keys(solvers)
    pretty_stats(stats[solver][!, cols], hdr_override=header)
end
```

| id | name | n | f(x) | ∇f(x) | # f | # ∇f | # ∇²f | iter | t | status |
|--------------|------------------------|--------------|--------------------------|------------------------|----------------------|------------------|----------|--------------------|------------------------|------------------------------|
| 25 | NZF1 | 91 | 2.09e+04 | 3.66e-05 | 229 | 194 | 0 | 193 | 3.03e-01 | first_order |
| 38 | arglina | 100 | 5.00e+01 | 7.84e-15 | 2 | 2 | 0 | 1 | 2.78e-01 | first_order |
| 39 40 | arglinb | 100 100 | 2.48e+01 5.11e+01 | 3.28e-04 4.44e-03 | 70 71 | 3 | 0 0 | 2 2 | 2.13e-01 2.14e-01 | first_order |
| 40 | arglinc argtrig | 100 | -9.90e+03 | 5.47e-03 | 136 | 108 | 0 | 107 | 2.14e-01 2.22e-01 | first_order first order |
| 42 | arwhead | 100 | 0.00e+00 | 4.95e-07 | 28 | 13 | j 0 | 12 | 1.84e-01 | first_order |
| 45 50 | bdqrtic | 100 6 | 1.89e+02 -3.17e+22 | 2.10e-04 4.12e+22 | 104 3 | 68 3 | 0 0 | 67 2 | 2.32e-01 2.19e-05 | first_order unbounded |
| 55 | biggs6 brownal | 100 | 1.92e-09 | 6.77e-04 | 27 | 3 | 0 | 2 | 2.19e-05 2.35e-01 | first order |
| 58 | broyden3d | 100 | 3.56e-01 | 1.42e-07 | 68 | 52 | j 0 | j 51 | 2.08e-01 | first_order |
| 59 | broydn7d | 100 | 3.60e+01 | 7.64e-07 | 419 222 | 389 | 0 | 388 | 3.03e-01 | first_order |
| 60 65 | brybnd chainwoo | 100 100 | 1.34e+00 1.00e+00 | 1.43e-05 7.78e-04 | 410 | 197 334 | 0 0 | 196 333 | 2.96e-01 2.33e-01 | first_order first order |
| 67 | chnrosnb | 100 | 2.35e-10 | 7.35e-05 | 679 | 626 | 0 | 625 | 2.33e-01 | first_order |
| 72 73 | clplatea clplateb | 100 100 | -9.15e-03 -6.20e-03 | 1.27e-08 1.49e-08 | 106 106 | 102 102 | 0 0 | 101 101 | 4.52e-01 4.79e-01 | first_order first order |
| 74 | clplatec | 100 | -5.11e-03 | 1.49e-08 | 1887 | 1748 | 0 | 1747 | 5.23e-01 | first_order |
| 76 | cosine | 100 | -9.90e+01 | 5.15e-08 | 28 | 19 | 0 | 18 | 1.89e-01 | first_order |
| 77 78 | cragglvy cragglvy2 | 100 100 | 3.23e+01 2.52e+01 | 5.75e-04 5.00e-04 | 96 105 | 72 82 | 0 0 | 71 81 | 2.45e-01 2.09e-01 | first_order first order |
| 79 | curly | 100 | -1.00e+04 | 3.58e-05 | 13024201 | 157983 | 0 | 157982 | 3.00e+01 | max_time |
| 80 | curly10 | 100 | -1.00e+04 | 3.58e-05 | 12165566 | 147638 | 0 | 147637 | 3.00e+01 | max_time |
| 81 82 | curly20 curly30 | 100 100 | -1.00e+04 -1.00e+04 | 9.40e-05 7.73e-05 | 9814493 7361660 | 118273 81338 | 0 0 | 118272 81337 | 3.00e+01 3.00e+01 | max_time max time |
| 84 | dixmaane | 99 | 1.00e+00 | 2.45e-06 | 73 | 66 | j 0 | 65 | 3.12e-01 | first_order |
| 85 86 | dixmaanf | 99 99 | 1.00e+00 | 4.57e-06 | 70 66 | 63 59 | 0 0 | 62 58 | 2.59e-01 4.44e-03 | first_order |
| 87 | dixmaang dixmaanh | 99 | 1.00e+00 1.00e+00 | 8.38e-06 1.98e-05 | 64 | 55 | 0 | 54 | 4.44e-03 4.21e-03 | first_order first order |
| 88 | dixmaani | 99 | 1.00e+00 | 2.15e-06 | 370 | 355 | 0 | 354 | 3.41e-01 | first_order |
| 89 90 | dixmaanj dixmaank | 99 99 | 1.00e+00 1.00e+00 | 4.92e-06 9.26e-06 | 226 164 | 211 155 | 0 0 | 210 154 | 3.15e-01 1.60e-02 | first_order first order |
| 90 | dixmaank dixmaanl | 99 | 1.00e+00 1.00e+00 | 9.26e-06 1.67e-05 | 104 | 128 | 0 | 154 | 1.80e-02 1.33e-02 | first_order |
| j 92 | dixmaanm | 99 | 1.00e+00 | 1.20e-06 | 412 | 397 | j 0 | 396 | 3.32e-01 | first_order |
| 93 | dixmaann dixmaano | 99 99 | 1.00e+00 1.00e+00 | 2.72e-06 4.65e-06 | 365 255 | 349 243 | 0 0 | 348 242 | 3.40e-01 3.31e-02 | first_order first order |
| j 95 | dixmaanp | 99 | 1.00e+00 | 9.59e-06 | 323 | 303 | 0 | 302 | 4.28e-02 | first_order |
| 96 | dixon3dq | 100 | 5.17e-14 | 4.99e-08 | 614 | 591 | 0 | 590 | 1.98e-01 | first_order |
| 97 | dqdrtic dqrtic | 100 100 | 3.76e-11 6.13e-02 | 7.31e-05 1.63e-01 | 33 45 | 13 21 | 0 0 | 12 20 | 1.85e-01 2.13e-01 | first_order first order |
| 100 | edensch | 100 | 6.03e+02 | 3.48e-06 | 32 | 24 | 0 | 23 | 1.93e-01 | first_order |
| 101 | j eg2 | 100 | -9.74e+01 | 8.54e-08 | 19 | 8 | 0 | j 7 | 1.84e-01 | first_order |
| 103 104 | engval1 enso | 100 9 | 1.09e+02 3.94e+02 | 1.44e-05 4.04e-07 | 35 49 | 21 38 | 0 0 | 20 37 | 2.13e-01 1.30e-03 | first_order first order |
| 105 | errinros | 100 | 3.88e+01 | 1.21e-03 | 493 | 296 | 0 | 295 | 2.23e-01 | first_order |
| 106 | extrosnb | 100 | 1.19e-11 | 1.53e-04 | 53 | 32 | 0 | 31 | 1.82e-01 | first_order |
| 107 108 | fletcbv2 fletcbv3 | 100 100 | -5.14e-01 -2.03e+00 | 1.29e-08 2.13e-09 | 395 39 | 376 33 | 0 0 | 375 32 | 2.64e-01 2.32e-01 | first_order first order |
| 109 | fletchcr | 100 | 3.40e-13 | 3.98e-06 | 575 | 522 | 0 | 521 | 2.24e-01 | first_order |
| 110 | fminsrf2 | 100 | 1.00e+02 | 4.62e-07 | 218 | 198 | 0 | 197 | 2.71e-01 | first_order |
| 111 | freuroth gauss1 | 100 8 | 5.98e+03 6.58e+02 | 2.24e-05 6.51e-03 | 39 7649661 | 24 198625 | 0 0 | 23 198624 | 2.62e-01 3.00e+01 | first_order max time |
| 113 | gauss2 | 8 | 6.24e+02 | 6.24e-03 | 6110 | 3339 | 0 | 3338 | 7.37e-02 | first_order |
| 114 | gauss3 genhumps | 8 | 6.22e+02 6.55e-13 | 5.84e-03 | 7683250 1471 | 184489 976 | 0 0 | 184488 975 | 3.00e+01 2.73e-01 | max_time |
| 116 117 | genrose | 100 100 | 1.00e+00 | 5.03e-07 7.51e-07 | 294 | 266 | 0 | 265 | 2.75e-01 2.05e-01 | first_order first order |
| 118 | genrose_nash | 100 | 1.00e+00 | 6.32e-07 | 362 | 297 | 0 | 296 | 2.41e-01 | first_order |
| 120 285 | hahn1 indef | 7 100 | 2.66e+04 -9.76e+03 | 5.19e+06 8.41e-07 | 416689 15301742 | 416596 347932 | 0 0 | 416595 347931 | 3.00e+01 3.00e+01 | max_time max time |
| 286 | integreq | 100 | 5.87e-17 | 1.11e-08 | 8 | 8 | 0 | 7 | 4.37e-01 | first_order |
| 288 | kirby2 | 5 | 1.52e+01 | 5.44e+02 | 204 | 121 | 0 | 120 | 2.63e-03 | first_order |
| 290 291 | lanczos1 | 6 6 | 2.15e-06 2.15e-06 | 4.41e-07 5.75e-07 | 157 187 | 123 137 | 0 0 | 122 136 | 2.83e-04 3.04e-04 | first_order first order |
| j 292 | lanczos3 | 6 | 2.17e-06 | 4.77e-07 | 189 | 136 | 0 | 135 | 3.15e-04 | first_order |
| 293 | liarwhd | 100 | 8.82e-12 | 1.01e-04 | 36 | 18 | 0 | 17 | 1.93e-01 | first_order |
| 301 306 | mgh17 morebv | 5 100 | 5.52e-02 2.45e-12 | 8.72e-07 3.74e-08 | 43 22476 | 22 21619 | 0 0 | 21 21618 | 5.60e-05 1.31e+00 | first_order first order |
| 308 | ncb20 | 100 | 1.65e+02 | 1.41e-06 | 5738489 | 98204 | 0 | 98203 | 3.00e+01 | max_time |
| 309 311 | ncb20b noncvxu2 | 100 100 | 1.97e+02 2.32e+02 | 3.15e-06 1.26e-04 | 5361388 438 | 88578 420 | 0 0 | 88577 419 | 3.00e+01 2.38e-01 | max_time first order |
| 311 | noncvxun | 100 | 2.32e+02 2.33e+02 | 1.26e-04 1.16e-04 | 211 | 196 | 0 | 195 | 2.07e-01 | first_order |
| 313 | nondia | 100 | 1.36e-12 | 5.83e-05 | 61 | 25 | 0 | 24 | 1.92e-01 | first_order |
| 314 315 | nondquar osbornel | 100 5 | 1.30e-06 2.34e-02 | 5.91e-06 3.11e-01 | 3063 70721080 | 2478 1124426 | 0 0 | 2477 1124425 | 2.84e-01 3.00e+01 | first_order max time |
| 316 | osborne2 | 11 | 2.01e-02 | 5.54e-08 | 347 | 306 | 0 | 305 | 2.86e-03 | first_order |
| 317 | palmer1c | 8 7 | 8.38e+01 | 3.49e+00 | 4061 | 2169 | j 0 | 2168 | 3.61e-01 | first_order |
| 318 319 | palmer1d palmer2c | 7 8 | 1.36e+01 2.22e+00 | 3.01e-01 2.15e-01 | 4142 1819 | 2264 865 | 0 0 | 2263 864 | 3.10e-01 9.49e-02 | first_order first order |
| 320 | palmer3c | 8 | 1.65e+00 | 8.39e-02 | 1044 | 527 | 0 | 526 | 7.06e-02 | first_order |
| 321 | palmer4c | 8 6 | 2.41e+00 1.06e+00 | 8.36e-02 | 1315 20 | 698 5 | 0 | 697 | 6.34e-02 4.48e-04 | first_order |
| 322 | palmer5c palmer6c | 6 8 | 1.06e+00 4.77e-02 | 3.14e-06 7.09e-03 | 20 7988 | 4303 | 0 0 | 14 4302 | 4.48e-04 2.76e-01 | first_order first_order |
| 325 | palmer7c | 8 | 2.16e+00 | 2.78e-02 | 8953 | 4851 | 0 | 4850 | 2.80e-01 | first_order |
| 326 | palmer8c penalty1 | 8 100 | 2.95e-01 1.16e+00 | 8.35e-03 4.05e+00 | 5174 53 | 2941 21 | 0 | 2940 20 | 1.67e-01 2.50e-01 | first_order first order |
| 327 | penalty1 penalty2 | 100 100 | 9.71e+04 | 1.58e-02 | 53 | 21 28 | 0 0 | 20 27 | 2.50e-01 2.70e-01 | first_order first_order |
| 329 | penalty3 | 100 | 1.00e+00 | 3.61e-03 | 153 | 105 | 0 | 104 | 3.77e-01 | first_order |
| 335 336 | powellsg power | 100 100 | 6.08e-10 2.65e-03 | 1.96e-05 7.22e-02 | 87 60 | 48 27 | 0 0 | 47 26 | 2.12e-01 2.26e-01 | first_order first order |
| 337 | quartc | 100 | 6.13e-02 | 1.63e-01 | 45 | 21 | 0 | 20 | 1.86e-01 | first_order |
| 343 | sbrybnd | 100 | 1.37e+01 | 3.99e-04 | 9702 | 9225 | 0 | 9224 | 1.70e+00 | first_order |
| 344 | schmvett scosine | 100 100 | -2.94e+02 -7.41e+01 | 1.03e-07 1.56e+04 | 38 802943 | 33 750145 | 0 0 | 32 750144 | 2.03e-01 3.00e+01 | first_order max time |
| 346 | sinquad | 100 | 1.76e-15 | 4.35e-08 | 183 | 108 | 0 | 107 | 2.08e-01 | first_order |
| 347 | sparsine | 100 | 3.53e-10 | 1.17e-04 | 427 | 370 | 0 | 369 | 2.61e-01 | first_order |
| 348 349 | sparsqur spmsrtls | 100 100 | 2.91e-08 4.23e-15 | 9.49e-06 6.15e-08 | 37 105 | 23 98 | 0 0 | 22 97 | 2.06e-01 4.80e-01 | first_order first order |
| 350 | srosenbr | 100 | 8.24e-15 | 2.12e-06 | 50 | 25 | 0 | 24 | 1.99e-01 | first_order |
| 360 | thurber | 7 | 2.82e+03 | 1.39e+00 | 10413 | 7971 | 0 | 7970 | 9.92e-02 | first_order |
| 361 362 | tointgss tquartic | 100 100 | 9.71e+00 1.71e-20 | 2.48e-07 8.21e-10 | 20 26 | 18 20 | 0 0 | 17 19 | 2.02e-01 1.95e-01 | first_order first order |
| 367 | tridia | 100 | 1.28e-11 | 1.53e-05 | 207 | 189 | 0 | 188 | 2.02e-03 | first_order |
| 368 | vardim | 100 | 2.52e+03 | 8.22e+05 | 95 | 21 | 0 | 20 | 2.74e-01 | first_order |
| 369 370 | vibrbeam watson | 8 31 | 4.63e+00 -3.83e+90 | 5.30e+00 8.06e+90 | 1602 2 | 1007 2 | 0 0 | 1006 1 | 4.37e-03 3.24e-03 | first_order unbounded |
| 371 | woods | 100 | 2.63e-09 | 3.88e-04 | 52 | 31 | 0 | 30 | 2.10e-01 | first_order |
| | <u> </u> | | · | · | | · | | | | 1 |
| id | name | n | f(x) | ∇f(x) | # f | # ∇f | # ∇²f | iter | t | status |

| id | name | n | f(x) | ∇f(x) | # f | # ∀ f | # ∇² f | iter | t | status | ĺ |
|----|------|---|------|-------|-----|--------------|--------|------|---|--------|---|
| | | | | | | | | | | | Í |

| 38 | 25 | NZF1 | 91 | 2.09e+04 | 2.62e-05 | 119 | 93 | 0 | 92 | 1.07e-03 | first order |
|--|-----|----------|-----|-----------|----------|----------|-----------|---|--------|----------|--------------------------------|
| 44 | | | | ! | | | | ! | | | - : |
| 42 | | | | | | | | ! | | | . – : |
| 24 | | ! | | | | | | ! | | | : - : |
| Section 100 1.58-000 1.73-000 6 70 70 1.58-00 1.58-001 1. | | | | | | | | ! | | | : - : |
