

Environments (compact)

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R environments

Environment basics

```
library(pryr)      # understand language at deeper level

e <- new.env()
parent.env(e)

## <environment: R_GlobalEnv>
e$a <- 5
e$b <- e$a

e$b

## [1] 5
e$a <- 7

e$b

## [1] 5
ls(globalenv())    # interactive ws; parent of globalenv is last env attached (library or require)

## [1] "e"
ls(e)

## [1] "a" "b"
ls(baseenv())      # where base functions live

## [1] "-"
## [2] "-.Date"
## [3] "-.POSIXt"
## [4] ":"
## [5] "::"
## [6] ":::"
## [7] "!"
## [8] "!.hexmode"
## [9] "!.octmode"
## [10] "!="
## [11] "("
## [12] "["
## [13] "[.AsIs"
## [14] "[.data.frame"
## [15] "[.Date"
## [16] "[.difftime"
```

```

## [17] "[.Dlist"
## [18] "[.DLLInfoList"
## [19] "[.factor"
## [20] "[.hexmode"
## [21] "[.listof"
## [22] "[.noquote"
## [23] "[.numeric_version"
## [24] "[.octmode"
## [25] "[.POSIXct"
## [26] "[.POSIXlt"
## [27] "[.simple.list"
## [28] "[.table"
## [29] "[.warnings"
## [30] "[["
## [31] "[[.data.frame"
## [32] "[[.Date"
## [33] "[[.factor"
## [34] "[[.numeric_version"
## [35] "[[.POSIXct"
## [36] "[[.POSIXlt"
## [37] "[[<-"
## [38] "[[<-.data.frame"
## [39] "[[<-.factor"
## [40] "[[<-.numeric_version"
## [41] "[[<-.POSIXlt"
## [42] "[<-"
## [43] "[<-.data.frame"
## [44] "[<-.Date"
## [45] "[<-.factor"
## [46] "[<-.numeric_version"
## [47] "[<-.POSIXct"
## [48] "[<-.POSIXlt"
## [49] "{"
## [50] "@"
## [51] "@<-"
## [52] "*"
## [53] ".*.difftime"
## [54] "/"
## [55] "/*.difftime"
## [56] "&"
## [57] "&.hexmode"
## [58] "&.octmode"
## [59] "&&"
## [60] "%*%"
## [61] "%/%"
## [62] "%%"
## [63] "%in%"
## [64] "%o%"
## [65] "%x%"
## [66] "^"
## [67] "+"
## [68] "+.Date"
## [69] "+.POSIXt"
## [70] "<"

```

```

## [71] "<-"
## [72] "<<-"
## [73] "<="
## [74] "="
## [75] "=="
## [76] ">"
## [77] ">="
## [78] "|"
## [79] "|.hexmode"
## [80] "|.octmode"
## [81] "||"
## [82] "~"
## [83] "$"
## [84] "$.DLLInfo"
## [85] "$.package_version"
## [86] "$<-"
## [87] "$<-.data.frame"
## [88] "abbreviate"
## [89] "abs"
## [90] "acos"
## [91] "acosh"
## [92] "addNA"
## [93] "addTaskCallback"
## [94] "agrep"
## [95] "agrep1"
## [96] "alist"
## [97] "all"
## [98] "all.equal"
## [99] "all.equal.character"
## [100] "all.equal.default"
## [101] "all.equal.environment"
## [102] "all.equal.envRefClass"
## [103] "all.equal.factor"
## [104] "all.equal.formula"
## [105] "all.equal.language"
## [106] "all.equal.list"
## [107] "all.equal.numeric"
## [108] "all.equal.POSIXt"
## [109] "all.equal.raw"
## [110] "all.names"
## [111] "all.vars"
## [112] "allowInterrupts"
## [113] "any"
## [114] "anyDuplicated"
## [115] "anyDuplicated.array"
## [116] "anyDuplicated.data.frame"
## [117] "anyDuplicated.default"
## [118] "anyDuplicated.matrix"
## [119] "anyNA"
## [120] "anyNA.numeric_version"
## [121] "anyNA.POSIXlt"
## [122] "aperm"
## [123] "aperm.default"
## [124] "aperm.table"

```

```

## [125] "append"
## [126] "apply"
## [127] "Arg"
## [128] "args"
## [129] "array"
## [130] "arrayInd"
## [131] "as.array"
## [132] "as.array.default"
## [133] "as.call"
## [134] "as.character"
## [135] "as.character.condition"
## [136] "as.character.Date"
## [137] "as.character.default"
## [138] "as.character.error"
## [139] "as.character.factor"
## [140] "as.character.hexmode"
## [141] "as.character.numeric_version"
## [142] "as.character.octmode"
## [143] "as.character.POSIXt"
## [144] "as.character.srcref"
## [145] "as.complex"
## [146] "as.data.frame"
## [147] "as.data.frame.array"
## [148] "as.data.frame.AsIs"
## [149] "as.data.frame.character"
## [150] "as.data.frame.complex"
## [151] "as.data.frame.data.frame"
## [152] "as.data.frame.Date"
## [153] "as.data.frame.default"
## [154] "as.data.frame.difftime"
## [155] "as.data.frame.factor"
## [156] "as.data.frame.integer"
## [157] "as.data.frame.list"
## [158] "as.data.frame.logical"
## [159] "as.data.frame.matrix"
## [160] "as.data.frame.model.matrix"
## [161] "as.data.frame.noquote"
## [162] "as.data.frame.numeric"
## [163] "as.data.frame.numeric_version"
## [164] "as.data.frame.ordered"
## [165] "as.data.frame.POSIXct"
## [166] "as.data.frame.POSIXlt"
## [167] "as.data.frame.raw"
## [168] "as.data.frame.table"
## [169] "as.data.frame.ts"
## [170] "as.data.frame.vector"
## [171] "as.Date"
## [172] "as.Date.character"
## [173] "as.Date.default"
## [174] "as.Date.factor"
## [175] "as.Date.numeric"
## [176] "as.Date.POSIXct"
## [177] "as.Date.POSIXlt"
## [178] "as.difftime"

