Simulation Information

Edward Gunning

2023-08-15

The simulations were run on the Irish Centre for High-End Computing (ICHEC) cluster. This document provides the sessionInfo() from each scenario as well as the number of cores used.

```
Baseline Scenario: N = 280, prop_missing = 0.1, long_strength = 1
## R version 4.1.2 (2021-11-01)
## Platform: x86_64-pc-linux-gnu (64-bit)
## Matrix products: default
          /ichec/packages/r/4.1.2/lib64/R/lib/libRblas.so
## LAPACK: /ichec/packages/r/4.1.2/lib64/R/lib/libRlapack.so
##
## locale:
                                   LC NUMERIC=C
   [1] LC_CTYPE=en_IE.UTF-8
   [3] LC_TIME=en_IE.UTF-8
                                   LC_COLLATE=en_IE.UTF-8
   [5] LC_MONETARY=en_IE.UTF-8
                                   LC_MESSAGES=en_IE.UTF-8
   [7] LC_PAPER=en_IE.UTF-8
                                   LC_NAME=C
  [9] LC_ADDRESS=C
##
                                   LC_TELEPHONE=C
## [11] LC_MEASUREMENT=en_IE.UTF-8 LC_IDENTIFICATION=C
## attached base packages:
## [1] splines
                 stats
                           graphics grDevices utils
                                                         datasets methods
## [8] base
##
## other attached packages:
  [1] mvtnorm 1.2-2
                          progress_1.2.2
                                            data.table 1.14.8 refund 0.1-32
  [5] lme4 1.1-34
                          Matrix 1.3-4
                                            fda 6.1.4
                                                              deSolve 1.36
   [9] fds 1.8
                          RCurl_1.98-1.6
                                            rainbow_3.7
                                                              pcaPP_2.0-3
##
## [13] MASS_7.3-54
##
## loaded via a namespace (and not attached):
## [1] mclust_6.0.0
                           Rcpp_1.0.8
                                                                  lattice_0.20-45
                                              here_1.0.1
## [5] prettyunits_1.1.1 assertthat_0.2.1
                                                                  foreach_1.5.2
                                              rprojroot_2.0.2
  [9] utf8_1.2.2
                           R6_2.5.1
                                              magic_1.6-1
                                                                 pracma_2.4.2
## [13] ggplot2_3.3.5
                           pillar_1.7.0
                                              rlang_1.0.1
                                                                 minqa_1.2.5
## [17] nloptr_2.0.0
                           grpreg_3.4.0
                                              munsell_0.5.0
                                                                 gamm4_0.2-6
                           pkgconfig_2.0.3
## [21] compiler_4.1.2
                                              pbs_1.1
                                                                 mgcv_1.9-0
## [25] tidyselect_1.1.1
                           tibble_3.1.6
                                              hdrcde 3.4
                                                                 matrixcalc_1.0-6
## [29] codetools_0.2-18
                           fansi_1.0.2
                                              crayon_1.5.0
                                                                 dplyr_1.0.8
## [33] bitops_1.0-7
                           grid_4.1.2
                                              nlme_3.1-153
                                                                  gtable_0.3.0
## [37] lifecycle_1.0.1
                           DBI_1.1.2
                                              magrittr_2.0.2
                                                                 scales_1.1.1
## [41] KernSmooth_2.23-20 cli_3.2.0
                                              doParallel_1.0.17
                                                                 ellipsis_0.3.2
```

