Package ‘bench’

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as_bench_mark ............................... Coerce to a bench mark object Bench mark objects

Description

This is typically needed only if you are performing additional manipulations after calling bench::mark().

Usage

as_bench_mark(x)

Arguments

x Object to be coerced

as_bench_time ............................... Human readable times

Description

Construct, manipulate and display vectors of elapsed times in seconds. These are numeric vectors, so you can compare them numerically, but they can also be compared to human readable values such as '10ms'.

Usage

as_bench_time(x)

Arguments

x A numeric or character vector. Character representations can use shorthand sizes (see examples).
Examples

```r
as_bench_time("1ns")
as_bench_time("1")
as_bench_time("1us")
as_bench_time("1ms")
as_bench_time("1s")

as_bench_time("100ns") < "1ms"

sum(as_bench_time(c("1MB", "5MB", "500KB")))
```

Description

Autoplot method for bench_mark objects

Usage

```r
autoplot.bench_mark(
  object,
  type = c("beeswarm", "jitter", "ridge", "boxplot", "violin"),
  ...
)
```

## S3 method for class 'bench_mark'
plot(x, ..., type = c("beeswarm", "jitter", "ridge", "boxplot", "violin"), y)

Arguments

- `object` A bench_mark object.
- `type` The type of plot. Plotting geoms used for each type are
  - beeswarm - `ggbeeswarm::geom_quasirandom()`
  - jitter - `ggplot2::geom_jitter()`
  - ridge - `ggridges::geom_density_ridges()`
  - boxplot - `ggplot2::geom_boxplot()`
  - violin - `ggplot2::geom_violin()`
- `...` Additional arguments passed to the plotting geom.
- `x` A bench_mark object.
- `y` Ignored, required for compatibility with the `plot()` generic.
Details

This function requires some optional dependencies. `ggplot2`, `tidyr`, and depending on the plot type `ggbeeswarm`, `ggridges`.

For type of beeswarm and jitter the points are colored by the highest level garbage collection performed during each iteration.

For plots with 2 parameters `ggplot2::facet_grid()` is used to construct a 2d facet. For other numbers of parameters `ggplot2::facet_wrap()` is used instead.

Examples

```r
dat <- data.frame(x = runif(10000, 1, 1000), y=runif(10000, 1, 1000))

res <- bench::mark(
  dat[dat$x > 500, ],
  dat[which(dat$x > 500), ],
  subset(dat, x > 500))

if (require(ggplot2) && require(tidyr)) {
  # Beeswarm plot
  autoplot(res)

  # ridge (joyplot)
  autoplot(res, "ridge")

  # If you want to have the plots ordered by execution time you can do so by
  # ordering factor levels in the expressions.
  if (require(dplyr) && require(forcats)) {
    res %>%
    mutate(expression = forcats::fct_reorder(as.character(expression), min, .desc = TRUE)) %>%
    as_bench_mark() %>%
    autoplot("violin")
  }
}
```

---

`bench_bytes`  
*Human readable memory sizes*

Description

Construct, manipulate and display vectors of byte sizes. These are numeric vectors, so you can compare them numerically, but they can also be compared to human readable values such as '10MB'.

Usage

```r
as_bench_bytes(x)
bench_bytes(x)
```
Arguments

x  A numeric or character vector. Character representations can use shorthand sizes (see examples).

Details

These memory sizes are always assumed to be base 1024, rather than 1000.

Examples

bench_bytes("1")
bench_bytes("1K")
bench_bytes("1Kb")
bench_bytes("1KiB")
bench_bytes("1MB")

bench_bytes("1KB") < "1MB"

sum(bench_bytes(c("1MB", "5MB", "500KB")))

bench_memory

Measure memory that an expression used.

Description

Measure memory that an expression used.

Usage

bench_memory(expr)

Arguments

expr  A expression to be measured.

Value

A tibble with two columns

- The total amount of memory allocated
- The raw memory allocations as parsed by profmem::readRprofmem()

Examples

if (capabilities("profmem")) {
  bench_memory(1 + 1:10000)
}
bench_process_memory

Retrieve the current and maximum memory from the R process

Description

The memory reported here will likely differ from that reported by gc(), as this includes all memory from the R process, including any child processes and memory allocated outside R’s garbage collector heap.

Usage

bench_process_memory()

Details

The OS APIs used are as follows

Windows:
- PROCESS_MEMORY_COUNTERS.WorkingSetSize
- PROCESS_MEMORY_COUNTERS.PeakWorkingSetSize

macOS:
- task_info(TASK_BASIC_INFO)
- rusage.ru_maxrss

linux:
- /proc/pid/status VmSize
- /proc/pid/status VmPeak and on Windows PROCESS_MEMORY_COUNTERS.PeakWorkingSetSize

bench_time

Measure Process CPU and real time that an expression used.

Description

Measure Process CPU and real time that an expression used.

Usage

bench_time(expr)

Arguments

expr        A expression to be timed.
Details
On some systems (such as macOS) the process clock has lower precision than the realtime clock, as a result there may be cases where the process time is larger than the real time for fast expressions.

Value
A `bench_time` object with two values.