```

```

## [179] "as.double"
## [180] "as.double.difftime"
## [181] "as.double.POSIXlt"
## [182] "as.environment"
## [183] "as.expression"
## [184] "as.expression.default"
## [185] "as.factor"
## [186] "as.function"
## [187] "as.function.default"
## [188] "as.hexmode"
## [189] "as.integer"
## [190] "as.list"
## [191] "as.list.data.frame"
## [192] "as.list.Date"
## [193] "as.list.default"
## [194] "as.list.environment"
## [195] "as.list.factor"
## [196] "as.list.function"
## [197] "as.list.numeric_version"
## [198] "as.list.POSIXct"
## [199] "as.list.POSIXlt"
## [200] "as.logical"
## [201] "as.logical.factor"
## [202] "as.matrix"
## [203] "as.matrix.data.frame"
## [204] "as.matrix.default"
## [205] "as.matrix.noquote"
## [206] "as.matrix.POSIXlt"
## [207] "as.name"
## [208] "as.null"
## [209] "as.null.default"
## [210] "as.numeric"
## [211] "as.numeric_version"
## [212] "as.octmode"
## [213] "as.ordered"
## [214] "as.package_version"
## [215] "as.pairlist"
## [216] "as.POSIXct"
## [217] "as.POSIXct.Date"
## [218] "as.POSIXct.default"
## [219] "as.POSIXct.numeric"
## [220] "as.POSIXct.POSIXlt"
## [221] "as.POSIXlt"
## [222] "as.POSIXlt.character"
## [223] "as.POSIXlt.Date"
## [224] "as.POSIXlt.default"
## [225] "as.POSIXlt.factor"
## [226] "as.POSIXlt.numeric"
## [227] "as.POSIXlt.POSIXct"
## [228] "as.qr"
## [229] "as.raw"
## [230] "as.single"
## [231] "as.single.default"
## [232] "as.symbol"

```

```

## [233] "as.table"
## [234] "as.table.default"
## [235] "as.vector"
## [236] "as.vector.factor"
## [237] "asin"
## [238] "asinh"
## [239] "asNamespace"
## [240] "asplit"
## [241] "asS3"
## [242] "asS4"
## [243] "assign"
## [244] "atan"
## [245] "atan2"
## [246] "atanh"
## [247] "attach"
## [248] "attachNamespace"
## [249] "attr"
## [250] "attr.all.equal"
## [251] "attr<-"
## [252] "attributes"
## [253] "attributes<-"
## [254] "autoload"
## [255] "autoloader"
## [256] "backsolve"
## [257] "baseenv"
## [258] "basename"
## [259] "besselI"
## [260] "besselJ"
## [261] "besselK"
## [262] "besselY"
## [263] "beta"
## [264] "bindingIsActive"
## [265] "bindingIsLocked"
## [266] "bindtextdomain"
## [267] "bitwAnd"
## [268] "bitwNot"
## [269] "bitwOr"
## [270] "bitwShiftL"
## [271] "bitwShiftR"
## [272] "bitwXor"
## [273] "body"
## [274] "body<-"
## [275] "bquote"
## [276] "break"
## [277] "browser"
## [278] "browserCondition"
## [279] "browserSetDebug"
## [280] "browserText"
## [281] "builtins"
## [282] "by"
## [283] "by.data.frame"
## [284] "by.default"
## [285] "bzfile"
## [286] "c"

```

```

## [287] "c.Date"
## [288] "c.difftime"
## [289] "c.noquote"
## [290] "c.numeric_version"
## [291] "c.POSIXct"
## [292] "c.POSIXlt"
## [293] "c.warnings"
## [294] "call"
## [295] "callCC"
## [296] "capabilities"
## [297] "casefold"
## [298] "cat"
## [299] "cbind"
## [300] "cbind.data.frame"
## [301] "ceiling"
## [302] "char.expand"
## [303] "character"
## [304] "charmatch"
## [305] "charToRaw"
## [306] "chartr"
## [307] "check_tzones"
## [308] "chkDots"
## [309] "chol"
## [310] "chol.default"
## [311] "chol2inv"
## [312] "choose"
## [313] "class"
## [314] "class<-"
## [315] "clearPushBack"
## [316] "close"
## [317] "close.connection"
## [318] "close.srcfile"
## [319] "close.srcfilealias"
## [320] "closeAllConnections"
## [321] "col"
## [322] "colMeans"
## [323] "colnames"
## [324] "colnames<-"
## [325] "colSums"
## [326] "commandArgs"
## [327] "comment"
## [328] "comment<-"
## [329] "complex"
## [330] "computeRestarts"
## [331] "conditionCall"
## [332] "conditionCall.condition"
## [333] "conditionMessage"
## [334] "conditionMessage.condition"
## [335] "conflictRules"
## [336] "conflicts"
## [337] "Conj"
## [338] "contributors"
## [339] "cos"
## [340] "cosh"

