Package ‘bench’

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Author Jim Hester [aut],
Davis Vaughan [aut, cre],
Drew Schmidt [ctb] (read_proc_file implementation)
Maintainer Davis Vaughan <davis@rstudio.com>
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as_bench_time

Description
This is typically needed only if you are performing additional manipulations after calling \texttt{mark()}. 

Usage
\texttt{as_bench_time(x)}

Arguments
\begin{itemize}
\item \texttt{x} \hspace{0.5cm} Object to be coerced
\end{itemize}

as_bench_time  \hspace{1cm} \textit{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
\texttt{as_bench_time(x)}

Arguments
\begin{itemize}
\item \texttt{x} \hspace{0.5cm} A numeric or character vector. Character representations can use shorthand sizes (see examples).
\end{itemize}
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")))
```

### autoplot.bench_mark

**Autoplot method for bench_mark objects**

**Description**

Autoplot method for bench_mark objects

**Usage**

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

```r
## 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

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

`as_bench_bytes(x)`

`bench_bytes(x)`
bench_load_average

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_load_average Get system load averages

Description

Uses OS system APIs to return the load average for the past 1, 5 and 15 minutes.

Usage

bench_load_average()

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.
bench_process_memory

Value

A tibble with two columns

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

Examples

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

bench_process_memory

Retrieves 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

```r
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

# 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

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
eelapsed

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.
mark

**Details**

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

```r
```
```{r bench.all_columns = TRUE}
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**

```r
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 \texttt{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 \ldots.

time\_unit

The environment which to evaluate the expressions.

Value

A \texttt{tibble} with the additional summary columns. The following summary columns are computed

- \texttt{expression} - bench\_expr \ The deparsed expression that was evaluated (or its name if one was provided).
- \texttt{min} - bench\_time \ The minimum execution time.
- \texttt{median} - bench\_time \ The sample median of execution time.
- \texttt{itr/sec} - double \ The estimated number of executions performed per second.
- \texttt{mem\_alloc} - bench\_bytes \ Total amount of memory allocated by R while running the expression. Memory allocated outside the R heap, e.g. by \texttt{malloc()} or \texttt{new} directly is not tracked, take care to avoid misinterpreting the results if running code that may do this.
- \texttt{gc/sec} - double \ The number of garbage collections per second.
- \texttt{n_itr} - integer \ Total number of iterations after filtering garbage collections (if filter\_gc == TRUE).
- \texttt{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.
- \texttt{total\_time} - bench\_time \ The total time to perform the benchmarks.
- \texttt{result} - list \ A list column of the object(s) returned by the evaluated expression(s).
- \texttt{memory} - list \ A list column with results from \texttt{Rprofmem()}.
- \texttt{time} - list \ A list column with results from \texttt{bench\_time} vectors for each evaluated expression.
- \texttt{gc} - list \ A list column with tibbles containing the level of garbage collection (0-2, columns) for each iteration (rows).

See Also

\texttt{press()} to run benchmarks across a grid of parameters.
Examples

```r
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))
```

---

Run setup code and benchmarks across a grid of parameters

**Description**

`press()` is used to run `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**

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

**Arguments**

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

- `.grid` A pre-built grid of values to use, typically a `data.frame` or `tibble`. This is useful if you only want to benchmark 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)
  })
```
summary.bench_mark

```
bench::mark(
  min_time = 0.05,
  bracket = dat[dat$x > 500, ],
  which = dat[which(dat$x > 500), ],
  subset = subset(dat, x > 500)
)
```

---

**summary.bench_mark**  
*Summarize mark results.*

### Description

Summarize mark results.

### Usage

```r
## 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.
- **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).

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 | **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**

```r
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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