| Section 1.50 1.52-09 5.77-04 27 4 0 3 9.38-05 first, price 1.50-09 1.50- | 45 | ! | | | | | | ! | | ! | : - : |
| Section 100 3.56-00 3.59-07 534 44 0 43 1.30-03 1.175-07 1.175 7.076 1.075 | | | | | | l . | ! | ! | | | |
| 1.00 | | ! | | | | | ! | ! | _ | | |
| Section 100 1.14e-08 1.44e-35 1.288 108 109 1.27e-03 1.27e-03 1.27e-13 1.27e-03 1.27e-13 1.27e-03 1.27e-13 1.27e-03 1.27e-13 1.27e-03 1.27e-13 1.27e-03 1.27e- | | ! | | | | | | ! | | | : – : |
| Feb | | brybnd | | | | | ! | ! | | | : – : |
| 22 | | | | | | | ! | ! | | | : – : |
| 73 | | : | | | | | ! | ! | | | : – : |
| 76 | | | | | | | | ! | | 3.05e-03 | : - : |
| 77 | • | : | | | | | | ! | | | . – : |
| 278 | | 1 | | ! | | | ! | ! | | | . – : |
| Online 1.00 | | | | | | | ! | | | | |
| Ball Curiyso 100 -1.00e-80 5.00e-50 5922945 11.778 0 11.177 3.06e-01 max. Lime 22 Curiyso 100 -1.00e-80 5.076-80 732910 74260 74200 74 | 79 | curly | 100 | -1.00e+04 | 3.51e-05 | 12887766 | 150839 | 0 | 150838 | 3.00e+01 | |
| Best | | , | | | | | | ! | | | |
| 64 dismaner 99 1.86-e-60 1.56-e-66 67 55 0 54 3.95-e-38 first order 85 dismaner 99 1.86-e-60 3.12-66 59 31 0 50 4 3.95-e-38 first order 66 dismaner 99 1.86-e-60 5.12-66 59 33 299 298 2.38-e-26 201 | | | | | | | | ! | | | . – : |
| Be | | : | | | | | | ! | | | |
| 87 cixmanni 99 1.0e-00 6.73e-96 63 59 0 49 4.14e-98 first_order 88 cixmanni 99 1.0e-00 5.75e-96 first_order 89 cixmanni 99 1.0e-00 5.75e-96 63 75 75 74e-97 | | : | | | | | | ! | | ! | : – : |
| 88 dismans 99 | | : | | | | | | ! | | ! | : – : |
| 88 | • | ! | | | | | | ! | | | : – : |
| 99 dismaaml 99 1,08-08 1,47-05 136 123 9 122 1,38-02 first_order 95 dismaaml 99 1,08-08 1,158-06 332 346 0 333 3,40-02 first_order 393 dismaaml 99 1,08-08 2,06-06 246 224 80 223 3,19-02 first_order 95 dismaaml 99 1,08-08 8,00-06 246 224 80 223 3,19-02 first_order 95 dismaaml 99 1,08-08 8,00-06 246 224 80 223 3,19-02 first_order 95 dismaaml 99 1,08-08 8,00-06 246 224 80 223 3,19-02 first_order 95 dismaaml 99 1,08-08 8,00-06 34 122 0 11 2,08-04 first_order 97 dayrtic 100 3,99-12 4,270-05 31 12 0 11 2,08-04 first_order 99 dartic 100 7,92-02 1,14-01 53 22 0 22 0 2,08-04 first_order 100 4,00-05 1,14-01 53 22 0 22 3,34-04 first_order 100 4,00-05 1,14-01 53 22 0 22 3,34-04 first_order 100 4,00-05 4,00-05 4,00-05 4,00-05 4,00-05 4,00-05 4,00-05 4,00-05 4,00-05 4,00-05 4,00-05 4,00-05 4,00-05 4, | | ! | | 1.00e+00 | | | | ! | | | |
| 92 dixmanm 99 1.00e-00 1.15e-06 391 364 0 363 4.96e-02 [first_order] 93 dixmanm 99 1.00e-00 4.30e-06 240 224 0 223 3.39e-02 [first_order] 94 dixmanm 99 1.00e-00 4.30e-06 244 226 0 223 3.39e-02 [first_order] 95 dixmand 99 1.00e-00 4.30e-06 244 226 0 225 3.29e-03 [first_order] 96 dixmand 99 1.00e-00 4.30e-06 244 226 0 225 3.29e-03 [first_order] 97 dightit 100 3.99e-12 4.77e-05 31 17 0 11 2.01e-04 [first_order] 98 dortic 100 2.92e-02 1.14e-01 53 20 0 20 11 2.01e-04 [first_order] 100 dedesch 100 6.09e-02 2.23e-06 30 22 0 21 7.38e-04 [first_order] 101 e.02 100 9.73e-03 6.34e-03 3 80e-03 3 80e-03 18 80e-02 18 80 19 7 1.39e-04 [first_order] 102 dedesch 100 6.09e-02 2.23e-06 30 22 0 21 7.38e-04 [first_order] 103 dedesch 100 6.09e-02 2.23e-06 30 22 0 21 7.38e-04 [first_order] 104 dix | ! | : | | | | | | ! | | | : – : |
| 93 dismann 99 1.00e+00 2.66e+06 240 224 0 223 3.19e+02 first order 95 dismann 99 1.00e+00 8.01e+06 256 231 0 220 0 223 3.22e+02 first order 95 dismann 99 1.00e+00 8.01e+06 2.756 231 0 230 3.37e+02 1.13e+02 99 dismann 99 1.00e+00 8.01e+06 2.756 231 0 2.20 0 21 3.36e+03 3.36e+03 1.75e+01 2.20 | | : | | | | | ! | ! | | | : – : |
| 99 dixmapan 99 1.00e-00 4.36e-06 244 226 0 275 3.72e-02 first_order 99 dixmapan 99 1.00e-00 8.00e-06 256 221 0 220 3.37e-02 first_order 90 dixmapan 100 3.49e-12 4.48e-08 441 424 0 423 3.50e-03 first_order 100 4.00e-06 100 3.99e-12 4.77e-05 31 12 0 11 2.00e-04 first_order 100 6.00e-06 100 5.99e-08 2.23e-06 30 22 0 21 7.38e-04 first_order 101 6.00e-06 100 6.38e-02 2.23e-06 30 22 0 21 7.38e-04 first_order 101 6.00e-07 6.71e-06 34 22 0 21 7.38e-04 first_order 103 6.00e-07 6.71e-06 34 22 0 21 7.38e-04 first_order 104 6.00e-07 6.71e-06 34 270 109 0 150 6.18e-03 first_order 105 6.00e-07 6.71e-06 34 270 109 0 150 6.18e-03 first_order 105 6.00e-07 6.71e-06 34 270 109 0 150 6.18e-03 first_order 105 6.00e-07 6.71e-06 3.22e-11 1.08e-04 6.71e-06 3.22e-11 1.08e-04 6.71e-06 3.22e-11 1.08e-04 6.71e-07 6.71e | | : | | | | | | ! | | | : – : |
| 96 dixon3rd 160 3.48-34 4.88-98 441 424 0 423 3.56-03 farst order 97 duftic 160 3.99-12 4.27e-65 31 12 0 11 2.01e-04 farst order 100 conscious 100 | 94 | dixmaano | 99 | 1.00e+00 | 4.36e-06 | 244 | 226 | 0 | 225 | 3.22e-02 | first_order |
| 97 dightic 100 3.99e-12 4.77e-95 31 12 0 11 2.01e-04 first order 100 edensch 100 6.08e-07 2.73e-06 30 22 0 21 6.08e-04 first order 101 edensch 100 6.08e-07 2.73e-06 30 22 0 21 7.38e-04 first order 101 edensch 100 6.08e-07 2.73e-06 30 22 0 21 7.38e-04 first order 101 edensch 101 | | 1 | | : | | | | ! | | | : – : |
| 98 dgriz | | : | | : | | | : | ! | | | : – : |
| 100 | • | ! | | | | 53 | 29 | ! | | | : – : |
| 1903 | 100 | edensch | 100 | 6.03e+02 | 2.23e-06 | 30 | 22 | ! | 21 | 7.38e-04 | first_order |
| 164 | | | | | | | | : | | : | : - : |
| 195 | | | | | | | | ! | | | . – : |
| 107 | 105 | ! | | 3.88e+01 | | 270 | 199 | ! | | : | : - : |
| 108 | ! | : | | | | | | ! | | | : - : |
| 109 | • | : | | | | | | ! | | | . – : |
| 1110 | | ! | | | | | | ! | | | . – : |
| 112 gauss2 8 6.28e+02 9.69e-05 316 180 0 179 3.17e-03 first order 114 gauss3 8 6.22e+02 4.3e-03 392 247 0 246 4.66e-03 first order 116 genhumps 100 3.51e-11 3.65e-06 1985 1209 0 1209 4.66e-03 first order 117 genrose 100 1.00e-00 1.78e-06 298 253 0 252 4.03e-03 first order 118 genrose nash 100 1.00e-00 1.78e-06 298 253 0 252 4.03e-03 first order 120 max 120 | 110 | | 100 | 1.00e+02 | 8.37e-07 | 136 | 117 | ! | 116 | ! | first_order |
| 113 | | : | | : | | | ! | ! | | : | : - : |
| 114 | | ! | | ! | | | | ! | | | : - : |
| 117 | : | : | | | | | | ! | | | : - : |
| 118 | : | : | | : | | | | ! | | ! | : – : |
| 120 | | | | | | | ! | ! | | | . – : |
| 285 | ! | : | | | | | | ! | | | . – : |
| 288 | 285 | indef | | -9.83e+03 | | | : | 0 | | 3.00e+01 | |
| 299 | | | | | | | 1 | | | ! | : – : |
| 291 | | : | | : | | | | ! | | : | : - : |
| 293 | | : | - | | | | | ! | | | : - : |
| 381 | | : | | : | | | | ! | | ! | - : |
| 396 | | ! | | : | | | ! | ! | | : | . – : |
| 398 | | : | | : | | | | ! | | | : - : |
| 311 | | | | 1.67e+02 | | | | ! | | | . – : |
| 312 | | : | | | | | | ! | | ! | |
| 313 | : | : | | | | | : | | | ! | : – : |
| 314 | | ! | | : | | | | ! | | | . – : |
| 316 | | : | | : | | | | ! | | | . – : |
| 317 | | : | | : | | | ! | ! | | : | : – : |
| 318 | | ! | | : | | | | ! | | : | : – : |
| 320 | 318 | palmer1d | 7 | 1.40e+01 | 2.48e-01 | 100 | 57 | 0 | 56 | 5.97e-03 | first_order |
| 321 | | ! | _ | : | | | | ! | | | : – : |
| 322 | | ! | _ | : | | | | ! | | | : – : |
| 324 | | ! | | | | | : | ! | | : | : – : |
| 326 | 324 | palmer6c | _ | 4.78e-02 | 1.80e-03 | 163 | 83 | ! | 82 | 3.70e-03 | : – : |
| 327 penalty1 100 1.16e+00 4.05e+00 53 21 0 20 4.59e-04 first_order | ! | | _ | : | | | ! | ! | - | : | . – ! |
| 328 | | ! | | : | | | | i | | | |
| 329 | 328 | | i | : | | 59 | 28 | : | | 2.93e-03 | first_order |
| 336 | 329 | penalty3 | 100 | | 5.17e-03 | 128 | 69 | 0 | | ! | first_order |
| 337 quartc 100 2.92e-02 1.14e-01 53 29 0 28 5.88e-04 first_order 343 sbrybnd 100 7.64e+00 3.72e-04 22559 20915 0 20914 3.16e+00 first_order 344 schwett 100 -2.94e+02 1.07e-07 26 22 0 21 6.47e-04 first_order 345 scosine 100 -7.81e+01 2.76e+04 797113 718704 0 718703 3.00e+01 max_time 346 sinquad 100 9.76e-16 3.86e-08 138 105 0 104 2.81e-03 first_order 347 sparsine 100 4.30e-10 9.06e-05 362 286 0 285 1.94e-02 first_order 348 sparsqur 100 4.72e-08 1.57e-05 41 27 0 26 6.40e-04 first_order 349 spmsrtls 100 7.70e-15 7.25e-08 87 77 0 76 7.95e-03 first_order 350 srosenbr 100 4.00e-13 1.97e-05 42 22 0 21 2.60e-04 first_order 360 thurber 7 2.82e+03 3.73e-02 198 132 0 131 1.82e-03 first_order 361 tointgss 100 9.71e+00 1.86e-07 20 18 0 17 6.65e-04 first_order 362 tquartic 100 4.21e-20 3.37e-09 24 19 0 18 2.95e-04 first_order 368 vardim 100 2.52e+03 8.22e+05 95 21 0 20 2.27e-04 first_order 369 vibrbeam 8 5.29e+00 1.94e+00 225 127 0 126 6.40e-04 first_order 370 watson 31 -3.83e+90 8.06e+90 2 2 0 1 3.05e-03 unbounded 3.00e+01 3.00 | | 1 - 1 | | | | | | ! | | | |
| 343 sbrybnd 100 7.64e+00 3.72e-04 22559 20915 0 20914 3.16e+00 first_order 344 schmvett 100 -2.94e+02 1.07e-07 26 22 0 21 6.47e-04 first_order 345 scosine 100 -7.81e+01 2.76e+04 797113 718704 0 718703 3.00e+01 max_time 346 sinquad 100 9.76e-16 3.86e-08 138 105 0 104 2.81e-03 first_order 347 sparsine 100 4.30e-10 9.06e-05 362 286 0 285 1.94e-02 first_order 348 sparsqur 100 4.72e-08 1.57e-05 41 27 0 26 6.40e-04 first_order 349 spmsrtls 100 7.70e-15 7.25e-08 87 77 0 76 7.95e-03 first_order 350 srosenbr 100 4.00e-13 1.97e-05 42 22 0 21 2.60e-04 first_order 360 thurber 7 2.82e+03 3.73e-02 198 132 0 131 1.82e-03 first_order 361 tointgss 100 9.71e+00 1.86e-07 20 18 0 17 6.65e-04 first_order 362 tquartic 100 4.21e-20 3.37e-09 24 19 0 18 2.95e-04 first_order 367 tridia 100 1.78e-12 1.44e-05 154 135 0 134 1.68e-03 first_order 368 vardim 100 2.52e+03 8.22e+05 95 21 0 20 2.27e-04 first_order 369 vibrbeam 8 5.29e+00 1.94e+00 225 127 0 126 6.40e-04 first_order 370 watson 31 -3.83e+90 8.06e+90 2 2 0 1 3.05e-03 unbounded 370 vardim 370 | | 1 | | : | | | | ! | | | . – ; |
| 345 scosine 100 -7.81e+01 2.76e+04 797113 718704 0 718703 3.00e+01 max_time 346 sinquad 100 9.76e-16 3.86e-08 138 105 0 104 2.81e-03 first_order 347 sparsine 100 4.30e-10 9.06e-05 362 286 0 285 1.94e-02 first_order 348 sparsqur 100 4.72e-08 1.57e-05 41 27 0 26 6.40e-04 first_order 349 spmsrtls 100 7.70e-15 7.25e-08 87 77 0 76 7.95e-03 first_order 350 srosenbr 100 4.00e-13 1.97e-05 42 22 0 21 2.60e-04 first_order 360 thurber 7 2.82e+03 3.73e-02 198 132 0 131 1.82e-03 first_order 361 tointgss 100 9.71e+00 1.86 | 343 | sbrybnd | 100 | 7.64e+00 | 3.72e-04 | 22559 | 20915 | 0 | 20914 | 3.16e+00 | first_order |