```

```

## [341] "cospi"
## [342] "crossprod"
## [343] "Cstack_info"
## [344] "cummax"
## [345] "cummin"
## [346] "cumprod"
## [347] "cumsum"
## [348] "curlGetHeaders"
## [349] "cut"
## [350] "cut.Date"
## [351] "cut.default"
## [352] "cut.POSIXt"
## [353] "data.class"
## [354] "data.frame"
## [355] "data.matrix"
## [356] "date"
## [357] "debug"
## [358] "debuggingState"
## [359] "debugonce"
## [360] "default.stringsAsFactors"
## [361] "delayedAssign"
## [362] "deparse"
## [363] "det"
## [364] "detach"
## [365] "determinant"
## [366] "determinant.matrix"
## [367] "dget"
## [368] "diag"
## [369] "diag<-"
## [370] "diff"
## [371] "diff.Date"
## [372] "diff.default"
## [373] "diff.difftime"
## [374] "diff.POSIXt"
## [375] "difftime"
## [376] "digamma"
## [377] "dim"
## [378] "dim.data.frame"
## [379] "dim<-"
## [380] "dimnames"
## [381] "dimnames.data.frame"
## [382] "dimnames<-"
## [383] "dimnames<-.data.frame"
## [384] "dir"
## [385] "dir.create"
## [386] "dir.exists"
## [387] "dirname"
## [388] "do.call"
## [389] "dontCheck"
## [390] "double"
## [391] "dput"
## [392] "dQuote"
## [393] "drop"
## [394] "droplevels"

```



```

## [395] "droplevels.data.frame"
## [396] "droplevels.factor"
## [397] "dump"
## [398] "duplicated"
## [399] "duplicated.array"
## [400] "duplicated.data.frame"
## [401] "duplicated.default"
## [402] "duplicated.matrix"
## [403] "duplicated.numeric_version"
## [404] "duplicated.POSIXlt"
## [405] "duplicated.warnings"
## [406] "dyn.load"
## [407] "dyn.unload"
## [408] "dynGet"
## [409] "eapply"
## [410] "eigen"
## [411] "emptyenv"
## [412] "enc2native"
## [413] "enc2utf8"
## [414] "encodeString"
## [415] "Encoding"
## [416] "Encoding<-"
## [417] "endsWith"
## [418] "enquote"
## [419] "env.profile"
## [420] "environment"
## [421] "environment<-"
## [422] "environmentIsLocked"
## [423] "environmentName"
## [424] "errorCondition"
## [425] "eval"
## [426] "eval.parent"
## [427] "evalq"
## [428] "exists"
## [429] "exp"
## [430] "expand.grid"
## [431] "expm1"
## [432] "expression"
## [433] "extSoftVersion"
## [434] "F"
## [435] "factor"
## [436] "factorial"
## [437] "fifo"
## [438] "file"
## [439] "file.access"
## [440] "file.append"
## [441] "file.choose"
## [442] "file.copy"
## [443] "file.create"
## [444] "file.exists"
## [445] "file.info"
## [446] "file.link"
## [447] "file.mode"
## [448] "file.mtime"

```

```

## [449] "file.path"
## [450] "file.remove"
## [451] "file.rename"
## [452] "file.show"
## [453] "file.size"
## [454] "file.symlink"
## [455] "Filter"
## [456] "Find"
## [457] "find.package"
## [458] "findInterval"
## [459] "findPackageEnv"
## [460] "findRestart"
## [461] "floor"
## [462] "flush"
## [463] "flush.connection"
## [464] "for"
## [465] "force"
## [466] "forceAndCall"
## [467] "formals"
## [468] "formals<-"
## [469] "format"
## [470] "format.AsIs"
## [471] "format.data.frame"
## [472] "format.Date"
## [473] "format.default"
## [474] "format.difftime"
## [475] "format.factor"
## [476] "format.hexmode"
## [477] "format.info"
## [478] "format.libraryIQR"
## [479] "format.numeric_version"
## [480] "format.octmode"
## [481] "format.packageInfo"
## [482] "format.POSIXct"
## [483] "format.POSIXlt"
## [484] "format.pval"
## [485] "format.summaryDefault"
## [486] "formatC"
## [487] "formatDL"
## [488] "forwardsolve"
## [489] "function"
## [490] "gamma"
## [491] "gc"
## [492] "gc.time"
## [493] "gcinfo"
## [494] "gctorture"
## [495] "gctorture2"
## [496] "get"
## [497] "get0"
## [498] "getAllConnections"
## [499] "getCallingDLL"
## [500] "getCallingDLLe"
## [501] "getConnection"
## [502] "getDLLRegisteredRoutines"