- **process** - The process CPU usage of the expression evaluation.
- **real** - The wallclock time of the expression evaluation.

See Also
`bench_memory()` To measure memory allocations for a given expression.

Examples

```r
# This will use ~.5 seconds of real time, but very little process time.
bench_time(Sys.sleep(.5))
```

---

### hires_time

*Return the current high-resolution real time.*

Description
Time is expressed as seconds since some arbitrary time in the past; it is not correlated in any way to the time of day, and thus is not subject to resetting or drifting. The hi-res timer is ideally suited to performance measurement tasks, where cheap, accurate interval timing is required.

Usage
`hires_time()`

Examples

```r
hires_time()
```

# R rounds doubles to 7 digits by default, see greater precision by setting # the digits argument when printing
print(hires_time(), digits = 20)

# Generally used by recording two times and then subtracting them
start <- hires_time()
end <- hires_time()
elapsed <- end - start
elapsed
knit_print.bench_mark Custom printing function for bench_mark objects in knitr documents

Description

By default data columns ('result', 'memory', 'time', 'gc') are omitted when printing in knitr. If you would like to include these columns set the knitr chunk option 'bench.all_columns = TRUE'.

Usage

knit_print.bench_mark(x, ..., options)

Arguments

x An R object to be printed

... Additional arguments passed to the S3 method. Currently ignored, except two optional arguments options and inline; see the references below.

options A list of knitr chunk options set in the currently evaluated chunk.

Details

You can set bench.all_columns = TRUE to show all columns of the bench mark object.

```
```
```r
bench::mark(
  subset(mtcars, cyl == 3),
  mtcars[mtcars$ cyl == 3, ]
```

mark Benchmark a series of functions

Description

Benchmark a list of quoted expressions. Each expression will always run at least twice, once to measure the memory allocation and store results and one or more times to measure timing.
Usage

mark(  
  ...,  
  min_time = 0.5,  
  iterations = NULL,  
  min_iterations = 1,  
  max_iterations = 10000,  
  check = TRUE,  
  memory = capabilities("profmem"),  
  filter_gc = TRUE,  
  relative = FALSE,  
  time_unit = NULL,  
  exprs = NULL,  
  env = parent.frame()  
)

Arguments

... Expressions to benchmark, if named the expression column will be the name, otherwise it will be the deparsed expression.

min_time The minimum number of seconds to run each expression, set to Inf to always run max_iterations times instead.

iterations If not NULL, the default, run each expression for exactly this number of iterations. This overrides both min_iterations and max_iterations.

min_iterations Each expression will be evaluated a minimum of min_iterations times.

max_iterations Each expression will be evaluated a maximum of max_iterations times.

check Check if results are consistent. If TRUE, checking is done with all.equal(), if FALSE checking is disabled and results are not stored. If check is a function that function will be called with each pair of results to determine consistency.

memory If TRUE (the default when R is compiled with memory profiling), track memory allocations using. If FALSE disable memory tracking.

filter_gc If TRUE remove iterations that contained at least one garbage collection before summarizing. If TRUE but an expression had a garbage collection in every iteration, filtering is disabled, with a warning.

relative If TRUE all summaries are computed relative to the minimum execution time rather than absolute time.

time_unit If NULL the times are reported in a human readable fashion depending on each value. If one of 'ns', 'us', 'ms', 's', 'm', 'h', 'd', 'w' the time units are instead expressed as nanoseconds, microseconds, milliseconds, seconds, hours, minutes, days or weeks respectively.

exprs A list of quoted expressions. If supplied overrides expressions defined in ....

env The environment which to evaluate the expressions
Value

A tibble with the additional summary columns. The following summary columns are computed:

- **expression** - *bench_expr* The deparsed expression that was evaluated (or its name if one was provided).
- **min** - *bench_time* The minimum execution time.
- **median** - *bench_time* The sample median of execution time.
- **itr/sec** - double The estimated number of executions performed per second.
- **mem_alloc** - *bench_bytes* Total amount of memory allocated by R while running the expression. Memory allocated outside the R heap, e.g. by `malloc()` or `new` directly is *not* tracked, take care to avoid misinterpreting the results if running code that may do this.
- **gc/sec** - double The number of garbage collections per second.
- **n_itr** - integer Total number of iterations after filtering garbage collections (if `filter_gc` == TRUE).
- **n_gc** - double Total number of garbage collections performed over all iterations. This is a pseudo-measure of the pressure on the garbage collector, if it varies greatly between to alternatives generally the one with fewer collections will cause fewer allocation in real usage.
- **total_time** - *bench_time* The total time to perform the benchmarks.
- **result** - list A list column of the object(s) returned by the evaluated expression(s).
- **memory** - list A list column with results from `Rprofmem()`.
- **time** - list A list column of *bench_time* vectors for each evaluated expression.
- **gc** - list A list column with tibbles containing the level of garbage collection (0-2, columns) for each iteration (rows).

See Also

`press()` to run benchmarks across a grid of parameters.