| 346 sinquad 100 9.76e-16 3.86e-08 138 105 0 104 2.81e-03 first_order 347 sparsine 100 4.30e-10 9.06e-05 362 286 0 285 1.94e-02 first_order 348 sparsqur 100 4.72e-08 1.57e-05 41 27 0 26 6.40e-04 first_order 349 spmsrtls 100 7.70e-15 7.25e-08 87 77 0 76 7.95e-03 first_order 350 srosenbr 100 4.00e-13 1.97e-05 42 22 0 21 2.60e-04 first_order 360 thurber 7 2.82e+03 3.73e-02 198 132 0 131 1.82e-03 first_order 361 tointgss 100 9.71e+00 1.86e-07 20 18 0 17 6.65e-04 first_order 362 tquartic 100 4.21e-20 3.37e-09 | | ! | | | | | | : | | ! | first_order |
| 347 sparsine 100 4.30e-10 9.06e-05 362 286 0 285 1.94e-02 first_order 348 sparsqur 100 4.72e-08 1.57e-05 41 27 0 26 6.40e-04 first_order 349 spmsrtls 100 7.70e-15 7.25e-08 87 77 0 76 7.95e-03 first_order 350 srosenbr 100 4.00e-13 1.97e-05 42 22 0 21 2.60e-04 first_order 360 thurber 7 2.82e+03 3.73e-02 198 132 0 131 1.82e-03 first_order 361 tointgss 100 9.71e+00 1.86e-07 20 18 0 17 6.65e-04 first_order 362 tquartic 100 4.21e-20 3.37e-09 24 19 0 18 2.95e-04 first_order 368 vardim 100 2.52e+03 8.22e+05 | | | | | | | : | ! | | : | |
| 348 sparsqur 100 4.72e-08 1.57e-05 41 27 0 26 6.40e-04 first_order 349 spmsrtls 100 7.70e-15 7.25e-08 87 77 0 76 7.95e-03 first_order 350 srosenbr 100 4.00e-13 1.97e-05 42 22 0 21 2.60e-04 first_order 360 thurber 7 2.82e+03 3.73e-02 198 132 0 131 1.82e-03 first_order 361 tointgss 100 9.71e+00 1.86e-07 20 18 0 17 6.65e-04 first_order 362 tquartic 100 4.21e-20 3.37e-09 24 19 0 18 2.95e-04 first_order 367 tridia 100 1.78e-12 1.44e-05 154 135 0 134 1.68e-03 first_order 368 vardim 100 2.52e+03 8.22e+05 | | | | | | | ! | | | : | : - : |
| 350 srosenbr 100 4.00e-13 1.97e-05 42 22 0 21 2.60e-04 first_order | 348 | sparsqur | 100 | 4.72e-08 | 1.57e-05 | 41 | 27 | 0 | 26 | 6.40e-04 | first_order |
| 360 | | i i | | | | | | : | | | first_order first_order |
| 361 tointgss 100 9.71e+00 1.86e-07 20 18 0 17 6.65e-04 first_order | | : | | | | | | ! | | : | : - : |
| 367 | 361 | tointgss | 100 | 9.71e+00 | 1.86e-07 | 20 | 18 | 0 | 17 | 6.65e-04 | first_order |
| 368 | | | i | i | | | | : | | : | : - : |
| 369 vibrbeam 8 5.29e+00 1.94e+00 225 127 0 126 6.40e-04 first_order 370 watson 31 -3.83e+90 8.06e+90 2 2 0 1 3.05e-03 unbounded | | • | | | | | | : | | | : - : |
| 370 watson 31 -3.83e+90 8.06e+90 2 2 0 1 3.05e-03 unbounded | | | i | | | | | ! | | | first_order first_order |
| 3/1 woods 100 1.72e-09 1.10e-03 48 28 0 27 2.84e-04 first_order | 370 | watson | 31 | -3.83e+90 | 8.06e+90 | 2 | 2 | 0 | 1 | 3.05e-03 | unbounded |
| | 371 | l woods | 100 | 1.72e-09 | 1.10e-03 | 48 |] 28 L | 0 | 27 | 2.84e-04 | first_order |
| | | | | | | | | | | | |

| id | name | n l | f(x) | ∇f(x) | # f | # ∀ f | # ∇ ² f | iter | t | status |
|--------------|------------------------|----------------|------------------------|----------------------|----------------------|------------------|-----------------------|--------------------|------------------------|--------------------------------|
| 25 | NZF1 | 91 | 2.09e+04 | 2.96e-05 | 295 | 156 | 0 | 155 | 1.62e-03 | first_order |
| 38 | arglina arglinb | 100 100 | 5.00e+01 2.48e+01 | 7.84e-15 3.28e-04 | 2 70 | 2 | 0 0 | 1 2 | 1.26e-04 1.23e-04 | first_order first order |
| 40 | arglinc | 100 | 5.11e+01 | 4.44e-03 | 71 | 3 | 0 | 2 | 8.99e-05 | first_order |
| 41 | argtrig | 100 | -9.90e+03 | 1.01e-07 | 1354 | 228 | 0 | 227 | 8.77e-03 1.54e-04 | first_order |
| 42 45 | arwhead bdqrtic | 100 100 | 0.00e+00 1.89e+02 | 2.91e-06 1.49e-04 | 27 66 | 12 41 | 0 0 | 11 40 | 5.89e-04 | first_order first order |
| j 50 | biggs6 | 6 | -3.17e+22 | 4.12e+22 | 3 | 3 | 0 | 2 | 1.69e-05 | unbounded |
| 55 58 | brownal broyden3d | 100 100 | 1.92e-09 3.56e-01 | 6.77e-04 5.72e-07 | 27 55 | 4 44 | 0 0 | 3 43 | 9.20e-05 1.27e-03 | first_order first order |
| j 59 | broydn7d | 100 | 3.55e+01 | 6.44e-07 | 423 | 391 | 0 | 390 | 1.95e-02 | first_order |
| 60 65 | brybnd chainwoo | 100 100 | 1.34e+00 1.00e+00 | 1.76e-05 1.01e-03 | 151 369 | 130 299 | 0 0 | 129 298 | 1.44e-02 3.81e-03 | first_order first order |
| 67 | chnrosnb | 100 | 1.11e-10 | 5.09e-05 | 587 | 544 | 0 | 543 | 1.55e-02 | first_order first order |
| 72 | clplatea | 100 | -9.15e-03 | 1.63e-08 | 100 | 98 | 0 | 97 | 4.10e-03 | first_order |
| 73 74 | clplateb clplatec | 100 100 | -6.20e-03 -5.11e-03 | 1.53e-08 2.02e-08 | 118 12244119 | 116 325169 | 0 0 | 115 325168 | 4.97e-03 3.00e+01 | first_order max time |
| 76 | cosine | 100 | -9.90e+01 | 2.90e-08 | 27 | 18 | 0 | 17 | 4.08e-04 | first_order |
| 77 78 | cragglvy cragglvy2 | 100 100 | 3.23e+01 2.52e+01 | 5.25e-04 3.58e-04 | 82 100 | 60 77 | 0 0 | 59 76 | 1.75e-03 2.17e-03 | first_order first order |
| 79 | curly | 100 | -1.00e+04 | 2.10e-07 | 3381 | 2886 | 0 | 2885 | 1.86e-01 | first_order |
| 80 | curly10 | 100 | -1.00e+04 | 2.10e-07 | 3381 | 2886 | 0 | 2885 | 1.98e-01 | first_order |
| 81 82 | curly20 curly30 | 100 100 | -1.00e+04 -1.00e+04 | 5.74e-05 1.21e-04 | 9654650 6994007 | 110767 82353 | 0 0 | 110766 82352 | 3.00e+01 3.00e+01 | max_time max time |
| j 84 | dixmaane | 99 | 1.00e+00 | 2.68e-06 | 70 | 64 | 0 | 63 | 4.59e-03 | first_order |
| 85 86 | dixmaanf dixmaang | 99 99 | 1.00e+00 1.00e+00 | 3.64e-06 9.44e-06 | 61 60 | 51 49 | 0 0 | 50 48 | 4.23e-03 4.06e-03 | first_order first order |
| 87 | dixmaanh | 99 | 1.00e+00 | 9.44e-00 9.03e-06 | 62 | 50 | 0 | 49 | 4.14e-03 | first_order |
| 88 | dixmaani | 99 | 1.00e+00 | 2.70e-06 | 344 | 322 | 0 | 321 | 3.18e-02 | first_order |
| 89 90 | dixmaanj dixmaank | 99 99 | 1.00e+00 1.00e+00 | 4.88e-06 9.70e-06 | 229 165 | 209 145 | 0 0 | 208 144 | 2.31e-02 1.60e-02 | first_order first order |
| 91 | dixmaanl | 99 | 1.00e+00 | 1.98e-05 | 136 | 123 | 0 | 122 | 1.37e-02 | first_order |
| 92 | dixmaanm | 99 | 1.00e+00 | 1.18e-06 | 411 | 394 | 0 | 393 | 5.40e-02 | first_order |
| 93 | dixmaann dixmaano | 99 99 | 1.00e+00 1.00e+00 | 2.70e-06 4.42e-06 | 318 315 | 294 292 | 0 0 | 293 291 | 4.18e-02 4.13e-02 | first_order first order |
| j 95 | dixmaanp | 99 | 1.00e+00 | 1.06e-05 | 219 | 201 | 0 | 200 | 2.92e-02 | first_order |
| 96 | dixon3dq | 100 100 | 2.25e-14 | 5.51e-08 | 574 31 | 548 | 0 0 | 547 11 | 4.68e-03 | first_order |
| 97 | dqdrtic dqrtic | 100 | 3.99e-12 3.41e-02 | 4.27e-05 1.32e-01 | 31 46 | 12 22 | | 21 | 1.89e-04 4.91e-04 | first_order first_order |
| 100 | edensch | 100 | 6.03e+02 | 2.48e-06 | 30 | 22 | 0 | 21 | 7.02e-04 | first_order |
| 101 | eg2 engval1 | 100 100 | -9.74e+01 1.09e+02 | 8.54e-08 6.34e-06 | 19 34 | 8 22 | 0 0 | 7 21 | 1.84e-04 3.27e-04 | first_order first order |
| 103 | enso | 9 | 3.94e+02 | 2.18e-06 | 39 | 26 | 0 | 25 | 1.01e-03 | first_order |
| 105 | errinros | 100 | 3.88e+01 | 1.35e-03 | 305 | 189 | 0 | 188 | 5.82e-03 | first_order |
| 106 107 | extrosnb fletcbv2 | 100 100 | 2.62e-11 -5.14e-01 | 1.24e-04 1.36e-08 | 51 342 | 31 324 | 0 0 | 30 323 | 4.38e-04 2.05e-02 | first_order first order |
| 108 | fletcbv3 | 100 | -2.04e+00 | 3.48e-09 | 61 | 45 | 0 | 44 | 3.34e-03 | first_order |
| 109 | fletchcr fminsrf2 | 100 100 | 2.21e-13 1.00e+02 | 3.78e-06 1.30e-06 | 508 166 | 465 145 | 0 0 | 464 144 | 5.39e-03 4.28e-03 | first_order |
| 111 | freuroth | 100 | 5.98e+03 | 2.46e-05 | 38 | 23 | 0 | 22 | 1.18e-03 | first_order first order |
| 112 | gauss1 | 8 | 6.58e+02 | 2.64e-03 | 7285000 | 197519 | 0 | 197518 | 3.00e+01 | max_time |
| 113 114 | gauss2 gauss3 | 8 8 | 6.24e+02 6.22e+02 | 2.07e-02 7.79e-03 | 7544758 7595067 | 185083 163414 | 0 0 | 185082 163413 | 3.00e+01 3.00e+01 | max_time max time |
| 114 | genhumps | 100 | 3.98e-10 | 1.15e-05 | 1702 | 1111 | 0 | 1110 | 5.64e-02 | first_order |
| 117 | genrose | 100 | 1.00e+00 | 1.93e-06 | 305 | 259 | 0 | 258 | 3.22e-03 | first_order |
| 118 | genrose_nash hahn1 | 100 7 | 1.00e+00 2.66e+04 | 1.50e-06 5.18e+06 | 350 410304 | 285 410211 | 0 0 | 284 410210 | 3.70e-03 3.00e+01 | first_order max time |
| 285 | indef | 100 | -9.82e+03 | 5.26e-08 | 205 | 109 | 0 | 108 | 3.43e-03 | first_order |
| 286 | integreq kirby2 | 100 5 | 5.84e-17 1.52e+01 | 1.10e-08 6.13e+02 | 8 206 | 8 123 | 0 0 | 7 122 | 2.00e-02 2.52e-03 | first_order first order |
| 290 | lanczos1 | 6 | 2.15e-06 | 8.76e-07 | 99 | 75 | 0 | 74 | 1.97e-04 | first_order |
| 291 | lanczos2 | 6 | 2.15e-06 | 3.93e-07 | 113 | 82 | 0 | 81 | 2.18e-04 | first_order |
| 292 | lanczos3 | 6 100 | 2.17e-06 3.71e-10 | 7.98e-08 1.19e-04 | 123 40 | 94 19 | 0 0 | 93 18 | 2.39e-04 2.51e-04 | first_order first order |
| j 301 | mgh17 | 5 | 5.52e-02 | 2.56e-06 | 39 | 27 | 0 | 26 | 5.60e-05 | first_order |
| 306 | morebv ncb20 | 100 100 | 1.79e-12 1.64e+02 | 3.36e-08 8.33e-07 | 11235 5976236 | 10723 98564 | 0 0 | 10722 98563 | 5.58e-01 3.00e+01 | first_order max time |
| 309 | ncb20b | 100 | 1.97e+02 | 4.16e-06 | 5421406 | 91078 | 0 | 91077 | 3.00e+01 | max_time |
| 311 | noncvxu2 | 100 | 2.32e+02 | 1.26e-04 | 426 | 406 | 0 | 405 | 1.01e-02 | first_order |
| 312 | noncvxun nondia | 100 100 | 2.33e+02 1.04e-13 | 8.91e-05 1.08e-05 | 268 48 | 259 25 | 0 0 | 258 24 | 6.61e-03 3.49e-04 | first_order first order |
| j 314 | nondquar | 100 | 7.92e-07 | 5.63e-06 | 2050 | 1576 | 0 | 1575 | 3.16e-02 | first_order |
| 315 | osbornel | 5 11 | 2.34e-02 2.01e-02 | 1.36e+02 5.49e-08 | 69891650 | 972573 | 0 0 | 972572 116 | 3.00e+01 1.17e-03 | max_time |
| 316 317 | osborne2 palmer1c | 8 | 8.44e+01 | 1.42e+00 | 138 161 | 117 75 | 0 | 74 | 1.17e-03 1.19e-02 | first_order first_order |
| 318 | palmer1d | 7 | 1.40e+01 | 2.12e-01 | 264 | 129 | 0 | 128 | 1.86e-02 | first_order |
| 319 320 | palmer2c palmer3c | 8 8 | 2.22e+00 1.65e+00 | 8.64e-02 8.37e-02 | 183 155 | 106 79 | 0 0 | 105 78 | 1.10e-02 2.25e-02 | first_order first order |
| 321 | palmer4c | 8 | 1.77e-01 | 1.35e-02 | 537 | 284 | 0 | 283 | 2.44e-02 | first_order |
| 322 | 1 ' | i : | 1.06e+00 | | | | 0 0 | 12 165 | : | first_order |
| 324 | palmer6c palmer7c | 8 8 | 4.78e-02 2.69e+00 | 6.80e-03 2.14e-02 | 320 170 | 166 97 | 0 0 | 165 96 | 7.60e-03 4.23e-03 | first_order first_order |
| 326 | palmer8c | 8 | 2.95e-01 | 1.26e-03 | 226 | 96 | 0 | 95 | 4.71e-03 | first_order |
| 327 | penalty1 penalty2 | 100 100 | 1.16e+00 9.71e+04 | 4.05e+00 2.16e-02 | 53 57 | 21 27 | 0 0 | 20 26 | 4.72e-04 2.94e-03 | first_order first order |
| 329 | penalty3 | 100 | 1.00e+00 | 5.18e-02 | 145 | 77 | 0 | 76 | 3.07e-03 | first_order first_order |
| 335 | powellsg | 100 | 7.91e-11 | 2.15e-05 | 62 | 47 | 0 | 46 | 5.14e-04 | first_order |
| 336 | power quartc | 100 100 | 2.77e-03 3.41e-02 | 6.60e-02 1.32e-01 | 59 46 | 27 22 | 0 0 | 26 21 | 3.52e-04 4.54e-04 | first_order first order |