```

```

## [503] "getDLLRegisteredRoutines.character"
## [504] "getDLLRegisteredRoutines.DLLInfo"
## [505] "getElement"
## [506] "geterrmessage"
## [507] "getExportedValue"
## [508] "getHook"
## [509] "getLoadedDLLs"
## [510] "getNamespace"
## [511] "getNamespaceExports"
## [512] "getNamespaceImports"
## [513] "getNamespaceInfo"
## [514] "getNamespaceName"
## [515] "getNamespaceUsers"
## [516] "getNamespaceVersion"
## [517] "getNativeSymbolInfo"
## [518] "getOption"
## [519] "getRversion"
## [520] "getSrcLines"
## [521] "getTaskCallbackNames"
## [522] "gettext"
## [523] "gettextf"
## [524] "getwd"
## [525] "gl"
## [526] "globalenv"
## [527] "gregexpr"
## [528] "grep"
## [529] "grepl"
## [530] "grepRaw"
## [531] "grouping"
## [532] "gsub"
## [533] "gzcon"
## [534] "gzfile"
## [535] "I"
## [536] "iconv"
## [537] "iconvlist"
## [538] "icuGetCollate"
## [539] "icuSetCollate"
## [540] "identical"
## [541] "identity"
## [542] "if"
## [543] "ifelse"
## [544] "Im"
## [545] "importIntoEnv"
## [546] "inherits"
## [547] "integer"
## [548] "interaction"
## [549] "interactive"
## [550] "intersect"
## [551] "intToBits"
## [552] "intToUtf8"
## [553] "inverse.rle"
## [554] "invisible"
## [555] "invokeRestart"
## [556] "invokeRestartInteractively"

```

```
## [557] "is.array"
## [558] "is.atomic"
## [559] "is.call"
## [560] "is.character"
## [561] "is.complex"
## [562] "is.data.frame"
## [563] "is.double"
## [564] "is.element"
## [565] "is.environment"
## [566] "is.expression"
## [567] "is.factor"
## [568] "is.finite"
## [569] "is.function"
## [570] "is.infinite"
## [571] "is.integer"
## [572] "is.language"
## [573] "is.list"
## [574] "is.loaded"
## [575] "is.logical"
## [576] "is.matrix"
## [577] "is.na"
## [578] "is.na.data.frame"
## [579] "is.na.numeric_version"
## [580] "is.na.POSIXlt"
## [581] "is.na<-"
## [582] "is.na<-.default"
## [583] "is.na<-.factor"
## [584] "is.na<-.numeric_version"
## [585] "is.name"
## [586] "is.nan"
## [587] "is.null"
## [588] "is.numeric"
## [589] "is.numeric_version"
## [590] "is.numeric.Date"
## [591] "is.numeric.difftime"
## [592] "is.numeric.POSIXt"
## [593] "is.object"
## [594] "is.ordered"
## [595] "is.package_version"
## [596] "is.pairlist"
## [597] "is.primitive"
## [598] "is.qr"
## [599] "is.R"
## [600] "is.raw"
## [601] "is.recursive"
## [602] "is.single"
## [603] "is.symbol"
## [604] "is.table"
## [605] "is.unsorted"
## [606] "is.vector"
## [607] "isatty"
## [608] "isBaseNamespace"
## [609] "isdebugged"
## [610] "isFALSE"
```

```

## [611] "isIncomplete"
## [612] "isNamespace"
## [613] "isNamespaceLoaded"
## [614] "ISOdate"
## [615] "ISOdatetime"
## [616] "isOpen"
## [617] "isRestart"
## [618] "isS4"
## [619] "isSeekable"
## [620] "isSymmetric"
## [621] "isSymmetric.matrix"
## [622] "isTRUE"
## [623] "jitter"
## [624] "julian"
## [625] "julian.Date"
## [626] "julian.POSIXt"
## [627] "kappa"
## [628] "kappa.default"
## [629] "kappa.lm"
## [630] "kappa.qr"
## [631] "kronecker"
## [632] "l10n_info"
## [633] "La_library"
## [634] "La_version"
## [635] "La.svd"
## [636] "labels"
## [637] "labels.default"
## [638] "lapply"
## [639] "lazyLoad"
## [640] "lazyLoadDBexec"
## [641] "lazyLoadDBfetch"
## [642] "lbeta"
## [643] "lchoose"
## [644] "length"
## [645] "length.POSIXlt"
## [646] "length<-"
## [647] "length<-.Date"
## [648] "length<-.difftime"
## [649] "length<-.factor"
## [650] "length<-.POSIXct"
## [651] "length<-.POSIXlt"
## [652] "lengths"
## [653] "letters"
## [654] "LETTERS"
## [655] "levels"
## [656] "levels.default"
## [657] "levels<-"
## [658] "levels<-.factor"
## [659] "lfactorial"
## [660] "lgamma"
## [661] "libcurlVersion"
## [662] "library"
## [663] "library.dynam"
## [664] "library.dynam.unload"

```

```

## [665] "licence"
## [666] "license"
## [667] "list"
## [668] "list.dirs"
## [669] "list.files"
## [670] "list2env"
## [671] "load"
## [672] "loadedNamespaces"
## [673] "loadingNamespaceInfo"
## [674] "loadNamespace"
## [675] "local"
## [676] "lockBinding"
## [677] "lockEnvironment"
## [678] "log"
## [679] "log10"
## [680] "log1p"
## [681] "log2"
## [682] "logb"
## [683] "logical"
## [684] "lower.tri"
## [685] "ls"
## [686] "make.names"
## [687] "make.unique"
## [688] "makeActiveBinding"
## [689] "Map"
## [690] "mapply"
## [691] "margin.table"
## [692] "mat.or.vec"
## [693] "match"
## [694] "match.arg"
## [695] "match.call"
## [696] "match.fun"
## [697] "Math.data.frame"
## [698] "Math.Date"
## [699] "Math.difftime"
## [700] "Math.factor"
## [701] "Math.POSIXt"
## [702] "matrix"
## [703] "max"
## [704] "max.col"
## [705] "mean"
## [706] "mean.Date"
## [707] "mean.default"
## [708] "mean.difftime"
## [709] "mean.POSIXct"
## [710] "mean.POSIXlt"
## [711] "mem.limits"
## [712] "mem.maxNSize"
## [713] "mem.maxVSize"
## [714] "memCompress"
## [715] "memDecompress"
## [716] "memory.profile"
## [717] "merge"
## [718] "merge.data.frame"