boot 1.3-28

iterators_1.0.14

vctrs 0.3.8

[45] generics_0.1.2

```
## [49] tools_4.1.2
                           glue_1.6.1
                                               purrr_0.3.4
                                                                  hms_1.1.1
## [53] ks_1.14.0
                           abind_1.4-5
                                               parallel_4.1.2
                                                                  colorspace_2.0-2
                           RLRsim 3.1-8
## [57] cluster_2.1.2
  • For this scenario, there were 39 cores used.
N=280, prop_missing = 0.1, long_strength = 2
## R version 4.1.2 (2021-11-01)
## Platform: x86_64-pc-linux-gnu (64-bit)
## Matrix products: default
           /ichec/packages/r/4.1.2/lib64/R/lib/libRblas.so
## BLAS:
## LAPACK: /ichec/packages/r/4.1.2/lib64/R/lib/libRlapack.so
##
## locale:
## [1] LC_CTYPE=en_IE.UTF-8
                                   LC_NUMERIC=C
   [3] LC_TIME=en_IE.UTF-8
                                   LC_COLLATE=en_IE.UTF-8
  [5] LC_MONETARY=en_IE.UTF-8
                                   LC_MESSAGES=en_IE.UTF-8
##
## [7] LC PAPER=en IE.UTF-8
                                   LC NAME=C
## [9] LC ADDRESS=C
                                   LC TELEPHONE=C
## [11] LC_MEASUREMENT=en_IE.UTF-8 LC_IDENTIFICATION=C
## attached base packages:
## [1] splines
                 stats
                           graphics grDevices utils
                                                          datasets methods
## [8] base
##
## other attached packages:
## [1] mvtnorm_1.2-2
                          progress_1.2.2
                                             data.table_1.14.8 refund_0.1-32
## [5] lme4_1.1-34
                          Matrix_1.3-4
                                             fda_6.1.4
                                                               deSolve_1.36
## [9] fds_1.8
                          RCurl_1.98-1.6
                                             rainbow_3.7
                                                               pcaPP_2.0-3
## [13] MASS_7.3-54
## loaded via a namespace (and not attached):
## [1] mclust_6.0.0
                                                                  lattice_0.20-45
                           Rcpp_1.0.8
                                              here_1.0.1
## [5] prettyunits_1.1.1 assertthat_0.2.1
                                               rprojroot_2.0.2
                                                                  foreach_1.5.2
## [9] utf8 1.2.2
                           R6 2.5.1
                                               magic_1.6-1
                                                                  pracma 2.4.2
## [13] ggplot2_3.3.5
                           pillar_1.7.0
                                                                  minqa_1.2.5
                                               rlang_1.0.1
## [17] nloptr_2.0.0
                           grpreg_3.4.0
                                               munsell_0.5.0
                                                                  gamm4_0.2-6
## [21] compiler_4.1.2
                           pkgconfig_2.0.3
                                               pbs_1.1
                                                                  mgcv_1.9-0
## [25] tidyselect_1.1.1
                           tibble_3.1.6
                                               hdrcde_3.4
                                                                  matrixcalc_1.0-6
## [29] codetools_0.2-18
                           fansi_1.0.2
                                               crayon_1.5.0
                                                                  dplyr_1.0.8
## [33] bitops_1.0-7
                           grid_4.1.2
                                               nlme_3.1-153
                                                                  gtable_0.3.0
## [37] lifecycle_1.0.1
                           DBI_1.1.2
                                               magrittr_2.0.2
                                                                  scales_1.1.1
## [41] KernSmooth_2.23-20 cli_3.2.0
                                               doParallel_1.0.17
                                                                  ellipsis_0.3.2
## [45] generics_0.1.2
                           vctrs_0.3.8
                                               boot_1.3-28
                                                                  iterators_1.0.14
## [49] tools_4.1.2
                           glue_1.6.1
                                               purrr_0.3.4
                                                                  hms_1.1.1
## [53] ks_1.14.0
                           abind_1.4-5
                                               parallel_4.1.2
                                                                  colorspace_2.0-2
## [57] cluster_2.1.2
                           RLRsim_3.1-8
  • For this scenario, there were 39 cores used.