| 343 | sbrybnd | 100 | 1.37e+01 | 3.77e-04 | 8008 | 7478 | 0 | 7477 | 1.14e+00 | first_order |
| 344 | schmvett | 100 | -2.94e+02 | 2.20e-07 | 28 81155 <i>4</i> | 24 | 0 | 23 | 6.45e-04 | first_order |
| 345 | scosine sinquad | 100 100 | -7.48e+01 6.10e-16 | 2.21e+04 5.73e-08 | 811554 172 | 734719 132 | 0 0 | 734718 131 | 3.00e+01 3.49e-03 | max_time first order |
| 347 | sparsine | 100 | 4.47e-10 | 1.13e-04 | 454 | 359 | 0 | 358 | 2.45e-02 | first_order |
| 348 | sparsqur spmsrtls | 100 100 | 5.09e-08 8.14e-15 | 1.46e-05 8.30e-08 | 37 83 | 23 79 | 0 0 | 22 78 | 5.19e-04 8.14e-03 | first_order first order |
| 349 | srosenbr | 100 | 3.97e-13 | 1.96e-05 | 42 | 22 | 0 | 78 | 2.58e-04 | first_order first_order |
| 360 | thurber | 7 | 2.82e+03 | 1.24e+00 | 291 | 201 | 0 | 200 | 2.66e-03 | first_order |
| 361 | tointgss tquartic | 100 100 | 9.71e+00 2.15e-20 | 1.84e-07 2.37e-09 | 20 24 | 18 19 | 0 0 | 17 18 | 7.20e-04 3.46e-04 | first_order first order |
| 367 | tridia | 100 | 1.86e-11 | 1.67e-05 | 172 | 147 | 0 | 146 | 2.02e-03 | first_order |
| 368 | vardim vibrbeam | 100 8 | 2.52e+03 5.28e+00 | 8.22e+05 1.43e+00 | 95 374 | 21 192 | 0 0 | 20 191 | 3.21e-04 9.32e-04 | first_order first order |
| 309 | vibrbeam watson | 8 | -3.83e+90 | 8.06e+90 | 2 | 192 | 0 | 191 | 9.32e-04 4.00e-03 | unbounded |
| 371 | woods | 100 | 2.73e-11 | 2.18e-04 | 51 | 30 | 0 | 29 | 3.73e-04 | first_order |
| | ada was found n | | | | | | | | | |

```
unbounded(df) = df.status .== :unbounded
 solved(df) = first_order(df) .| unbounded(df)
 costnames = ["obj", "grad", "hess", "obj + grad + hess"]
   df -> .!solved(df) .* Inf .+ df.neval_obj,
   df -> .!solved(df) .* Inf .+ df.neval grad,
   df -> .!solved(df) .* Inf .+ df.neval_hess,
   df -> .!solved(df) .* Inf .+ df.neval_obj .+ df.neval_grad .+ df.neval_hess,
 using Plots
gr()
profile solvers(stats, costs, costnames)
 Warning: some measures are zero; shifting all by one
BenchmarkProfiles /home/julien/.julia/packages/BenchmarkProfiles/KnjdY/src/performance_profiles.jl:16
 Warning: some measures are zero; shifting all by one
 @ BenchmarkProfiles /home/julien/.julia/packages/BenchmarkProfiles/KnjdY/src/performance_profiles.jl:16
 Warning: some measures are zero; shifting all by one
Warning: some measures are zero; SHILLING ALL BY ONE

@ BenchmarkProfiles /home/julien/.julia/packages/BenchmarkProfiles/KnjdY/src/performance_profiles.jl:16
 Warning: some measures are zero; shifting all by one
 @ BenchmarkProfiles /home/julien/.julia/packages/BenchmarkProfiles/KnjdY/src/performance profiles.jl:16
                                                                                                                                                  obj + grad + hess
                                                                  grad
 1.00
                                             1.00
                                                                                          1.00
 0.75
                                                                                          0.75
                                                                                                                                     0.75
 0.50
                                                                                         0.50
                                                                                                                                     0.50
                                             0.25
                                                                                          0.25
                                                                                                                                     0.25
                                    - Ibfgs_5
- Ibfgs_20
- Ibfgs_10
 0.00
      20
                                                  20
                                                             2<sup>2</sup>
                                             1.00
 1.00
                                                                                         1.00
                                                                                                                                     1.00
 0.75
                                             0.75
                                                                                         0.75
                                                                                                                                     0.75
 0.50
                                             0.50
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                                                                                                                                     0.50
                                             0.25
                                                                                         0.25
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                                             0.00
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                     23
                           24
                                25
                                                  2°
                                                       21
                                                             2<sup>2</sup>
                                                                  23
                                                                       24
                                                                            25
                                                                                                                                  21.0
                                                                                                                                                    2<sup>2</sup>
                2<sup>2</sup>
                                                                                                                                                         23
 1.00
                                             1.00
                                                                                         1.00
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                                             0.75
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                                             0.50
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                                             0.25
                                                                                         0.25
                                                                                                                                     0.25
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                                             0.00
                                                                                         0.00
                                                                                                                                     0.00
                                                                               25
                                                                                                                                  21.0
 1.00
                                             1.00
                                                                                          1.00
                                                                                                                                     1.00
 0.75
                                                                                         0.75
                                                                                                                                     0.75
 0.50
                                    lbfgs_10
lbfgs_20
 0.00
                                                                                                                                                                            23
                                                  20
                                                                                     23
                                                                                                                                          20
                                                                                                                                                     21
                                                                                                                                           Within this factor of the best (log scale)
       Within this factor of the best (log scale)
                                                   Within this factor of the best (log scale)
                                                                                               Within this factor of the best (log scale)
```

Analyse des résultats:

On utilise ici 105 problèmes, les profils de performance sont présentés ci-haut. À noter que je n'impose pas la dimension des problèmes, car cela fait crash les solveurs pour une raison mystérieuse. Ces 105 problèmes prennent environ 20 min à rouler. Je ne vais donc pas augmenter davantage la taille.

On remarque sans surprise que la méthode lbfgs 20 qui a une plus grande mémoire résouds un peu plus de problèmes que les deux autres méthodes, mais plus on accepte un facteur loin du meilleur plus les deux autres méthodes deviennent compétitives. En effet, pour 2^3 et plus, les trois solveurs se confondent.

En se référant au tableau généré plus haut, on remarque que le problème osborne1 n'est pas résolu par les trois solveurs testés. On peut obtenir cette information avec la colonne status qui indique qu'on a atteint le temps maximal de calcul pour ce problème.

Exercice 4: Benchmark LBFGS vs Newton-CG

Comparer la meilleure variante obtenue (justifier) à l'Exercice 3 et comparer cette méthode à Newton-CG sur la même collection de problèmes sans contraintes de OptimizationProblems.jl. Préciser combien de problèmes sont utilisés, inclure des profils de performance, et mentionner un/des problèmes qui ne sont pas résolus par l'algorithme.

Étant donné que la méthode lbfgs 20 résoud davantage de problèmes que les deux autres méthodes, nous allons utiliser cet algorithme.