```

```

## [719] "merge.default"
## [720] "message"
## [721] "mget"
## [722] "min"
## [723] "missing"
## [724] "Mod"
## [725] "mode"
## [726] "mode<-"
## [727] "month.abb"
## [728] "month.name"
## [729] "months"
## [730] "months.Date"
## [731] "months.POSIXt"
## [732] "mostattributes<-"
## [733] "names"
## [734] "names.POSIXlt"
## [735] "names<-"
## [736] "names<-.POSIXlt"
## [737] "namespaceExport"
## [738] "namespaceImport"
## [739] "namespaceImportClasses"
## [740] "namespaceImportFrom"
## [741] "namespaceImportMethods"
## [742] "nargs"
## [743] "nchar"
## [744] "ncol"
## [745] "NCOL"
## [746] "Negate"
## [747] "new.env"
## [748] "next"
## [749] "NextMethod"
## [750] "ngettext"
## [751] "nlevels"
## [752] "noquote"
## [753] "norm"
## [754] "normalizePath"
## [755] "nrow"
## [756] "NROW"
## [757] "nullfile"
## [758] "numeric"
## [759] "numeric_version"
## [760] "nzchar"
## [761] "objects"
## [762] "oldClass"
## [763] "oldClass<-"
## [764] "OlsonNames"
## [765] "on.exit"
## [766] "open"
## [767] "open.connection"
## [768] "open.srcfile"
## [769] "open.srcfilealias"
## [770] "open.srcfilecopy"
## [771] "Ops.data.frame"
## [772] "Ops.Date"

```

```

## [773] "Ops.difftime"
## [774] "Ops.factor"
## [775] "Ops.numeric_version"
## [776] "Ops.ordered"
## [777] "Ops.POSIXt"
## [778] "options"
## [779] "order"
## [780] "ordered"
## [781] "outer"
## [782] "package_version"
## [783] "packageEvent"
## [784] "packageHasNamespace"
## [785] "packageNotFoundError"
## [786] "packageStartupMessage"
## [787] "packBits"
## [788] "pairlist"
## [789] "parent.env"
## [790] "parent.env<-"
## [791] "parent.frame"
## [792] "parse"
## [793] "parseNamespaceFile"
## [794] "paste"
## [795] "paste0"
## [796] "path.expand"
## [797] "path.package"
## [798] "pcre_config"
## [799] "pi"
## [800] "pipe"
## [801] "pmatch"
## [802] "pmax"
## [803] "pmax.int"
## [804] "pmin"
## [805] "pmin.int"
## [806] "polyroot"
## [807] "pos.to.env"
## [808] "Position"
## [809] "pretty"
## [810] "pretty.default"
## [811] "prettyNum"
## [812] "print"
## [813] "print.AsIs"
## [814] "print.by"
## [815] "print.condition"
## [816] "print.connection"
## [817] "print.data.frame"
## [818] "print.Date"
## [819] "print.default"
## [820] "print.difftime"
## [821] "print.Dlist"
## [822] "print.DLLInfo"
## [823] "print.DLLInfoList"
## [824] "print.DLLRegisteredRoutines"
## [825] "print.eigen"
## [826] "print.factor"

```



```

## [827] "print.function"
## [828] "print.hexmode"
## [829] "print.libraryIQR"
## [830] "print.listof"
## [831] "print.NativeRoutineList"
## [832] "print.noquote"
## [833] "print.numeric_version"
## [834] "print.octmode"
## [835] "print.packageInfo"
## [836] "print.POSIXct"
## [837] "print.POSIXlt"
## [838] "print.proc_time"
## [839] "print.restart"
## [840] "print.rle"
## [841] "print.simple.list"
## [842] "print.srcfile"
## [843] "print.srcref"
## [844] "print.summary.table"
## [845] "print.summary.warnings"
## [846] "print.summaryDefault"
## [847] "print.table"
## [848] "print.warnings"
## [849] "prmatrix"
## [850] "proc.time"
## [851] "prod"
## [852] "prop.table"
## [853] "provideDimnames"
## [854] "psigamma"
## [855] "pushBack"
## [856] "pushBackLength"
## [857] "q"
## [858] "qr"
## [859] "qr.coef"
## [860] "qr.default"
## [861] "qr.fitted"
## [862] "qr.Q"
## [863] "qr.qty"
## [864] "qr.qy"
## [865] "qr.R"
## [866] "qr.resid"
## [867] "qr.solve"
## [868] "qr.X"
## [869] "quarters"
## [870] "quarters.Date"
## [871] "quarters.POSIXt"
## [872] "quit"
## [873] "quote"
## [874] "R_system_version"
## [875] "R.home"
## [876] "R.version"
## [877] "R.Version"
## [878] "R.version.string"
## [879] "range"
## [880] "range.default"