Examples

dat <- data.frame(x = runif(100, 1, 1000), y=runif(10, 1, 1000))
mark(
  min_time = .1,
  dat[dat$x > 500, ],
  dat[which(dat$x > 500), ],
  subset(dat, x > 500))
Description

`press()` is used to run `bench::mark()` across a grid of parameters and then press the results together.

The parameters you want to set are given as named arguments and a grid of all possible combinations is automatically created.

The code to setup and benchmark is given by one unnamed expression (often delimited by `{`).

If replicates are desired a dummy variable can be used, e.g. `rep = 1:5` for replicates.

Usage

```r
press(..., .grid = NULL)
```

Arguments

... If named, parameters to define, if unnamed the expression to run. Only one unnamed expression is permitted.

.grid A pre-build grid of values to use, typically a data.frame or tibble. This is useful if you only want to use a subset of all possible combinations.

Examples

```r
# Helper function to create a simple data.frame of the specified dimensions
create_df <- function(rows, cols) {
  as.data.frame(setNames(
    replicate(cols, runif(rows, 1, 1000), simplify = FALSE),
    rep_len(c("x", letters), cols))
  )
}

# Run 4 data sizes across 3 samples with 2 replicates (24 total benchmarks)
press(
  rows = c(1000, 10000),
  cols = c(10, 100),
  rep = 1:2,
  {
    dat <- create_df(rows, cols)
    bench::mark(
      min_time = .05,
      bracket = dat[dat$x > 500, ],
      which = dat[which(dat$x > 500), ],
      subset = subset(dat, x > 500)
    )
  }
)
```
summary.bench_mark

Summary bench::mark results.

Description

Summarize bench::mark results.

Usage

## S3 method for class 'bench_mark'
summary(object, filter_gc = TRUE, relative = FALSE, time_unit = NULL, ...)

Arguments

object bench_mark object to summarize.
filter_gc If TRUE remove iterations that contained at least one garbage collection before summarizing. If TRUE but an expression had a garbage collection in every iteration, filtering is disabled, with a warning.
relative If TRUE all summaries are computed relative to the minimum execution time rather than absolute time.
time_unit If NULL the times are reported in a human readable fashion depending on each value. If one of 'ns', 'us', 'ms', 's', 'm', 'h', 'd', 'w' the time units are instead expressed as nanoseconds, microseconds, milliseconds, seconds, hours, minutes, days or weeks respectively.
...
Additional arguments ignored.

Details

If filter_gc == TRUE (the default) runs that contain a garbage collection will be removed before summarizing. This is most useful for fast expressions when the majority of runs do not contain a gc. Call summary(filter_gc = FALSE) if you would like to compute summaries with these times, such as expressions with lots of allocations when all or most runs contain a gc.

Value

A tibble with the additional summary columns. The following summary columns are computed

- expression - bench_expr: The deparsed expression that was evaluated (or its name if one was provided).
- min - bench_time: The minimum execution time.
- median - bench_time: The sample median of execution time.
- itr/sec - double: The estimated number of executions performed per second.
- mem_alloc - bench_bytes: Total amount of memory allocated by R while running the expression. Memory allocated outside the R heap, e.g. by malloc() or new directly is not tracked, take care to avoid misinterpreting the results if running code that may do this.
workout

- gc/sec - double The number of garbage collections per second.
- n_itr - integer Total number of iterations after filtering garbage collections (if filter_gc == TRUE).
- n_gc - double Total number of garbage collections performed over all iterations. This is a pseudo-measure of the pressure on the garbage collector, if it varies greatly between alternatives generally the one with fewer collections will cause fewer allocation in real usage.
- total_time - bench_time The total time to perform the benchmarks.
- result - list A list column of the object(s) returned by the evaluated expression(s).
- memory - list A list column with results from Rprofmem().
- time - list A list column of bench_time vectors for each evaluated expression.
- gc - list A list column with tibbles containing the level of garbage collection (0-2, columns) for each iteration (rows).

Examples

```r
dat <- data.frame(x = runif(10000, 1, 1000), y=runif(10000, 1, 1000))

# `bench::mark()` implicitly calls summary() automatically
results <- bench::mark(
  dat[dat$x > 500, ],
  dat[which(dat$x > 500), ],
  subset(dat, x > 500))

# However you can also do so explicitly to filter gc differently.
summary(results, filter_gc = FALSE)

# Or output relative times
summary(results, relative = TRUE)
```

Workout a group of expressions individually

Description

Given an block of expressions in {} workout() individually times each expression in the group. workout_expressions() is a lower level function most useful when reading lists of calls from a file.

Usage

```r
workout(expr, description = NULL)

workout_expressions(exprs, env = parent.frame(), description = NULL)
```
Arguments

- **expr**: one or more expressions to workout, use {} to pass multiple expressions.
- **description**: A name to label each expression, if not supplied the deparsed expression will be used.
- **exprs**: A list of calls to measure.
- **env**: The environment in which the expressions should be evaluated.

Examples

```
workout({
  x <- 1:1000
  evens <- x %% 2 == 0
  y <- x[evens]
  length(y)
  length(which(evens))
  sum(evens)
})
```

# The equivalent to the above, reading the code from a file
workout_expressions(as.list(parse(system.file("examples/exprs.R", package = "bench"))))
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