```
solvers = Dict(
          :newton_cg => model -> armijo_Newton_cg(model),
          :lbfgs_20 => model -> limited_bfgs(model; mem=20),
        stats = bmark solvers(
         solvers, ad_problems,
         skipif=prob -> (!unconstrained(prob) || get_nvar(prob) > 150 || get_nvar(prob) < 5),</pre>
        Info:
                         Name
                                         ncon
                                                       status
                                                                             f(x)
                                                                                      Dual
                                                                                              Primal
       <sup>i</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:127
                                                                5.0e-01 2.1e+04 3.6e-05
        Info:
                         NZF1
                                   91
                                           0
                                                  first order
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                  first order
                                                                3.3e-01 5.0e+01
        Info:
                      aralina
                                  100
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                      arglinb
                                  100
                                           0
                                                  first_order 3.4e-01 2.5e+01 2.1e-04 0.0e+00
        @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first order
                                  100
                                                               2.9e-01 5.1e+01 1.8e-03
                      arglinc
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                                  100
                                           0
                                                     not desc 0.0e+00 7.5e-01 5.8e+00 0.0e+00
                      argtrig
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                                  100
                                           0
                                                  first order
                                                                3.2e-01 0.0e+00 3.6e-08
                      arwhead
        @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                  first_order 3.4e-01 1.9e+02 7.6e-06 0.0e+00
        Info:
                      bdgrtic
                                  100
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                                3.5e-04 -1.0e+01
        Info:
                       biggs6
                                    6
                                           0
                                                  first_order
       [ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                                3.6e-01 1.9e-09 6.2e-04 0.0e+00
                                                  first order
        Info:
                      brownal
                                  100
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                                3.4e-01 5.1e-15 4.8e-07
        Info:
                    broyden3d
                                  100
                                           0
                                                  first_order
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                     broydn7d
                                  100
                                           0
                                                     not_desc
                                                               4.4e-01 9.8e+01 3.7e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                  first_order
                                  100
                                                               3.6e-01 2.1e-16 1.4e-07
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Warning: catenary: number of variables adjusted to be a multiple of 3
       L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/catenary.jl:4
        Warning: catenary: number of variables adjusted to be greater or equal to 6
        @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/catenary.jl:6
                     chainwoo
        Info:
                                  100
                                           0
                                                     not_desc 3.8e-01 1.7e+03 3.5e+01 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                                                     not_desc 3.3e-01 9.1e+01 1.5e+00
                     chnrosnb
                                  100
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     clplatea
                                  100
                                           0
                                                  first order 5.3e-01 -9.1e-03 2.4e-10 0.0e+00
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                                                                5.1e-01 -6.2e-03 9.0e-09
                                  100
                                           0
                     clplateb
                                                  first order
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                     clplatec
                                  100
                                           0
                                                  first_order
                                                               5.6e-01 -5.1e-03 7.0e-11
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                       cosine
                                  100
                                                     not_desc
                                                                0.0e+00
                                                                         8.7e+01
       [ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        · Info:
                     cragglvy
                                  100
                                           0
                                                  first order 3.9e-01 3.2e+01 5.8e-05
       ^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                                        2.5e+01 1.9e-04
        Info:
                                  100
                                           0
                                                  first_order
                                                                3.5e-01
                    cragglvy2
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                        curly
                                  100
                                           0
                                                     not_desc 0.0e+00 -6.2e-03 1.3e+01
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                     not_desc 0.0e+00 -6.2e-03 1.3e+01
                      curly10
                                  100
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                      curly20
                                           0
                                                     not desc 0.0e+00 -1.3e-02 2.8e+01
        Info:
                                  100
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                                  100
                                           0
                                                     not desc 0.0e+00 -2.0e-02 4.6e+01
                      curly30
                                                                                            0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Warning: dixmaan: number of variables adjusted to be a multiple of 3
       UptimizationProblems.ADNLPProblems/home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
                                                               4.0e-01 1.0e+00 1.2e-08
        Info:
                                                   first order
       i @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Warning: dixmaan: number of variables adjusted to be a multiple of 3
       L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
                                                  first order 4.0e-01 1.0e+00 1.1e-07 0.0e+00
                     dixmaanf
                                   99
                                           0
       r Info:
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Warning: dixmaan: number of variables adjusted to be a multiple of 3
        @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan efgh.jl:12
        Info:
                                                  first order 1.9e-02 1.0e+00 7.8e-06 0.0e+00
                     dixmaang
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       Warning: dixmaan: number of variables adjusted to be a multiple of 3 @ OptimizationProblems.ADNLPProblems/home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
       Info: dixmaanh 99 0 first_order 1.7e-02 1.0e+00 7.7e-06 0.0 @ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first order 1.7e-02 1.0e+00 7.7e-06 0.0e+00
        - Warning: dixmaan: number of variables adjusted to be a multiple of 3
       0 OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
       first order 5.4e-01 1.0e+00 8.9e-07 0.0e+00
        Warning: dixmaan: number of variables adjusted to be a multiple of 3
        @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan ijkl.jl:12
        Info:
                     dixmaani
                                                  first order 5.0e-01 1.0e+00 1.0e-07 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Warning: dixmaan: number of variables adjusted to be a multiple of 3
        @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan ijkl.jl:12
       r Info:
                                                  first order 1.1e-01 1.0e+00 6.1e-06 0.0e+00
                     dixmaank
                                   99
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Warning: dixmaan: number of variables adjusted to be a multiple of 3
       L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
                                                  first order 1.0e-01 1.0e+00 5.9e-07 0.0e+00
        Info:
                     dixmaanl
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Warning: dixmaan: number of variables adjusted to be a multiple of 3
       0 OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan mnop.jl:12
```

```
first order 5.5e-01 1.0e+00 9.5e-10
r Info:
                            99
                                     0
              dixmaanm
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
[ @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
ŗ Info:
                                            first order 6.4e-01 1.0e+00 2.8e-07 0.0e+00
              dixmaann
                            99
                                     0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>i</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
r Info:
                                            first_order 1.9e-01 1.0e+00 2.1e-06 0.0e+00
              dixmaano
i @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
                                            first order 1.6e-01 1.0e+00 2.7e-06 0.0e+00
                            99
                                     0
 Info:
              dixmaanp
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
              dixon3dq
                           100
                                     0
                                            first_order 3.0e-01 0.0e+00 0.0e+00 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
               dqdrtic
                           100
                                     0
                                            first_order 2.9e-01 1.8e-11 8.6e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                dartic
                           100
                                     0
                                            first order 3.1e-01 1.9e-02 6.4e-02 0.0e+00
^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                     0
 Info:
                           100
                                            first order 3.1e-01 6.0e+02 4.0e-06 0.0e+00
               edensch
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                            first_order 3.3e-01 -9.9e+01 1.4e-09 0.0e+00
 Info:
                   eg2
                           100
                                     0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
               engval1
                                            first order 2.9e-01 1.1e+02 3.3e-06
 Info:
                           100
                                     0
[ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                             9
                                     0
                                              not desc 8.4e-04 5.0e+02 3.0e+01 0.0e+00
 Info:
                  enso
^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order 4.3e-01 3.9e+01 1.1e-03
 Info:
                           100
                                     0
              errinros
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              extrosnb
                           100
                                     0
                                            first_order 5.0e-01 3.6e-06 8.2e-05 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                     0
              fletcbv2
                           100
                                            first order 4.1e-01 -5.1e-01 1.2e-10
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                                                      0.0e+00
                                     0
                                              not desc 3.5e-01 -4.1e-02 1.4e-03
 Info:
              fletcbv3
                           100
^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                           100
                                     0
                                               max time 3.0e+01
              fletchcr
                                                                        NaN
                                                                                       0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                           100
                                            first order 6.3e-01 1.0e+02 1.1e-07
              fminsrf2
                                     0
                                                                                       0.0e + 00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
              freuroth
                           100
                                     0
                                               not desc 0.0e+00 5.0e+04 3.9e+03
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                qauss1
                                            first order 4.6e-03 6.6e+02 5.9e-04 0.0e+00
· Info:
                             8
                                     0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order 5.6e-03 6.2e+02 4.5e-03 0.0e+00
 Info:
                                     0
                gauss2
                             8
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
                gauss3
                             8
                                     0
                                            first order 8.8e-03 6.2e+02 5.8e-06 0.0e+00
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
              genhumps
                           100
                                     0
                                               not desc 0.0e+00 2.5e+06 8.5e+02
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
- Info:
                                             not desc 3.5e-01 3.9e+02 5.4e+01 0.0e+00
               genrose
                           100
                                     0
^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                              not_desc 3.1e-01 3.9e+02 5.2e+01
 Info:
                           100
                                     0
          genrose nash
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 hahn1
                             7
                                     0
                                               not_desc 5.7e-03 5.4e+03 2.2e+06 0.0e+00
^{\mathsf{L}} @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                 indef
                           100
                                     0
                                               not desc 0.0e+00 9.2e+01 1.1e+01
L@ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                     0
                                           first order 5.6e-01 3.4e-20 2.6e-10 0.0e+00
 Info:
              intearea
                           100
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                kirby2
                             5
 Info:
                                     0
                                            first order 1.5e-03 1.5e+01 5.6e+02 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                               not desc 3.0e-04 1.5e-03 1.1e-03
 Info:
                             6
                                     0
              lanczos1
<sup>i</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
· Info:
              lanczos2
                             6
                                     0
                                               not_desc  3.0e-04  1.5e-03  1.1e-03
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                             6
                                     0
                                             not_desc 2.9e-04 1.5e-03 1.1e-03 0.0e+00
 Info:
              lanczos3
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                            first order 2.9e-01 6.7e-15 2.9e-06 0.0e+00
               liarwhd
                           100
                                     0
 Info:
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                              not_desc 7.3e-05 5.9e-02 4.7e-04
 Info:
                 mgh17
                             5
                                     0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                     0
                                            first order
 Info:
                morebv
                           100
                                                        6.1e-01 1.0e-12 2.2e-09
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                              not_desc 4.7e-01 1.8e+02 4.7e-02 0.0e+00
 Info:
                 ncb20
                           100
                                     0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                               not_desc 1.1e+00 2.0e+02 1.6e-03 0.0e+00
                           100
 Info:
                ncb20b
                                     0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
Info: noncvxu2 100 0 not desc 0.0e+00 2.6e+06 9.5e+03 0.0e+00
 Info:
              noncvxu2
                        100
<sup>Ĺ</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
              noncvxun
                          100
                                  0
                                             not desc 0.0e+00 2.7e+06 1.0e+04 0.0e+00
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
┌ Info:
                          100 0 first order 2.8e-01 1.4e-08 4.7e-05 0.0e+00
                nondia
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
```

```
first_order 5.2e-01 5.8e-09 2.5e-06
                           100
                                    0
 Info:
              nondquar
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                           first order 2.2e-03 2.4e-02 4.1e-06 0.0e+00
 Info:
                             5
                                    0
              osborne1
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              osborne2
                                    0
                                              not desc 5.6e-04 1.7e-01 6.9e-02 0.0e+00
· Info:
                           11
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              palmer1c
                            8
                                    0
                                           first_order 4.1e-03 8.4e+01 1.3e+00 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              palmer1d
                            7
                                    0
                                           first order 3.5e-03 1.4e+01 1.7e-01 0.0e+00
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              palmer2c
г Info:
                             8
                                    0
                                           first order 4.6e-03 2.2e+00 8.6e-02 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              palmer3c
                             8
                                    0
- Info:
                                           first order 5.3e-03 1.7e+00 7.3e-02 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first_order 5.1e-03 2.4e+00 7.9e-02 0.0e+00
 Info:
              palmer4c
                            8
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
              palmer5c
                             6
                                    0
                                           first_order 2.5e-03 1.1e+00 1.4e-09 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              palmer6c
                             8
                                    0
                                           first_order 4.9e-03 4.8e-02 3.2e-04
[ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
              palmer7c
                             8
                                    0
                                           first order 2.8e-03 2.7e+00 2.1e-02 0.0e+00
r Info:
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
              palmer8c
                            8
                                    0
                                           first order 5.0e-03 3.0e-01 1.1e-03 0.0e+00
 Info:
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                           100
                                    0
 Info:
              penalty1
                                            first_order 3.2e-01 1.4e+00 4.6e+00 0.0e+00
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first_order 4.0e-01 9.7e+04 7.6e-03
 Info:
              penalty2
                          100
                                    0
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
r Info:
              penalty3
                           100
                                    0
                                              not desc 4.8e-01 1.0e+08 5.8e+04
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first_order 3.3e-01 7.0e-08 1.6e-05 0.0e+00
                          100
                                    0
 Info:
              powellsg
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                           100
                                    0
                                            first_order 2.8e-01 1.8e-03 4.7e-02
 Info:
                 power
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                quartc
                           100
                                    0
                                           first_order 3.1e-01 1.9e-02 6.4e-02 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               sbrybnd
                           100
                                    0
                                              not desc 0.0e+00 7.8e+02 2.7e+04 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                              not_desc 0.0e+00 -1.9e+02 2.0e+01 0.0e+00
 Info:
              schmvett
                          100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                              not desc 0.0e+00 8.7e+01 8.1e+02 0.0e+00
                           100
                                    0
 Info:
               scosine
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
               sinquad
                                             not desc 3.3e-01 1.1e-01 2.8e-02 0.0e+00
 Info:
                           100
                                    0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                    0
 Info:
              sparsine
                          100
                                           first order 5.1e-01 2.1e+03 2.0e-05
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first_order 3.2e-01 1.7e-08 6.2e-06 0.0e+00
 Info:
                          100
                                    0
              sparsqur
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                              not desc 0.0e+00 3.6e+01 4.8e+00
              spmsrtls
                           100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                             not desc 2.8e-01 2.1e+02 1.4e+01 0.0e+00
              srosenbr
                           100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                            7
                                    0
                                              not desc 2.3e-03 1.5e+04 1.4e+02 0.0e+00
 Info:
               thurber
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first_order 3.2e-01 9.7e+00 3.8e-07 0.0e+00
 Info:
                          100
                                    0
              tointgss
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
              tquartic
                           100
                                    0
                                              not desc 2.9e-01 3.6e-01 4.7e-02 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                tridia
                           100
                                    0
                                           first order 2.2e-02 3.4e-13 1.1e-05 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
- Info:
                vardim
                           100
                                    0
                                           first order 3.2e-01 3.6e+03 1.1e+06