```

```

## [881] "rank"
## [882] "rapply"
## [883] "raw"
## [884] "rawConnection"
## [885] "rawConnectionValue"
## [886] "rawShift"
## [887] "rawToBits"
## [888] "rawToChar"
## [889] "rbind"
## [890] "rbind.data.frame"
## [891] "rcond"
## [892] "Re"
## [893] "read.dcf"
## [894] "readBin"
## [895] "readChar"
## [896] "readline"
## [897] "readLines"
## [898] "readRDS"
## [899] "readRenviron"
## [900] "Recall"
## [901] "Reduce"
## [902] "reg.finalizer"
## [903] "regexec"
## [904] "regexpr"
## [905] "registerS3method"
## [906] "registerS3methods"
## [907] "regmatches"
## [908] "regmatches<-"
## [909] "remove"
## [910] "removeTaskCallback"
## [911] "rep"
## [912] "rep_len"
## [913] "rep.Date"
## [914] "rep.factor"
## [915] "rep.int"
## [916] "rep.numeric_version"
## [917] "rep.POSIXct"
## [918] "rep.POSIXlt"
## [919] "repeat"
## [920] "replace"
## [921] "replicate"
## [922] "require"
## [923] "requireNamespace"
## [924] "restartDescription"
## [925] "restartFormals"
## [926] "retracemem"
## [927] "return"
## [928] "returnValue"
## [929] "rev"
## [930] "rev.default"
## [931] "rle"
## [932] "rm"
## [933] "RNGkind"
## [934] "RNGversion"

```

```

## [935] "round"
## [936] "round.Date"
## [937] "round.POSIXt"
## [938] "row"
## [939] "row.names"
## [940] "row.names.data.frame"
## [941] "row.names.default"
## [942] "row.names<-"
## [943] "row.names<-.data.frame"
## [944] "row.names<-.default"
## [945] "rowMeans"
## [946] "rownames"
## [947] "rownames<-"
## [948] "rowsum"
## [949] "rowsum.data.frame"
## [950] "rowsum.default"
## [951] "rowSums"
## [952] "sample"
## [953] "sample.int"
## [954] "sapply"
## [955] "save"
## [956] "save.image"
## [957] "saveRDS"
## [958] "scale"
## [959] "scale.default"
## [960] "scan"
## [961] "search"
## [962] "searchpaths"
## [963] "seek"
## [964] "seek.connection"
## [965] "seq"
## [966] "seq_along"
## [967] "seq_len"
## [968] "seq.Date"
## [969] "seq.default"
## [970] "seq.int"
## [971] "seq.POSIXt"
## [972] "sequence"
## [973] "serialize"
## [974] "set.seed"
## [975] "setdiff"
## [976] "setequal"
## [977] "setHook"
## [978] "setNamespaceInfo"
## [979] "setSessionTimeLimit"
## [980] "setTimeLimit"
## [981] "setwd"
## [982] "showConnections"
## [983] "shQuote"
## [984] "sign"
## [985] "signalCondition"
## [986] "signif"
## [987] "simpleCondition"
## [988] "simpleError"

```

```

## [989] "simpleMessage"
## [990] "simpleWarning"
## [991] "simplify2array"
## [992] "sin"
## [993] "single"
## [994] "sinh"
## [995] "sink"
## [996] "sink.number"
## [997] "sinpi"
## [998] "slice.index"
## [999] "socketConnection"
## [1000] "socketSelect"
## [1001] "solve"
## [1002] "solve.default"
## [1003] "solve.qr"
## [1004] "sort"
## [1005] "sort.default"
## [1006] "sort.int"
## [1007] "sort.list"
## [1008] "sort.POSIXlt"
## [1009] "source"
## [1010] "split"
## [1011] "split.data.frame"
## [1012] "split.Date"
## [1013] "split.default"
## [1014] "split.POSIXct"
## [1015] "split<-"
## [1016] "split<-.data.frame"
## [1017] "split<-.default"
## [1018] "sprintf"
## [1019] "sqrt"
## [1020] "sQuote"
## [1021] "srcfile"
## [1022] "srcfilealias"
## [1023] "srcfilecopy"
## [1024] "srcref"
## [1025] "standardGeneric"
## [1026] "startsWith"
## [1027] "stderr"
## [1028] "stdin"
## [1029] "stdout"
## [1030] "stop"
## [1031] "stopifnot"
## [1032] "storage.mode"
## [1033] "storage.mode<-"
## [1034] "str2expression"
## [1035] "str2lang"
## [1036] "strftime"
## [1037] "strptime"
## [1038] "strrep"
## [1039] "strsplit"
## [1040] "strtoi"
## [1041] "strtrim"
## [1042] "structure"