N=280, prop_missing = 0.1, long_strength = 3
## R version 4.1.2 (2021-11-01)
```

```
## Platform: x86_64-pc-linux-gnu (64-bit)
##
## Matrix products: default
         /ichec/packages/r/4.1.2/lib64/R/lib/libRblas.so
## LAPACK: /ichec/packages/r/4.1.2/lib64/R/lib/libRlapack.so
##
## locale:
## [1] LC_CTYPE=en_IE.UTF-8
                                   LC NUMERIC=C
## [3] LC_TIME=en_IE.UTF-8
                                   LC_COLLATE=en_IE.UTF-8
## [5] LC_MONETARY=en_IE.UTF-8
                                   LC_MESSAGES=en_IE.UTF-8
## [7] LC_PAPER=en_IE.UTF-8
                                   LC_NAME=C
## [9] LC_ADDRESS=C
                                   LC_TELEPHONE=C
## [11] LC_MEASUREMENT=en_IE.UTF-8 LC_IDENTIFICATION=C
##
## attached base packages:
## [1] splines
                 stats
                           graphics grDevices utils
                                                          datasets methods
## [8] base
##
## other attached packages:
## [1] mvtnorm 1.2-2
                          progress_1.2.2
                                            data.table 1.14.8 refund 0.1-32
## [5] lme4_1.1-34
                          Matrix_1.3-4
                                            fda_6.1.4
                                                              deSolve_1.36
                          RCurl_1.98-1.6
                                            rainbow_3.7
                                                              pcaPP_2.0-3
## [9] fds 1.8
## [13] MASS_7.3-54
## loaded via a namespace (and not attached):
## [1] mclust_6.0.0
                           Rcpp_1.0.8
                                              here_1.0.1
                                                                  lattice_0.20-45
                           assertthat_0.2.1
## [5] prettyunits_1.1.1
                                              rprojroot_2.0.2
                                                                  foreach_1.5.2
## [9] utf8_1.2.2
                           R6_2.5.1
                                              magic_1.6-1
                                                                  pracma_2.4.2
## [13] ggplot2_3.3.5
                           pillar_1.7.0
                                              rlang_1.0.1
                                                                  minqa_1.2.5
                                              munsell_0.5.0
## [17] nloptr_2.0.0
                           grpreg_3.4.0
                                                                  gamm4_0.2-6
## [21] compiler_4.1.2
                           pkgconfig_2.0.3
                                              pbs_1.1
                                                                  mgcv_1.9-0
## [25] tidyselect_1.1.1
                           tibble_3.1.6
                                              hdrcde_3.4
                                                                  matrixcalc_1.0-6
## [29] codetools_0.2-18
                           fansi_1.0.2
                                              crayon_1.5.0
                                                                  dplyr_1.0.8
## [33] bitops_1.0-7
                           grid_4.1.2
                                              nlme_3.1-153
                                                                  gtable_0.3.0
## [37] lifecycle_1.0.1
                           DBI_1.1.2
                                              magrittr_2.0.2
                                                                  scales 1.1.1
## [41] KernSmooth_2.23-20 cli_3.2.0
                                              doParallel_1.0.17
                                                                  ellipsis_0.3.2
## [45] generics 0.1.2
                           vctrs 0.3.8
                                              boot 1.3-28
                                                                  iterators 1.0.14
## [49] tools_4.1.2
                                              purrr_0.3.4
                           glue_1.6.1
                                                                  hms_1.1.1
## [53] ks 1.14.0
                           abind_1.4-5
                                              parallel_4.1.2
                                                                  colorspace_2.0-2
## [57] cluster_2.1.2
                           RLRsim_3.1-8
  • For this scenario, there were 39 cores used.
N=280, prop_missing = 0.2, long_strength = 1
## R version 4.1.2 (2021-11-01)
## Platform: x86_64-pc-linux-gnu (64-bit)
## Matrix products: default
           /ichec/packages/r/4.1.2/lib64/R/lib/libRblas.so
## LAPACK: /ichec/packages/r/4.1.2/lib64/R/lib/libRlapack.so
##
## locale:
## [1] LC_CTYPE=en_IE.UTF-8
                                   LC NUMERIC=C
## [3] LC_TIME=en_IE.UTF-8
                                   LC_COLLATE=en_IE.UTF-8
```

```
## [5] LC_MONETARY=en_IE.UTF-8
                                   LC MESSAGES=en IE.UTF-8