                                                                                      0.0e + 00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first_order 1.0e-03 1.6e-01 2.2e+00 0.0e+00
 Info:
              vibrbeam
                            8
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                              not desc 1.3e-01 1.6e+00 2.9e+01
 Info:
                watson
                            31
                                    0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 woods
                           100
                                    0
                                              not desc 3.4e-01 8.1e+02 1.2e+02 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                  Name
                                                status
                                                            Time
                                                                      f(x)
                          nvar
                                 ncon
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:127
                                           first order 1.1e-03 2.1e+04 2.6e-05 0.0e+00
 Info:
                  NZF1
                           91
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               arglina
                           100
                                    0
                                           first order 1.4e-04 5.0e+01 7.8e-15
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
г Info:
               arglinb
                           100
                                    0
                                           first_order 1.4e-04 2.5e+01 3.3e-04 0.0e+00
[ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
┌ Info:
                          100
                                    0
                                           first order 9.9e-05 5.1e+01 4.4e-03 0.0e+00
               arglinc
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                           first_order 3.2e-03 -9.9e+03 5.6e-08 0.0e+00
┌ Info:
               argtrig
                          100
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first_order 1.7e-04 0.0e+00 2.9e-06
 Info:
               arwhead
                           100
                                    0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                           100
                                           first_order 6.5e-04 1.9e+02 1.3e-04
r Info:
               bdqrtic
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                biggs6
                                   0
                                             unbounded 2.4e-05 -3.2e+22 4.1e+22
                            6
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
Info:
                                          first_order 9.8e-05 1.9e-09 6.8e-04 0.0e+00
                          100
                                    0
               brownal
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                           first_order 1.3e-03 3.6e-01 3.1e-07 0.0e+00
 Info:
             broyden3d
                          100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
_{\Gamma} Info:
                                           first order 1.7e-02 3.6e+01 6.6e-07
              broydn7d
                           100
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 1.3e-02 1.3e+00 1.4e-05 0.0e+00
┌ Info:
                brybnd
                           100
<sup>[</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: catenary: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/catenary.jl:4
- Warning: catenary: number of variables adjusted to be greater or equal to 6
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/catenary.jl:6
Γ Info:
              chainwoo
                           100
                                    0
                                           first order 4.3e-03 1.0e+00 9.9e-04
                                                                                     0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
┌ Info:
                                           first_order 1.8e-02 5.8e-11 7.8e-05
              chnrosnb
                           100
                                    0
<sup>i</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 2.9e-03 -9.1e-03 1.6e-08
- Info:
              clplatea
                          100
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                          100
                                    0
                                           first_order 3.1e-03 -6.2e-03 1.4e-08 0.0e+00
 Info:
              clplateb
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info:
              clplatec
                          100
                                    0
                                              max_time 3.0e+01 -5.1e-03 2.4e-08 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
```

```
4.2e-04 -9.9e+01 2.8e-08
┌ Info:
                          100
                                    0
                cosine
                                           first_order
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              cradalvv
                          100
                                    0
                                           first order
                                                        1.8e-03 3.2e+01 3.8e-04
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                                           first order 1.8e-03 2.5e+01 5.6e-04 0.0e+00
             cragglvy2
                          100
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
                 curly
                          100
                                    0
                                              max_time 3.0e+01 -1.0e+04 3.5e-05 0.0e+00
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
               curly10
                          100
                                              max_time
                                                       3.0e+01 -1.0e+04 3.5e-05
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               curly20
                          100
                                    0
                                              max time 3.0e+01 -1.0e+04 5.0e-05 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               curly30
                          100
                                    0
                                              max time 3.0e+01 -1.0e+04 3.7e-05 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
              dixmaane
                           99
                                    0
                                           first order
                                                       4.0e-03 1.0e+00 1.7e-06 0.0e+00
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
© OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
              dixmaanf
                           99
                                    0
                                           first order 4.3e-03 1.0e+00 3.4e-06 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
                                           first order 4.0e-03 1.0e+00 9.1e-06
                                                                                     0.0e+00
              dixmaang
 Info:
                           99
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_efgh.jl:12
Info: dixmaanh 99 0 first_order 4.2e-03 1.0e+00 6.7e-06 0.0e @ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 4.2e-03 1.0e+00 6.7e-06 0.0e+00
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan ijkl.jl:12
 Info:
              dixmaani
                            99
                                    0
                                           first_order 3.0e-02 1.0e+00 2.6e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
              dixmaanj
                                           first order 2.5e-02 1.0e+00 3.9e-06 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
L @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
                                           first_order 1.8e-02 1.0e+00 9.2e-06 0.0e+00
              dixmaank
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_ijkl.jl:12
                                           first order 1.4e-02 1.0e+00 1.5e-05 0.0e+00
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
<sup>L</sup> @ OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
                                           first order 5.0e-02 1.0e+00 1.1e-06 0.0e+00
 Info:
              dixmaanm
                           99
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan mnop.jl:12
 Info:
                                           first_order 3.2e-02 1.0e+00 2.7e-06 0.0e+00
              dixmaann
                                    0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
Q OptimizationProblems.ADNLPProblems /home/julien/.julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan_mnop.jl:12
                                           first order 3.2e-02 1.0e+00 4.4e-06 0.0e+00
 Info:
              dixmaano
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Warning: dixmaan: number of variables adjusted to be a multiple of 3
 @ OptimizationProblems.ADNLPProblems /home/julia/packages/OptimizationProblems/fiJkh/src/ADNLPProblems/dixmaan mnop.jl:12
                                           first_order
                                                        3.4e-02 1.0e+00 8.0e-06
 Info:
              dixmaanp
                                    0
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
- Info:
              dixon3dq
                          100
                                    0
                                           first order
                                                        4.0e-03 3.4e-14 4.8e-08 0.0e+00
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order 1.9e-04 4.0e-12 4.3e-05
 · Info:
               dqdrtic
                          100
                                    0
                                                                                     0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first_order 6.5e-04 2.9e-02 1.1e-01
 Info:
                dgrtic
                          100
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
               edensch
                          100
                                           first order
                                                        7.0e-04 6.0e+02 2.2e-06
                                    0
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order
 Info:
                          100
                                    0
                                                       1.8e-04 -9.7e+01 8.5e-08
                   eg2
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                          100
                                    0
                                           first order
                                                        3.2e-04 1.1e+02 6.7e-06 0.0e+00
- Info:
               engval1
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                                                     0.0e+00
 Info:
                  enso
                            9
                                    0
                                           first order
                                                        9.9e-04 3.9e+02 9.7e-07
 @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order
                                                        6.2e-03 3.9e+01 5.6e-04
 Info:
              errinros
                          100
                                    0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                           first order
              extrosnb
                                                        4.4e-04 3.2e-11 1.5e-04
 @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info:
              fletcbv2
                          100
                                    0
                                           first order 4.5e-03 -5.1e-01 1.4e-08 0.0e+00
  @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
 Info: fletcbv3 100 0 first_order 3.7e-03 -2.0e+00 5.6e-09 0.0e+00
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
              fletchcr 100 0 first_order 5.7e-03 3.5e-13 3.9e-06 0.0e+00
 Info:
i @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                          first_order 4.0e-03 1.0e+02 8.4e-07 0.0e+00
┌ Info:
              fminsrf2
                          100
                                0
i @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
┌ Info:
              freuroth
                          100
                                0
                                          first order 1.2e-03 6.0e+03 2.3e-05 0.0e+00
© SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
 Info: gauss1
                          8 0
                                        first order 3.2e-03 6.6e+02 9.7e-05 0.0e+00
L@ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                         8 0 first_order 4.3e-03 6.2e+02 4.3e-03 0.0e+00
 · Info: gauss2
L@ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                          first_order 4.1e-03 6.2e+02 5.3e-05 0.0e+00
          gauss3
                          8 0
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                          100
                                  0
                                           first order 6.6e-02 3.5e-11 3.7e-06 0.0e+00
             genhumps
@ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
Info: genrose 100 0 first_order 4.0e-03 1.0e+00 1.8e-06 0.0e @ SolverBenchmark/home/julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                 0 first order 4.0e-03 1.0e+00 1.8e-06 0.0e+00
                        100 0 first_order 4.5e-03 1.0e+00 1.2e-06 0.0e+00
- Info: genrose_nash
L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                          7 0 max_time 3.0e+01 2.7e+04 5.2e+06 0.0e+00
 · Info: hahn1
<sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
```

```
max_time 3.0e+01 -9.8e+03 6.6e-07
                                  100
                                           0
                        indef
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     integreg
                                  100
                                           0
                                                  first order 2.0e-02 5.8e-17 1.1e-08
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first order 2.5e-03 1.5e+01 5.5e+02 0.0e+00
        · Info:
                       kirby2
                                    5
                                           0
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     lanczos1
                                    6
                                           0
                                                   first order 2.0e-04 2.1e-06 5.8e-07 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                                    6
                                           0
                                                   first order 2.1e-04 2.1e-06 3.1e-07
                     lanczos2
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                     lanczos3
       г Info:
                                    6
                                           0
                                                   first order 2.1e-04 2.2e-06 7.1e-07 0.0e+00
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        · Info:
                      liarwhd
                                  100
                                           0
                                                   first order 3.0e-04 1.1e-10 1.3e-04 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first_order 5.6e-05 5.5e-02 1.2e-06 0.0e+00
        Info:
                        mgh17
                                    5
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                       morebv
                                  100
                                           0
                                                   first order
                                                                4.5e-01 2.7e-11 3.7e-08
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                        ncb20
                                  100
                                           0
                                                     max time 3.0e+01 1.7e+02 6.6e-07 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                       ncb20b
                                  100
                                           0
                                                     max time 3.0e+01 2.0e+02 2.4e-06
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                     noncvxu2
                                  100
                                           0
                                                   first_order 1.2e-02 2.3e+02 1.3e-04 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first order
                                                               4.3e-03 2.3e+02 1.5e-04
        Info:
                     noncvxun
                                  100
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first_order 2.9e-04 3.4e-15 7.8e-06 0.0e+00
                       nondia
                                  100
                                            0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                     nondquar
                                  100
                                           0
                                                   first order 2.3e-02 7.4e-07 5.6e-06 0.0e+00
        Info:
       L@ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                     max_time 3.0e+01 2.3e-02 4.1e+04 0.0e+00
        Info:
                                           0
                     osborne1
                                    5
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first_order 7.5e-04 2.0e-02 2.6e-08
                                           0
        Info:
                     osborne2
                                   11
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first_order 6.9e-03 8.4e+01 1.8e+00
                     palmer1c
                                    8
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                     palmer1d
                                    7
                                           0
                                                  first order 6.2e-03 1.4e+01 2.5e-01 0.0e+00
        Info:
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                                    8
                                           0
                                                  first order 3.3e-03 2.2e+00 9.1e-02 0.0e+00
                     palmer2c
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first order 2.3e-03 1.7e+00 7.8e-02 0.0e+00
        Info:
                     palmer3c
                                    8
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first order 3.8e-03 1.8e-01 6.4e-02
        Info:
                     palmer4c
                                    8
                                           0
       <sup>i</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       - Info:
                     palmer5c
                                    6
                                           0
                                                   first order 3.7e-04 1.1e+00 1.4e-06
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     palmer6c
                                    8
                                           0
                                                   first_order 4.4e-03 4.8e-02 1.8e-03 0.0e+00
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first order 3.5e-03 2.7e+00 2.5e-02 0.0e+00
        Info:
                     palmer7c
                                    8
                                           0
        @ SolverBenchmark /home/julian/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        Info:
                     palmer8c
                                    8
                                           0
                                                   first_order 4.7e-03 3.0e-01 4.2e-03 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                               4.6e-04 1.2e+00 4.0e+00
        Info:
                     penalty1
                                  100
                                           0
                                                   first_order
       © SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                     penalty2
                                           0
                                                   first order 3.0e-03 9.7e+04 2.0e-02 0.0e+00
        - Info:
                                  100
       L@ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     penalty3
                                  100
                                           0
                                                   first_order 2.7e-03 1.0e+00 5.2e-03 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                   first_order 4.6e-04 1.4e-09 1.9e-05
        Info:
                     powellsg
                                  100
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                  100
                                           0
                                                   first order 3.8e-04 1.6e-03 7.1e-02 0.0e+00
        Info:
                        power
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                       quartc
                                  100
                                           0
                                                   first order
                                                               6.0e-04 2.9e-02 1.1e-01 0.0e+00
       <sup>[</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        - Info:
                                  100
                                           0
                                                   first order 3.2e+00 7.6e+00 3.7e-04
                      sbrvbnd
                                                                                             0.0e + 00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   first_order 6.0e-04 -2.9e+02 1.1e-07 0.0e+00
        Info:
                     schmvett
                                  100
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
                                                     \max_{	ext{time}}
        Info:
                                  100
                                           0
                                                                3.0e+01 -7.8e+01 4.6e+05
                      scosine
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       - Info:
                      sinquad
                                  100
                                           0
                                                   first order 2.9e-03 9.8e-16 3.9e-08 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                     sparsine
        Info:
                                  100
                                           0
                                                   first order 2.0e-02 4.3e-10 9.1e-05 0.0e+00
       <sup>L</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                     sparsqur
                                  100
                                           0
                                                  first_order 6.0e-04 4.7e-08 1.6e-05 0.0e+00
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                     spmsrtls
                                  100
                                           0
                                                   first order 8.1e-03 7.7e-15 7.3e-08 0.0e+00
       r Info:
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                                                   first order 2.6e-04 4.0e-13 2.0e-05
                     srosenbr
                                  100
                                           0
        @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
       r Info:
                      thurber
                                    7
                                           0
                                                   first order 1.8e-03 2.8e+03 3.7e-02 0.0e+00
       └ @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info: tointgss 100 0 first_order 7.4e-04 9.7e+00 1.9e-07 0.0e+00
       L@ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run solver.jl:175
        · Info:
                    tquartic
                                 100
                                       0
                                                 first_order 3.6e-04 4.2e-20 3.4e-09 0.0e+00
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                  100
                                          0
                                                  first_order 2.0e-03 1.8e-12 1.4e-05 0.0e+00
                      tridia
       <sup>i</sup> @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       Info: vardim 100 0 first_order 3.3e-04 2.5e+03 8.2e+05 0.0e @ SolverBenchmark/home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                  first order 3.3e-04 2.5e+03 8.2e+05 0.0e+00
       _{\Gamma} Info:
                                                  first order 6.5e-04 5.3e+00 1.9e+00 0.0e+00
                     vibrbeam
                                  8
                                        0
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
                                                   unbounded 4.6e-03 -3.8e+90 8.1e+90 0.0e+00
                                  31 0
        Info:
                       watson
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
        Info:
                       woods
                                 100
                                          0
                                               first order 3.6e-04 1.7e-09 1.1e-03 0.0e+00
       L @ SolverBenchmark /home/julien/.julia/packages/SolverBenchmark/YM13z/src/run_solver.jl:175
       Dict{Symbol, DataFrames.DataFrame} with 2 entries:
         :newton_cg => 105×39 DataFrame...
         :lbfgs_20 => 105×39 DataFrame...