```

```

## [1043] "strwrap"
## [1044] "sub"
## [1045] "subset"
## [1046] "subset.data.frame"
## [1047] "subset.default"
## [1048] "subset.matrix"
## [1049] "substitute"
## [1050] "substr"
## [1051] "substr<-"
## [1052] "substring"
## [1053] "substring<-"
## [1054] "sum"
## [1055] "summary"
## [1056] "summary.connection"
## [1057] "summary.data.frame"
## [1058] "Summary.data.frame"
## [1059] "summary.Date"
## [1060] "Summary.Date"
## [1061] "summary.default"
## [1062] "Summary.difftime"
## [1063] "summary.factor"
## [1064] "Summary.factor"
## [1065] "summary.matrix"
## [1066] "Summary.numeric_version"
## [1067] "Summary.ordered"
## [1068] "summary.POSIXct"
## [1069] "Summary.POSIXct"
## [1070] "summary.POSIXlt"
## [1071] "Summary.POSIXlt"
## [1072] "summary.proc_time"
## [1073] "summary.srcfile"
## [1074] "summary.srcref"
## [1075] "summary.table"
## [1076] "summary.warnings"
## [1077] "suppressMessages"
## [1078] "suppressPackageStartupMessages"
## [1079] "suppressWarnings"
## [1080] "suspendInterrupts"
## [1081] "svd"
## [1082] "sweep"
## [1083] "switch"
## [1084] "sys.call"
## [1085] "sys.calls"
## [1086] "Sys.chmod"
## [1087] "Sys.Date"
## [1088] "sys.frame"
## [1089] "sys.frames"
## [1090] "sys.function"
## [1091] "Sys.getenv"
## [1092] "Sys.getlocale"
## [1093] "Sys.getpid"
## [1094] "Sys.glob"
## [1095] "Sys.info"
## [1096] "sys.load.image"

```

```
## [1097] "Sys.localeconv"
## [1098] "sys.nframe"
## [1099] "sys.on.exit"
## [1100] "sys.parent"
## [1101] "sys.parents"
## [1102] "Sys.readlink"
## [1103] "sys.save.image"
## [1104] "Sys.setenv"
## [1105] "Sys.setFileTime"
## [1106] "Sys.setlocale"
## [1107] "Sys.sleep"
## [1108] "sys.source"
## [1109] "sys.status"
## [1110] "Sys.time"
## [1111] "Sys.timezone"
## [1112] "Sys.umask"
## [1113] "Sys.unsetenv"
## [1114] "Sys.which"
## [1115] "system"
## [1116] "system.file"
## [1117] "system.time"
## [1118] "system2"
## [1119] "t"
## [1120] "T"
## [1121] "t.data.frame"
## [1122] "t.default"
## [1123] "table"
## [1124] "tabulate"
## [1125] "tan"
## [1126] "tanh"
## [1127] "tanpi"
## [1128] "tapply"
## [1129] "taskCallbackManager"
## [1130] "tcrossprod"
## [1131] "tempdir"
## [1132] "tempfile"
## [1133] "textConnection"
## [1134] "textConnectionValue"
## [1135] "tolower"
## [1136] "topenv"
## [1137] "toString"
## [1138] "toString.default"
## [1139] "toupper"
## [1140] "trace"
## [1141] "traceback"
## [1142] "tracemem"
## [1143] "tracingState"
## [1144] "transform"
## [1145] "transform.data.frame"
## [1146] "transform.default"
## [1147] "trigamma"
## [1148] "trimws"
## [1149] "trunc"
## [1150] "trunc.Date"
```

```

## [1151] "trunc.POSIXt"
## [1152] "truncate"
## [1153] "truncate.connection"
## [1154] "try"
## [1155] "tryCatch"
## [1156] "typeof"
## [1157] "unclass"
## [1158] "undebug"
## [1159] "union"
## [1160] "unique"
## [1161] "unique.array"
## [1162] "unique.data.frame"
## [1163] "unique.default"
## [1164] "unique.matrix"
## [1165] "unique.numeric_version"
## [1166] "unique.POSIXlt"
## [1167] "unique.warnings"
## [1168] "units"
## [1169] "units.difftime"
## [1170] "units<-"
## [1171] "units<- .difftime"
## [1172] "unix.time"
## [1173] "unlink"
## [1174] "unlist"
## [1175] "unloadNamespace"
## [1176] "unlockBinding"
## [1177] "unname"
## [1178] "unserialize"
## [1179] "unsplit"
## [1180] "untrace"
## [1181] "untracemem"
## [1182] "unz"
## [1183] "upper.tri"
## [1184] "url"
## [1185] "UseMethod"
## [1186] "utf8ToInt"
## [1187] "validEnc"
## [1188] "validUTF8"
## [1189] "vapply"
## [1190] "vector"
## [1191] "Vectorize"
## [1192] "version"
## [1193] "warning"
## [1194] "warningCondition"
## [1195] "warnings"
## [1196] "weekdays"
## [1197] "weekdays.Date"
## [1198] "weekdays.POSIXt"
## [1199] "which"
## [1200] "which.max"
## [1201] "which.min"
## [1202] "while"
## [1203] "with"
## [1204] "with.default"