                                   LC NAME=C
## [7] LC_PAPER=en_IE.UTF-8
## [9] LC ADDRESS=C
                                   LC TELEPHONE=C
## [11] LC_MEASUREMENT=en_IE.UTF-8 LC_IDENTIFICATION=C
## attached base packages:
                           graphics grDevices utils
## [1] splines
                 stats
                                                          datasets methods
## [8] base
##
## other attached packages:
## [1] mvtnorm_1.2-2
                          progress_1.2.2
                                            data.table_1.14.8 refund_0.1-32
## [5] lme4_1.1-34
                          Matrix_1.3-4
                                                               deSolve_1.36
                                            fda_6.1.4
## [9] fds_1.8
                          RCurl_1.98-1.6
                                            rainbow_3.7
                                                               pcaPP_2.0-3
## [13] MASS_7.3-54
##
## loaded via a namespace (and not attached):
## [1] mclust_6.0.0
                           Rcpp_1.0.8
                                              here_1.0.1
                                                                  lattice_0.20-45
## [5] prettyunits 1.1.1
                           assertthat 0.2.1
                                              rprojroot_2.0.2
                                                                  foreach 1.5.2
                                                                  pracma_2.4.2
## [9] utf8_1.2.2
                           R6_2.5.1
                                              magic_1.6-1
## [13] ggplot2_3.3.5
                           pillar_1.7.0
                                              rlang_1.0.1
                                                                  minqa_1.2.5
## [17] nloptr_2.0.0
                           grpreg_3.4.0
                                              munsell_0.5.0
                                                                  gamm4_0.2-6
## [21] compiler_4.1.2
                           pkgconfig_2.0.3
                                              pbs_1.1
                                                                  mgcv_1.9-0
## [25] tidyselect_1.1.1
                           tibble_3.1.6
                                              hdrcde_3.4
                                                                  matrixcalc_1.0-6
                           fansi 1.0.2
## [29] codetools 0.2-18
                                              crayon 1.5.0
                                                                  dplyr_1.0.8
## [33] bitops_1.0-7
                           grid_4.1.2
                                              nlme 3.1-153
                                                                  gtable_0.3.0
## [37] lifecycle_1.0.1
                           DBI_1.1.2
                                              magrittr_2.0.2
                                                                  scales_1.1.1
## [41] KernSmooth_2.23-20 cli_3.2.0
                                              doParallel_1.0.17
                                                                  ellipsis_0.3.2
## [45] generics_0.1.2
                           vctrs_0.3.8
                                              boot_1.3-28
                                                                  iterators_1.0.14
## [49] tools_4.1.2
                           glue_1.6.1
                                              purrr_0.3.4
                                                                  hms_1.1.1
## [53] ks_1.14.0
                           abind_1.4-5
                                              parallel_4.1.2
                                                                  colorspace_2.0-2
## [57] cluster_2.1.2
                           RLRsim_3.1-8
  • For this scenario, there were 39 cores used.
N=280, prop_missing = 0.5, long_strength = 1
## R version 4.1.2 (2021-11-01)
## Platform: x86_64-pc-linux-gnu (64-bit)
## Matrix products: default
           /ichec/packages/r/4.1.2/lib64/R/lib/libRblas.so
## LAPACK: /ichec/packages/r/4.1.2/lib64/R/lib/libRlapack.so
##
## locale:
## [1] LC_CTYPE=en_IE.UTF-8
                                   LC_NUMERIC=C
## [3] LC_TIME=en_IE.UTF-8
                                   LC_COLLATE=en_IE.UTF-8
                                   LC_MESSAGES=en_IE.UTF-8
## [5] LC_MONETARY=en_IE.UTF-8
   [7] LC_PAPER=en_IE.UTF-8
                                   LC_NAME=C
## [9] LC_ADDRESS=C
                                   LC_TELEPHONE=C
## [11] LC_MEASUREMENT=en_IE.UTF-8 LC_IDENTIFICATION=C
## attached base packages:
## [1] splines
                 stats
                           graphics grDevices utils
                                                          datasets methods
## [8] base
##
```

```
## other attached packages:
## [1] mvtnorm_1.2-2
                                            data.table_1.14.8 refund_0.1-32
                          progress_1.2.2