In []: # this code was found as is @ https://jso.dev/OptimizationProblems.jl/dev/benchmark/
```

```
cols = [:id, :name, :nvar, :objective, :dual_feas, :neval_obj, :neval_grad, :neval_hess, :iter, :elapsed_time, :status]
header = Dict(
    :nvar => "n",
    :objective => "f(x)",
    :dual_feas => "||∇f(x)||",
    :neval_obj => "# f",
    :neval_grad => "# ∇f",
    :neval_hess => "# ∇²f",
    :elapsed_time => "t",
```

```
for solver ∈ keys(solvers)
    pretty_stats(stats[solver][!, cols], hdr_override=header)
    end
```

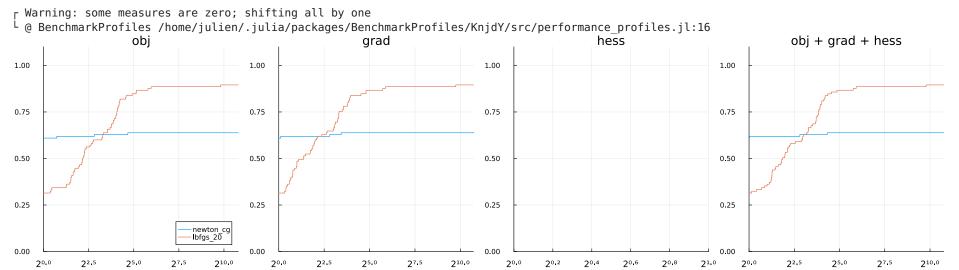
| id | name | n | f(x) | ∇f(x) | # f | # ∇f | # ∇²f | iter | t | status |
|--------------|------------------------|--------------|------------------------|------------------------|-----------------------|---------------|----------|-------------|----------------------|------------------------------|
| 25 | NZF1 | 91 | 2.09e+04 | 3.56e-05 | 18 | 18 | 0 | 17 | 5.03e-01 | first order |
| 38 | arglina | 100 | 5.00e+01 | 7.84e-15 | 2 | 2 | 0 | 1 | 3.31e-01 | first_order |
| 39 40 | arglinb arglinc | 100 100 | 2.48e+01 5.11e+01 | 2.05e-04 1.81e-03 | 2 2 | 2 2 | 0 0 | 1 1 | 3.38e-01 2.92e-01 | first_order first order |
| 41 | argtrig | 100 | 7.52e-01 | 5.82e+00 | 1 | 1 | 0 | j 0 | 0.00e+00 | not_desc |
| 42 45 | arwhead bdqrtic | 100 100 | 0.00e+00 1.89e+02 | 3.59e-08 7.59e-06 | 7 15 | 7 15 | 0 0 | 6 14 | 3.22e-01 3.36e-01 | first_order first order |
| 50 | biggs6 | 6 | -1.01e+01 | 8.01e-08 | 21 | 21 | 0 | 20 | 3.50e-04 | first_order |
| 55 58 | brownal broyden3d | 100 100 | 1.92e-09 5.12e-15 | 6.19e-04 4.81e-07 | 2 11 | 2 11 | 0 0 | 1 10 | 3.65e-01 3.35e-01 | first_order first order |
| 59 | broydn7d | 100 | 9.78e+01 | 3.74e+00 | 4 | 4 | 0 | 3 | 4.39e-01 | not_desc |
| 60 | brybnd | 100 | 2.10e-16 | 1.43e-07 | 11 | 11 | 0 | 10 | 3.58e-01 | first_order |
| 65 67 | chainwoo chnrosnb | 100 100 | 1.72e+03 9.08e+01 | 3.50e+01 1.49e+00 | 6 16 | 6 14 | 0 0 | 5 13 | 3.83e-01 3.29e-01 | not_desc not desc |
| 72 | clplatea | 100 | -9.15e-03 | 2.44e-10 | 7 | 7 | 0 | 6 | 5.32e-01 | first_order |
| 73 74 | clplateb clplatec | 100 100 | -6.20e-03 -5.11e-03 | 8.96e-09 7.00e-11 | 5 6 | 5 6 | 0 0 | 4 5 | 5.12e-01 5.56e-01 | first_order first order |
| 76 | cosine | 100 | 8.69e+01 | 7.00e-11 7.19e+00 | 1 | 1 | 0 | 0 | 0.00e+00 | not_desc |
| 77 | cragglvy | 100 | 3.23e+01 | 5.82e-05 | 18 | 18 | 0 | 17 | 3.86e-01 | first_order |
| 78 79 | cragglvy2 curly | 100 100 | 2.52e+01 -6.24e-03 | 1.88e-04 1.31e+01 | 19 1 | 19 1 | 0 0 | 18 0 | 3.48e-01 0.00e+00 | first_order not desc |
| 80 | curly10 | 100 | -6.24e-03 | 1.31e+01 | 1 | 1 | 0 | 0 | 0.00e+00 | not_desc |
| 81 82 | curly20 curly30 | 100 100 | -1.30e-02 -2.04e-02 | 2.83e+01 4.63e+01 | 1 1 | 1 1 | 0 0 | 0 0 | 0.00e+00 0.00e+00 | not_desc |
| 84 | dixmaane | 99 | 1.00e+00 | 1.19e-08 | 13 | 13 | 0 | 12 | 3.99e-01 | first_order |
| 85 | dixmaanf | 99 | 1.00e+00 | 1.11e-07 | 13 | 13 | 0 | 12 | 4.03e-01 | first_order |
| 86 87 | dixmaang dixmaanh | 99 99 | 1.00e+00 1.00e+00 | 7.80e-06 7.70e-06 | 13 13 | 13 13 | 0 0 | 12 12 | 1.89e-02 1.66e-02 | first_order first order |
| 88 | dixmaani | 99 | 1.00e+00 | 8.88e-07 | 13 | 13 | 0 | 12 | 5.37e-01 | first_order |
| 89 90 | dixmaanj dixmaank | 99 99 | 1.00e+00 1.00e+00 | 1.00e-07 6.07e-06 | 16 18 | 16 16 | 0 0 | 15 15 | 5.04e-01 1.09e-01 | first_order first order |
| j 91 | dixmaanl | 99 | 1.00e+00 | 5.86e-07 | 20 | 15 | 0 | 14 | 1.01e-01 | first_order |
| 92 | dixmaanm | 99 | 1.00e+00 | 9.54e-10 | 13 | 13 | 0 | 12 | 5.55e-01 | first_order |
| 93 | dixmaann dixmaano | 99 99 | 1.00e+00 1.00e+00 | 2.79e-07 2.12e-06 | 15 18 | 15 15 | 0 0 | 14 14 | 6.40e-01 1.92e-01 | first_order first order |
| 95 | dixmaanp | 99 | 1.00e+00 | 2.71e-06 | 15 | 15 | 0 | 14 | 1.60e-01 | first_order |
| 96 | dixon3dq dqdrtic | 100 100 | 0.00e+00 1.84e-11 | 0.00e+00 8.63e-06 | 8 7 | 8 7 | 0 0 | 7 6 | 3.04e-01 2.88e-01 | first_order first order |
| 98 | dqrtic | 100 | 1.87e-02 | 6.40e-02 | 17 | 17 | 0 | 16 | 3.13e-01 | first_order |
| 100 | edensch | 100 | 6.03e+02 | 3.98e-06 | 11 | 11 | 0 | 10 | 3.14e-01 | first_order |
| 101 103 | eg2 engval1 | 100 100 | -9.89e+01 1.09e+02 | 1.42e-09 3.25e-06 | 4 12 | 4 12 | 0 0 | 3 11 | 3.29e-01 2.85e-01 | first_order first order |
| 104 | enso | 9 | 4.99e+02 | 2.99e+01 | ј з ј | 3 | 0 | 2 | 8.44e-04 | not_desc |
| 105 106 | errinros extrosnb | 100 100 | 3.88e+01 3.62e-06 | 1.10e-03 8.17e-05 | 197 1272 | 93 325 | 0 0 | 92 324 | 4.27e-01 5.00e-01 | first_order first order |
| 107 | fletcbv2 | 100 | -5.14e-01 | 1.17e-10 | 12/2 4 | 4 | 0 | 324 | 4.09e-01 | first_order |
| 108 | fletcbv3 | 100 | -4.09e-02 | 1.35e-03 | 2 | 2 | 0 | 1 | 3.45e-01 | not_desc |
| 109 110 | fletchcr fminsrf2 | 100 100 | NaN 1.00e+02 | NaN 1.07e-07 | 2189618 226 | 2189618 32 | 0 0 | 2189617 | 3.00e+01 6.30e-01 | max_time first order |
| 111 | freuroth | 100 | 4.98e+04 | 3.93e+03 | 1 | 1 | 0 | j 0 | 0.00e+00 | not_desc |
| 112 113 | gauss1 | 8 8 | 6.58e+02 6.24e+02 | 5.90e-04 4.54e-03 | 18 21 | 18 21 | 0 0 | 17 20 | 4.60e-03 5.61e-03 | first_order |
| 113 | gauss2 gauss3 | 8 | 6.24e+02 | 5.82e-06 | 21 | 27 | 0 | 26 | 8.85e-03 | first_order first order |
| 116 | genhumps | 100 | 2.54e+06 | 8.47e+02 | 1 | 1 | 0 | 0 | 0.00e+00 | not_desc |
| 117 118 | genrose genrose | 100 100 | 3.92e+02 3.91e+02 | 5.42e+01 5.21e+01 | 9 9 | 4 4 | 0 0 | 3 3 | 3.49e-01 3.07e-01 | not_desc |
| 120 | hahn1 | 7 | 5.35e+03 | 2.16e+06 | 23 | 23 | 0 | 22 | 5.71e-03 | not_desc |
| 285 286 | indef integreq | 100 100 | 9.17e+01 3.35e-20 | 1.12e+01 2.64e-10 | 1 6 | 1 6 | 0 0 | 0 5 | 0.00e+00 5.58e-01 | not_desc |
| 288 | kirby2 | 5 | 1.52e+01 | 5.59e+02 | 22 | 20 | 0 | 19 | 1.51e-03 | first_order |
| 290 | lanczos1 | 6 | 1.50e-03 | 1.09e-03 | 13 | 13 | 0 | 12 | 3.03e-04 | not_desc |
| 291 292 | lanczos2 | 6 6 | 1.50e-03 1.50e-03 | 1.09e-03 1.09e-03 | 13 13 | 13 13 | 0 0 | 12 12 | 3.03e-04 2.94e-04 | not_desc not desc |
| 293 | liarwhd | 100 | 6.69e-15 | 2.86e-06 | 16 | 16 | 0 | 15 | 2.87e-01 | first_order |
| 301 306 | mgh17 morebv | 5 100 | 5.86e-02 1.00e-12 | 4.73e-04 2.18e-09 | 7 10 | 7 10 | 0 0 | 6 9 | 7.32e-05 6.15e-01 | not_desc |
| 308 | ncb20 | 100 | 1.80e+02 | 4.72e-02 | 7 | 7 | 0 | 6 | 4.74e-01 | not_desc |
| 309 | ncb20b noncvxu2 | 100 100 | 1.97e+02 2.64e+06 | 1.64e-03 9.53e+03 | 23 1 | 11 | 0 0 | 10 0 | 1.08e+00 0.00e+00 | not_desc not desc |
| 311 | noncvxu2 noncvxun | 100 | 2.73e+06 | 9.53e+03 1.02e+04 | 1 | 1 1 | 0 | 0 | 0.00e+00 | not_desc not_desc |
| 313 | nondia | 100 | 1.45e-08 | 4.74e-05 | 12 | 9 | 0 | 8 | 2.83e-01 | first_order |
| 314 315 | nondquar osbornel | 100 5 | 5.83e-09 2.38e-02 | 2.53e-06 4.13e-06 | 90 196 | 41 105 | 0 0 | 40 104 | 5.21e-01 2.23e-03 | first_order first order |
| 316 | osborne2 | 11 | 1.67e-01 | 6.92e-02 | 6 | 6 | 0 | 5 | 5.63e-04 | not_desc |
| 317 318 | palmer1c palmer1d | 8 7 | 8.38e+01 1.39e+01 | 1.29e+00 1.73e-01 | 6 6 | 6 6 | 0 0 | 5 5 | 4.07e-03 3.51e-03 | first_order first order |
| 319 | palmer2c | 8 | 2.21e+00 | 8.62e-02 | 6 | 6 | 0 | 5 | 4.64e-03 | first_order |
| 320 321 | palmer3c palmer4c | 8 8 | 1.65e+00 | 7.27e-02 7.94e-02 | 5 5 | 5 5 | 0 0 | 4 4 | 5.26e-03 5.07e-03 | first_order |
| 321 | palmer4c palmer5c | 8 6 | 2.41e+00 1.06e+00 | 7.94e-02 1.39e-09 | 5 14 | 14 | | 4 13 | 2.49e-03 | first_order first_order |
| 324 | palmer6c | 8 | 4.78e-02 | 3.17e-04 | 7 | 7 | 0 | 6 | 4.90e-03 | first_order |
| 325 326 | palmer7c palmer8c | 8 8 | 2.69e+00 2.95e-01 | 2.13e-02 1.14e-03 | 6 8 | 6 8 | 0 0 | 5 7 | 2.82e-03 4.98e-03 | first_order first order |
| 327 | penalty1 | 100 | 1.36e+00 | 4.55e+00 | 16 | 16 | 0 | 15 | 3.22e-01 | first_order |
| 328 | penalty2 | 100 | 9.71e+04 | 7.64e-03 | 20 | 20 | 0 | 19 | 4.00e-01 | first_order |
| 329 335 | penalty3 powellsg | 100 100 | 1.00e+08 7.04e-08 | 5.81e+04 1.56e-05 | 3 21 | 3 21 | 0 0 | 2 20 | 4.84e-01 3.27e-01 | not_desc first_order |
| 336 | power | 100 | 1.84e-03 | 4.68e-02 | 18 | 18 | 0 | 17 | 2.83e-01 | first_order |
| 337 343 | quartc sbrybnd | 100 100 | 1.87e-02 7.84e+02 | 6.40e-02 2.70e+04 | 17 1 | 17 1 | 0 0 | 16 0 | 3.12e-01 0.00e+00 | first_order not desc |
| 344 | schmvett | 100 | -1.89e+02 | 2.04e+01 | 1 | 1 | 0 | 0 | 0.00e+00 | not_desc |
| 345 | scosine | 100 | 8.69e+01 1.11e-01 | 8.14e+02 | 1 | 1 | 0 | 0 8 | 0.00e+00 | not_desc not desc |
| 346 347 | sinquad sparsine | 100 100 | 1.11e-01 2.05e+03 | 2.77e-02 2.01e-05 | 10 20 | 9 20 | 0 0 | 8 19 | 3.28e-01 5.11e-01 | not_desc first_order |
| 348 | sparsqur | 100 | 1.73e-08 | 6.17e-06 | 17 | 17 | 0 | 16 | 3.18e-01 | first_order |
| 349 350 | spmsrtls srosenbr | 100 100 | 3.61e+01 2.06e+02 | 4.84e+00 1.38e+01 | 1 3 | 1 | 0 0 | 0 2 | 0.00e+00 2.85e-01 | not_desc not desc |
| 360 | thurber | 7 | 1.45e+04 | 1.40e+02 | 42 | 34 | 0 | 33 | 2.29e-03 | not_desc |
| 361 | tointgss | 100 | 9.71e+00 3.61e-01 | 3.76e-07 | 7 5 | 7 | 0 | 6 | 3.15e-01 | first_order |
| 362 367 | tquartic tridia | 100 100 | 3.61e-01 3.38e-13 | 4.66e-02 1.12e-05 | 5 16 | 4 16 | 0 0 | 3 15 | 2.86e-01 2.18e-02 | not_desc first_order |
| 368 | vardim | 100 | 3.59e+03 | 1.08e+06 | 16 | 16 | 0 | 15 | 3.24e-01 | first_order |
| 369 370 | vibrbeam watson | 8 31 | 1.56e-01 1.58e+00 | 2.24e+00 2.94e+01 | 36 4 | 36 4 | 0 0 | 35 3 | 1.02e-03 1.29e-01 | first_order not desc |
| 371 | woods | 100 | 8.06e+02 | 1.19e+02 | 6 | 6 | 0 | 5 | 3.40e-01 | not_desc |
| | T | · | · | · | | | | | · | · |
| id | name | n | f(x) | ∇f(x) | # f | # ∀ f | # ∇²f | iter | t | status |

| id | name | n | f(x) | ∇f(x) | # f | # ∀ f | # ∇²f | iter | t | status | |
|----|------|---|------|---------------|-----|--------------|-------|------|---|--------|--|
| | | | | | | | 1 | | | | |

| 25 | NZF1 | 91 | 2.09e+04 | 2.62e-05 | 119 | 93 | 0 | 92 | 1.13e-03 | first order |
|------------|------------------------|--------------|---|----------------------|--------------------|-------------------|----------|-----------------|----------------------|------------------------------|
| 38 | arglina | 100 | 5.00e+01 | 7.84e-15 | 2 | 2 | 0 | 1 | 1.13e-03 | first_order |
| 39 | arglinb | 100 | 2.48e+01 | 3.28e-04 | 70 | 3 | 0 | 2 | 1.36e-04 | first_order |