## [5] lme4 1.1-34
                          Matrix 1.3-4
                                            fda 6.1.4
                                                              deSolve 1.36
                                                               pcaPP_2.0-3
## [9] fds_1.8
                          RCurl_1.98-1.6
                                            rainbow_3.7
## [13] MASS_7.3-54
##
## loaded via a namespace (and not attached):
## [1] mclust_6.0.0
                           Rcpp_1.0.8
                                              here_1.0.1
                                                                  lattice_0.20-45
## [5] prettyunits_1.1.1 assertthat_0.2.1
                                              rprojroot_2.0.2
                                                                  foreach_1.5.2
## [9] utf8_1.2.2
                           R6_2.5.1
                                              magic_1.6-1
                                                                  pracma_2.4.2
## [13] ggplot2_3.3.5
                           pillar_1.7.0
                                              rlang_1.0.1
                                                                 minqa_1.2.5
## [17] nloptr_2.0.0
                                              munsell_0.5.0
                                                                  gamm4_0.2-6
                           grpreg_3.4.0
                                                                 mgcv_1.9-0
## [21] compiler_4.1.2
                           pkgconfig_2.0.3
                                              pbs_1.1
                                              hdrcde_3.4
## [25] tidyselect_1.1.1
                           tibble_3.1.6
                                                                  matrixcalc_1.0-6
## [29] codetools_0.2-18
                           fansi_1.0.2
                                              crayon_1.5.0
                                                                  dplyr_1.0.8
## [33] bitops_1.0-7
                           grid_4.1.2
                                              nlme_3.1-153
                                                                  gtable_0.3.0
## [37] lifecycle_1.0.1
                           DBI_1.1.2
                                              magrittr_2.0.2
                                                                  scales_1.1.1
## [41] KernSmooth 2.23-20 cli 3.2.0
                                              doParallel_1.0.17 ellipsis_0.3.2
## [45] generics_0.1.2
                           vctrs_0.3.8
                                              boot_1.3-28
                                                                  iterators_1.0.14
## [49] tools 4.1.2
                           glue 1.6.1
                                              purrr 0.3.4
                                                                  hms 1.1.1
## [53] ks_1.14.0
                           abind_1.4-5
                                              parallel_4.1.2
                                                                  colorspace_2.0-2
## [57] cluster_2.1.2
                           RLRsim_3.1-8
  • For this scenario, there were 39 cores used.
N=500, prop_missing = 0.1, long_strength = 1
## R version 4.1.2 (2021-11-01)
## Platform: x86_64-pc-linux-gnu (64-bit)
##
## Matrix products: default
           /ichec/packages/r/4.1.2/lib64/R/lib/libRblas.so
## LAPACK: /ichec/packages/r/4.1.2/lib64/R/lib/libRlapack.so
##
## locale:
## [1] LC_CTYPE=en_IE.UTF-8
                                   LC_NUMERIC=C
## [3] LC TIME=en IE.UTF-8
                                   LC COLLATE=en IE.UTF-8
                                   LC MESSAGES=en IE.UTF-8
## [5] LC MONETARY=en IE.UTF-8
## [7] LC PAPER=en IE.UTF-8
                                   LC NAME=C
   [9] LC ADDRESS=C
                                   LC TELEPHONE=C
## [11] LC_MEASUREMENT=en_IE.UTF-8 LC_IDENTIFICATION=C
## attached base packages:
## [1] splines
                           graphics grDevices utils
                 stats
                                                         datasets methods
## [8] base
##
## other attached packages:
## [1] mvtnorm_1.2-2
                          progress_1.2.2
                                            data.table_1.14.8 refund_0.1-32
## [5] lme4_1.1-34
                                            fda_6.1.4
                                                              deSolve_1.36
                          Matrix_1.3-4
## [9] fds 1.8
                          RCurl_1.98-1.6
                                            rainbow_3.7
                                                              pcaPP_2.0-3
## [13] MASS_7.3-54
## loaded via a namespace (and not attached):
## [1] mclust_6.0.0
                           Rcpp 1.0.8
                                              here 1.0.1
                                                                 lattice_0.20-45
```