| 40 41 | arglinc argtrig | 100 100 | 5.11e+01 -9.90e+03 | 4.44e-03 5.59e-08 | 71 113 | 3 91 | 0 0 | 90 | 9.89e-05 3.23e-03 | first_order first order |
| 41 | arytrig | 100 | 0.00e+00 | 2.91e-06 | 27 | 12 | 0 | 11 | 1.66e-04 | first_order |
| 45 | bdqrtic | 100 | 1.89e+02 | 1.29e-04 | 66 | 39 | 0 | 38 | 6.46e-04 | first_order |
| 50 | biggs6 | 6 | -3.17e+22 | 4.12e+22 | 3 | 3 | 0 | 2 | 2.41e-05 | unbounded |
| 55 58 | brownal broyden3d | 100 100 | 1.92e-09 3.56e-01 | 6.77e-04 3.09e-07 | 27 54 | 4 44 | 0 0 | 3 43 | 9.80e-05 1.35e-03 | first_order first order |
| 59 | broydn7d | 100 | 3.55e+01 | 6.63e-07 | 347 | 320 | 0 | 319 | 1.69e-02 | first order |
| 60 | brybnd | 100 | 1.34e+00 | 1.44e-05 | 128 | 108 | 0 | 107 | 1.26e-02 | first_order |
| 65 | chainwoo | 100 | 1.00e+00 | 9.86e-04 | 356 | 295 | 0 | 294 | 4.29e-03 | first_order |
| 67 | chnrosnb clplatea | 100 100 | 5.84e-11 -9.15e-03 | 7.76e-05 1.60e-08 | 621 70 | 564 66 | 0 0 | 563 65 | 1.75e-02 2.95e-03 | first_order first order |
| 73 | clplateb | 100 | -6.20e-03 | 1.41e-08 | 73 | 69 | 0 | 68 | 3.10e-03 | first_order |
| 74 | clplatec | 100 | -5.11e-03 | 2.37e-08 | 12055857 | 314642 | 0 | 314641 | 3.00e+01 | max_time |
| 76 77 | cosine cragglvy | 100 100 | -9.90e+01 3.23e+01 | 2.84e-08 3.81e-04 | 27 83 | 18 60 | 0 0 | 17 59 | 4.21e-04 1.77e-03 | first_order first order |
| 78 | cragglvy2 | 100 | 2.52e+01 | 5.62e-04 | 86 | 63 | 0 | 62 | 1.77e-03 | first_order |
| 79 | curly | 100 | -1.00e+04 | 3.51e-05 | 12922080 | 151238 | 0 | 151237 | 3.00e+01 | max_time |
| 80 | curly10 | 100 | -1.00e+04 | 3.51e-05 | 12195122 | 142785 | 0 | 142784 | 3.00e+01 | max_time |
| 81 82 | curly20 curly30 | 100 100 | -1.00e+04 -1.00e+04 | 5.01e-05 3.67e-05 | 9462517 7261456 | 109634 74260 | 0 0 | 109633 74259 | 3.00e+01 3.00e+01 | max_time max time |
| 84 | dixmaane | 99 | 1.00e+00 | 1.66e-06 | 67 | 55 | 0 | 54 | 3.99e-03 | first_order |
| 85 | dixmaanf | 99 | 1.00e+00 | 3.35e-06 | 62 | 51 | 0 | 50 | 4.27e-03 | first_order |
| 86 87 | dixmaang dixmaanh | 99 99 | 1.00e+00 1.00e+00 | 9.12e-06 6.71e-06 | 56 63 | 48 50 | 0 0 | 47 49 | 4.00e-03 4.21e-03 | first_order |
| 88 | dixmaani | 99 | 1.00e+00 | 2.59e-06 | 310 | 299 | 0 | 298 | 2.96e-02 | first_order first order |
| 89 | dixmaanj | 99 | 1.00e+00 | 3.91e-06 | 241 | 223 | 0 | 222 | 2.48e-02 | first_order |
| 90 | dixmaank | 99 | 1.00e+00 | 9.22e-06 | 175 | 158 | 0 | 157 | 1.77e-02 | first_order |
| 91 92 | dixmaanl dixmaanm | 99 99 | 1.00e+00 1.00e+00 | 1.47e-05 1.15e-06 | 136 391 | 123 364 | 0 0 | 122 363 | 1.39e-02 5.00e-02 | first_order first order |
| 92 | dixmaann | 99 | 1.00e+00 | 2.66e-06 | 240 | 224 | 0 | 223 | 3.16e-02 | first_order |
| 94 | dixmaano | 99 | 1.00e+00 | 4.36e-06 | 244 | 226 | j 0 | 225 | 3.19e-02 | first_order |
| 95 | dixmaanp | 99 | 1.00e+00 | 8.01e-06 | 256 | 231 | 0 | 230 | 3.37e-02 | first_order |
| 96 | dixon3dq dqdrtic | 100 100 | 3.41e-14 3.99e-12 | 4.84e-08 4.27e-05 | 441 31 | 424 12 | 0 0 | 423 11 | 4.02e-03 1.88e-04 | first_order first order |
| 98 | dqrtic | 100 | 2.92e-02 | 1.14e-01 | 53 | 29 | 0 | 28 | 6.51e-04 | first_order |
| 100 | edensch | 100 | 6.03e+02 | 2.23e-06 | 30 | 22 | 0 | 21 | 7.03e-04 | first_order |
| 101 | eg2 engval1 | 100 100 | -9.74e+01 1.09e+02 | 8.54e-08 6.71e-06 | 19 34 | 8 22 | 0 0 | 7 21 | 1.79e-04 3.21e-04 | first_order first order |
| 103 | enso | 100 | 3.94e+02 | 9.65e-07 | 39 | 26 | 0 | 25 | 9.94e-04 | first_order |
| 105 | errinros | 100 | 3.88e+01 | 5.58e-04 | 270 | 199 | 0 | 198 | 6.16e-03 | first_order |
| 106 | extrosnb | 100 | 3.22e-11 | 1.48e-04 | 50 | 30 | 0 | 29 | 4.39e-04 | first_order |
| 107 108 | fletcbv2 fletcbv3 | 100 100 | -5.14e-01 -2.03e+00 | 1.37e-08 5.57e-09 | 250 68 | 235 48 | 0 0 | 234 47 | 4.51e-03 3.67e-03 | first_order first order |
| 100 | fletchcr | 100 | 3.45e-13 | 3.88e-06 | 436 | 395 | 0 0 | 394 | 5.67e-03 | first order |
| 110 | fminsrf2 | 100 | 1.00e+02 | 8.37e-07 | 136 | 117 | 0 | 116 | 4.04e-03 | first_order |
| 111 | freuroth | 100 | 5.98e+03 | 2.34e-05 | 38 | 23 | 0 | 22 | 1.23e-03 | first_order |
| 112 113 | gauss1 gauss2 | 8 8 | 6.58e+02 6.24e+02 | 9.69e-05 4.34e-03 | 316 392 | 180 247 | 0 0 | 179 246 | 3.23e-03 4.32e-03 | first_order first order |
| 114 | gauss3 | 8 | 6.22e+02 | 5.31e-05 | 389 | 230 | 0 | 229 | 4.09e-03 | first_order |
| 116 | genhumps | 100 | 3.51e-11 | 3.68e-06 | 1985 | 1209 | 0 | 1208 | 6.59e-02 | first_order |
| 117 118 | genrose genrose | 100 100 | 1.00e+00 1.00e+00 | 1.78e-06 1.22e-06 | 298 379 | 253 281 | 0 0 | 252 280 | 3.96e-03 4.45e-03 | first_order first order |
| 120 | hahn1 | 100 | 2.66e+04 | 5.18e+06 | 408002 | 407909 | 0 0 | 407908 | 3.00e+01 | max time |
| 285 | indef | 100 | -9.83e+03 | 6.61e-07 | 14573272 | 316908 | 0 | 316907 | 3.00e+01 | max_time |
| 286 | integreq | 100 | 5.84e-17 | 1.10e-08 | 8 | 8 | 0 | 7 | 2.00e-02 | first_order |
| 288 | kirby2 lanczos1 | 5 6 | 1.52e+01 2.15e-06 | 5.45e+02 5.75e-07 | 206 104 | 123 83 | 0 0 | 122 82 | 2.49e-03 1.99e-04 | first_order first order |
| 291 | lanczos2 | 6 | 2.15e-06 | 3.12e-07 | 111 | 90 | 0 | 89 | 2.13e-04 | first_order |
| 292 | lanczos3 | 6 | 2.17e-06 | 7.13e-07 | 109 | 86 | 0 | 85 | 2.06e-04 | first_order |
| 293 | liarwhd | 100 5 | 1.08e-10 5.52e-02 | 1.31e-04 | 38 38 | 20 26 | 0 0 | 19 25 | 3.01e-04 5.60e-05 | first_order |
| 306 | mgh17 morebv | 100 | 2.74e-11 | 1.21e-06 3.75e-08 | 9018 | 8593 | 0 | 8592 | 4.54e-01 | first_order first order |
| 308 | ncb20 | 100 | 1.67e+02 | 6.56e-07 | 5610143 | 100675 | 0 | 100674 | 3.00e+01 | max_time |
| 309 | ncb20b | 100 | 1.97e+02 | 2.36e-06 | 5360514 | 86703 | 0 | 86702 | 3.00e+01 | max_time |
| 311 | noncvxu2 noncvxun | 100 100 | 2.32e+02 2.33e+02 | 1.34e-04 1.47e-04 | 510 191 | 489 174 | 0 0 | 488 173 | 1.19e-02 4.27e-03 | first_order first order |
| 313 | nondia | 100 | 3.45e-15 | 7.84e-06 | 48 | 25 | 0 | 24 | 2.93e-04 | first_order |
| 314 | nondquar | 100 | 7.41e-07 | 5.60e-06 | 1528 | 1148 | 0 | 1147 | 2.28e-02 | first_order |
| 315 | osbornel | 5 5 | 2.33e-02 | 4.07e+04 | 70424827 | 981474 | 0 | 981473 | 3.00e+01 | max_time |
| 316 317 | osborne2 palmer1c | 11 8 | 2.01e-02 8.44e+01 | 2.56e-08 1.81e+00 | 85 100 | 74 52 | 0 0 | 73 51 | 7.50e-04 6.93e-03 | first_order first order |
| 318 | palmer1d | | 1.40e+01 | 2.48e-01 | 100 | 57 | 0 | 56 | 6.22e-03 | first_order |
| 319 | palmer2c | 8 | 2.22e+00 | 9.13e-02 | 77 | 38 | 0 | 37 | 3.30e-03 | first_order |
| 320 321 | palmer3c palmer4c | 8 8 | 1.65e+00 1.77e-01 | 7.85e-02 6.38e-02 | 58 91 | 22 40 | 0 0 | 21 39 | 2.35e-03 3.82e-03 | first_order first order |
| 321 | palmer4c palmer5c | 8 6 | 1.77e-01 1.06e+00 | 1.35e-02 | 18 | 40 13 | 0 | 12 | 3.82e-03 3.70e-04 | first_order first order |
| 324 | palmer6c | 8 | 4.78e-02 | 1.80e-03 | 163 | 83 | 0 | 82 | 4.44e-03 | first_order |
| 325 | palmer7c | 8 | 2.69e+00 | 2.46e-02 | 113 | 68 | 0 | 67 | 3.51e-03 | first_order |
| 326 | palmer8c penalty1 | 8 100 | 2.95e-01 1.16e+00 | 4.21e-03 4.05e+00 | 129 53 | 79 21 | 0 0 | 78 20 | 4.74e-03 4.58e-04 | first_order first order |
| 328 | penalty2 | 100 | 9.71e+04 | 1.98e-02 | 59 | 28 | 0 | 27 | 3.01e-03 | first_order |
| 329 | penalty3 | 100 | 1.00e+00 | 5.17e-03 | 128 | 69 | 0 | 68 | 2.70e-03 | first_order |
| 335 | powellsg | 100 | 1.40e-09 | 1.91e-05 | 60 60 | 41 | 0 | 40 | 4.62e-04 | first_order |
| 336 337 | power guartc | 100 100 | 1.56e-03 2.92e-02 | 7.07e-02 1.14e-01 | 60 53 | 28 29 | 0 0 | 27 28 | 3.78e-04 6.03e-04 | first_order first order |
| 343 | sbrybnd | 100 | 7.64e+00 | 3.72e-04 | 22559 | 20915 | 0 | 20914 | 3.22e+00 | first_order |
| 344 | schmvett | 100 | -2.94e+02 | 1.07e-07 | 26 | 22 | 0 | 21 | 6.03e-04 | first_order |
| 345 | scosine sinquad | 100 100 | -7.78e+01 9.76e-16 | 4.57e+05 3.86e-08 | 788053 138 | 710529 105 | 0 0 | 710528 104 | 3.00e+01 2.93e-03 | max_time first order |
| 346 | sinquad sparsine | 100 | 9.76e-16 4.30e-10 | 9.06e-05 | 362 | 286 | 0 | 285 | 2.93e-03 2.01e-02 | first_order first order |
| 348 | sparsqur | 100 | 4.72e-08 | 1.57e-05 | 41 | 27 | 0 | 26 | 6.04e-04 | first_order |
| 349 | spmsrtls | 100 | 7.70e-15 | 7.25e-08 | 87 | 77 | 0 | 76 | 8.08e-03 | first_order |
| 350 360 | srosenbr thurber | 100 7 | 4.00e-13 2.82e+03 | 1.97e-05 3.73e-02 | 42 198 | 22 132 | 0 0 | 21 131 | 2.64e-04 1.84e-03 | first_order first order |
| 361 | tointgss | 100 | 9.71e+00 | 1.86e-07 | 20 | 132 | 0 | 17 | 7.38e-04 | first_order |
| 362 | tquartic | 100 | 4.21e-20 | 3.37e-09 | 24 | 19 | 0 | 18 | 3.58e-04 | first_order |
| 367 368 | tridia vardim | 100 100 | 1.78e-12 2.52e+03 | 1.44e-05 8.22e+05 | 154 95 | 135 21 | 0 0 | 134 20 | 1.97e-03 3.26e-04 | first_order |
| 368 | vardim vibrbeam | 100 8 | 2.52e+03 5.29e+00 | 8.22e+05 1.94e+00 | 225 | 21 127 | | 126 | 3.26e-04 6.55e-04 | first_order first_order |
| 370 | watson | 31 | -3.83e+90 | 8.06e+90 | 2 | 2 | 0 | 1 | 4.57e-03 | unbounded |
| 371 | woods | 100 | 1.72e-09 | 1.10e-03 | 48 | 28 | j 0 | 27 | 3.60e-04 | first_order |
| | ····· | | *************************************** | | | | | | | |
| | | | | | | | | | | |

```
costs = [
    df -> .!solved(df) .* Inf .+ df.neval_obj,
    df -> .!solved(df) .* Inf .+ df.neval_grad,
    df -> .!solved(df) .* Inf .+ df.neval_hess,
    df -> .!solved(df) .* Inf .+ df.neval_obj .+ df.neval_grad .+ df.neval_hess,
]

using Plots
gr()
profile_solvers(stats, costs, costnames)
```



J'ai un peu de la misère à comprendre les graphiques et j'utilise cet article comme référence: https://link.springer.com/article/10.1007/s101070100263.

De ce que je comprends, Newton-CG a environ 60% de probabilité d'être le meilleur initialement, mais plus on est tolérant plus lbfgs20 devient compétitif.

On a produit les profils de performance à partir des 105 problèmes utilisés à l'exercice 3.

On remarque cette fois-ci que osborne1 est résolu par newton-cg, mais que fletchcr n'est pas résolu (status = max_time). On retrouve aussi plusieurs problèmes avec le status not_desc, mais je n'ai pas réussi à trouver de la documentation qui explique ce que ça signifie quant à la résolution des problèmes.