foreach_1.5.2

[5] prettyunits_1.1.1 assertthat_0.2.1 rprojroot_2.0.2

```
## [9] utf8_1.2.2
                           R6 2.5.1
                                                                   pracma_2.4.2
                                               magic_1.6-1
## [13] ggplot2_3.3.5
                           pillar_1.7.0
                                                                   minqa_1.2.5
                                               rlang_1.0.1
                                               munsell 0.5.0
## [17] nloptr_2.0.0
                           grpreg_3.4.0
                                                                   gamm4 0.2-6
## [21] compiler_4.1.2
                           pkgconfig_2.0.3
                                                                   mgcv_1.9-0
                                               pbs_1.1
## [25] tidyselect_1.1.1
                           tibble_3.1.6
                                               hdrcde_3.4
                                                                   matrixcalc_1.0-6
## [29] codetools 0.2-18
                           fansi 1.0.2
                                               crayon 1.5.0
                                                                   dplyr_1.0.8
## [33] bitops 1.0-7
                           grid 4.1.2
                                               nlme 3.1-153
                                                                   gtable 0.3.0
                                                                   scales_1.1.1
## [37] lifecycle_1.0.1
                           DBI_1.1.2
                                               magrittr_2.0.2
## [41] KernSmooth_2.23-20 cli_3.2.0
                                               doParallel_1.0.17
                                                                   ellipsis_0.3.2
                                               boot_1.3-28
## [45] generics_0.1.2
                           vctrs_0.3.8
                                                                   iterators_1.0.14
## [49] tools_4.1.2
                           glue_1.6.1
                                               purrr_0.3.4
                                                                   hms_1.1.1
## [53] ks_1.14.0
                           abind_1.4-5
                                               parallel_4.1.2
                                                                   colorspace_2.0-2
## [57] cluster_2.1.2
                           RLRsim_3.1-8
```

• For this scenario, there were 30 cores used.

N=1000, prop_missing = 0.1, long_strength = 1

Due to out-of-memory (OOM) errors, this was split into two smaller batches of simulations (250 replicates each).

Part 1

```
## R version 4.1.2 (2021-11-01)
## Platform: x86_64-pc-linux-gnu (64-bit)
##
## Matrix products: default
           /ichec/packages/r/4.1.2/lib64/R/lib/libRblas.so
## BLAS:
## LAPACK: /ichec/packages/r/4.1.2/lib64/R/lib/libRlapack.so
## locale:
##
   [1] LC_CTYPE=en_IE.UTF-8
                                   LC NUMERIC=C
   [3] LC_TIME=en_IE.UTF-8
                                   LC_COLLATE=en_IE.UTF-8
  [5] LC_MONETARY=en_IE.UTF-8
                                   LC_MESSAGES=en_IE.UTF-8
  [7] LC_PAPER=en_IE.UTF-8
                                   LC_NAME=C
##
##
  [9] LC_ADDRESS=C
                                   LC_TELEPHONE=C
## [11] LC_MEASUREMENT=en_IE.UTF-8 LC_IDENTIFICATION=C
##
## attached base packages:
## [1] splines
                 stats
                           graphics grDevices utils
                                                          datasets methods
## [8] base
##
## other attached packages:
                                             data.table_1.14.8 refund_0.1-32
##
  [1] mvtnorm_1.2-2
                          progress_1.2.2
  [5] lme4 1.1-34
                                             fda 6.1.4
##
                          Matrix_1.3-4
                                                               deSolve 1.36
## [9] fds_1.8
                          RCurl_1.98-1.6
                                                               pcaPP_2.0-3
                                             rainbow_3.7
## [13] MASS 7.3-54
##
## loaded via a namespace (and not attached):
  [1] mclust_6.0.0
                           Rcpp_1.0.8
                                                                  lattice_0.20-45
                                               here_1.0.1
## [5] prettyunits_1.1.1
                           assertthat_0.2.1
                                               rprojroot_2.0.2
                                                                  foreach_1.5.2
## [9] utf8_1.2.2
                           R6_2.5.1
                                               magic_1.6-1
                                                                  pracma_2.4.2
## [13] ggplot2_3.3.5
                           pillar_1.7.0
                                               rlang_1.0.1
                                                                  minqa_1.2.5
## [17] nloptr_2.0.0
                           grpreg_3.4.0
                                               munsell_0.5.0
                                                                  gamm4_0.2-6
## [21] compiler_4.1.2
                           pkgconfig_2.0.3
                                              pbs_1.1
                                                                  mgcv_1.9-0
```

```
## [25] tidyselect_1.1.1
                           tibble_3.1.6
                                               hdrcde_3.4
                                                                   matrixcalc 1.0-6
## [29] codetools_0.2-18
                           fansi_1.0.2
                                               crayon_1.5.0
                                                                   dplyr_1.0.8
                           grid 4.1.2
## [33] bitops_1.0-7
                                               nlme 3.1-153
                                                                   gtable_0.3.0
## [37] lifecycle_1.0.1
                           DBI_1.1.2
                                               magrittr_2.0.2
                                                                   scales_1.1.1
## [41] KernSmooth_2.23-20 cli_3.2.0
                                               doParallel_1.0.17
                                                                   ellipsis_0.3.2
## [45] generics 0.1.2
                           vctrs 0.3.8
                                               boot 1.3-28
                                                                   iterators 1.0.14
## [49] tools 4.1.2
                           glue 1.6.1
                                               purrr 0.3.4
                                                                   hms 1.1.1
## [53] ks 1.14.0
                           abind 1.4-5
                                               parallel_4.1.2
                                                                   colorspace_2.0-2
## [57] cluster_2.1.2
                           RLRsim_3.1-8
```

• For this scenario, there were 20 cores used.

Part 2

```
## R version 4.1.2 (2021-11-01)
## Platform: x86_64-pc-linux-gnu (64-bit)
##
## Matrix products: default
           /ichec/packages/r/4.1.2/lib64/R/lib/libRblas.so
## LAPACK: /ichec/packages/r/4.1.2/lib64/R/lib/libRlapack.so
##
## locale:
## [1] LC_CTYPE=en_IE.UTF-8
                                   LC NUMERIC=C
  [3] LC_TIME=en_IE.UTF-8
                                   LC_COLLATE=en_IE.UTF-8
  [5] LC_MONETARY=en_IE.UTF-8
                                   LC MESSAGES=en IE.UTF-8
## [7] LC_PAPER=en_IE.UTF-8
                                   LC_NAME=C
                                   LC_TELEPHONE=C
## [9] LC ADDRESS=C
## [11] LC MEASUREMENT=en IE.UTF-8 LC IDENTIFICATION=C
## attached base packages:
## [1] splines
                 stats
                           graphics grDevices utils
                                                          datasets methods
## [8] base
##
## other attached packages:
## [1] mvtnorm_1.2-2
                                             data.table_1.14.8 refund_0.1-32
                          progress_1.2.2
## [5] lme4_1.1-34
                          Matrix_1.3-4
                                             fda_6.1.4
                                                               deSolve_1.36
                          RCurl_1.98-1.6
                                                               pcaPP_2.0-3
## [9] fds_1.8
                                             rainbow_3.7
## [13] MASS_7.3-54
##
## loaded via a namespace (and not attached):
## [1] mclust_6.0.0
                           Rcpp_1.0.8
                                                                  lattice_0.20-45
                                               here_1.0.1
   [5] prettyunits_1.1.1
                           assertthat 0.2.1
                                                                  foreach_1.5.2
                                               rprojroot_2.0.2
## [9] utf8_1.2.2
                           R6_2.5.1
                                                                  pracma_2.4.2
                                               magic_1.6-1
## [13] ggplot2_3.3.5
                           pillar_1.7.0
                                               rlang_1.0.1
                                                                  minqa_1.2.5
## [17] nloptr 2.0.0
                           grpreg_3.4.0
                                               munsell 0.5.0
                                                                  gamm4 0.2-6
## [21] compiler_4.1.2
                           pkgconfig_2.0.3
                                               pbs_1.1
                                                                  mgcv 1.9-0
## [25] tidyselect_1.1.1
                           tibble_3.1.6
                                               hdrcde_3.4
                                                                  matrixcalc_1.0-6
## [29] codetools_0.2-18
                           fansi_1.0.2
                                               crayon_1.5.0
                                                                  dplyr_1.0.8
                                               nlme_3.1-153
## [33] bitops_1.0-7
                           grid_4.1.2
                                                                  gtable_0.3.0
## [37] lifecycle_1.0.1
                           DBI_1.1.2
                                               magrittr_2.0.2
                                                                  scales_1.1.1
## [41] KernSmooth_2.23-20 cli_3.2.0
                                               doParallel_1.0.17
                                                                  ellipsis_0.3.2
                                               boot_1.3-28
## [45] generics_0.1.2
                           vctrs_0.3.8
                                                                  iterators_1.0.14
## [49] tools_4.1.2
                           glue_1.6.1
                                               purrr_0.3.4
                                                                  hms_1.1.1
## [53] ks_1.14.0
                           abind_1.4-5
                                               parallel_4.1.2
                                                                  colorspace_2.0-2
## [57] cluster_2.1.2
                           RLRsim_3.1-8
```

• For this scenario, there were 20 cores used.