```

```
## [1205] "withAutoprint"
## [1206] "withCallingHandlers"
## [1207] "within"
## [1208] "within.data.frame"
## [1209] "within.list"
## [1210] "withRestarts"
## [1211] "withVisible"
## [1212] "write"
## [1213] "write.dcf"
## [1214] "writeBin"
## [1215] "writeChar"
## [1216] "writeLines"
## [1217] "xor"
## [1218] "xpdrows.data.frame"
## [1219] "xtfrm"
## [1220] "xtfrm.AsIs"
## [1221] "xtfrm.Date"
## [1222] "xtfrm.default"
## [1223] "xtfrm.difftime"
## [1224] "xtfrm.factor"
## [1225] "xtfrm.numeric_version"
## [1226] "xtfrm.POSIXct"
## [1227] "xtfrm.POSIXlt"
## [1228] "xzfile"
## [1229] "zapsmall"
```

```
ls(emptyenv())      # ultimate ancestor
```

```
## character(0)
```

```
ls(environment())   # current env
```

```
## [1] "e"
```

```
search()
```

```
## [1] ".GlobalEnv"      "package:pryr"      "package:stats"
## [4] "package:graphics" "package:grDevices" "package:utils"
## [7] "package:datasets" "package:methods"   "Autoloads"
## [10] "package:base"
```

```
ls(as.environment("package:stats"))
```

```
## [1] "acf"                "acf2AR"            "add.scope"
## [4] "add1"               "addmargins"        "aggregate"
## [7] "aggregate.data.frame" "aggregate.ts"      "AIC"
## [10] "alias"              "anova"              "ansari.test"
## [13] "aov"                "approx"             "approxfun"
## [16] "ar"                 "ar.burg"            "ar.mle"
## [19] "ar.ols"             "ar.yw"              "arima"
## [22] "arima.sim"          "arima0"             "arima0.diag"
## [25] "ARMAacf"            "ARMAtoMA"           "as.dendrogram"
## [28] "as.dist"            "as.formula"         "as.hclust"
## [31] "as.stepfun"         "as.ts"              "asOneSidedFormula"
## [34] "ave"                "bandwidth.kernel"   "bartlett.test"
## [37] "BIC"                "binom.test"         "binomial"
## [40] "biplot"             "Box.test"           "bw.bcv"
```


## [43]	"bw.nrd"	"bw.nrd0"	"bw.SJ"
## [46]	"bw.ucv"	"C"	"cancor"
## [49]	"case.names"	"ccf"	"chisq.test"
## [52]	"cmdscale"	"coef"	"coefficients"
## [55]	"complete.cases"	"confint"	"confint.default"
## [58]	"confint.lm"	"constrOptim"	"contr.helmert"
## [61]	"contr.poly"	"contr.SAS"	"contr.sum"
## [64]	"contr.treatment"	"contrasts"	"contrasts<="
## [67]	"convolve"	"cooks.distance"	"cophenetic"
## [70]	"cor"	"cor.test"	"cov"
## [73]	"cov.wt"	"cov2cor"	"covratio"
## [76]	"cpgram"	"cutree"	"cycle"
## [79]	"D"	"dbeta"	"dbinom"
## [82]	"dcauchy"	"dchisq"	"decompose"
## [85]	"delete.response"	"deltat"	"dendrapplly"
## [88]	"density"	"density.default"	"deriv"
## [91]	"deriv3"	"deviance"	"dexp"
## [94]	"df"	"df.kernel"	"df.residual"
## [97]	"DF2formula"	"dfbeta"	"dfbetas"
## [100]	"dffits"	"dgamma"	"dgeom"
## [103]	"dhyper"	"diffinv"	"dist"
## [106]	"dlnorm"	"dlogis"	"dmultinom"
## [109]	"dnbinom"	"dnorm"	"dpois"
## [112]	"drop.scope"	"drop.terms"	"drop1"
## [115]	"dsignrank"	"dt"	"dummy.coef"
## [118]	"dummy.coef.lm"	"dunif"	"dweibull"
## [121]	"dwilcox"	"ecdf"	"eff.aovlist"
## [124]	"effects"	"embed"	"end"
## [127]	"estVar"	"expand.model.frame"	"extractAIC"
## [130]	"factanal"	"factor.scope"	"family"
## [133]	"fft"	"filter"	"fisher.test"
## [136]	"fitted"	"fitted.values"	"fivenum"
## [139]	"fligner.test"	"formula"	"frequency"
## [142]	"friedman.test"	"ftable"	"Gamma"
## [145]	"gaussian"	"get_all_vars"	"getCall"
## [148]	"getInitial"	"glm"	"glm.control"
## [151]	"glm.fit"	"hasTsp"	"hat"
## [154]	"hatvalues"	"hclust"	"heatmap"
## [157]	"HoltWinters"	"influence"	"influence.measures"
## [160]	"integrate"	"interaction.plot"	"inverse.gaussian"
## [163]	"IQR"	"is.empty.model"	"is.leaf"
## [166]	"is.mts"	"is.stepfun"	"is.ts"
## [169]	"is.tskernel"	"isoreg"	"KalmanForecast"
## [172]	"KalmanLike"	"KalmanRun"	"KalmanSmooth"
## [175]	"kernapply"	"kernel"	"kmeans"
## [178]	"knots"	"kruskal.test"	"ks.test"
## [181]	"ksmooth"	"lag"	"lag.plot"
## [184]	"line"	"lm"	"lm.fit"
## [187]	"lm.influence"	"lm.wfit"	"loadings"
## [190]	"loess"	"loess.control"	"loess.smooth"
## [193]	"logLik"	"loglin"	"lowess"
## [196]	"ls.diag"	"ls.print"	"lsfit"
## [199]	"mad"	"mahalanobis"	"make.link"
## [202]	"makeARIMA"	"makepredictcall"	"manova"

## [205]	"mantelhaen.test"	"mauchly.test"	"mcnemar.test"
## [208]	"median"	"median.default"	"medpolish"
## [211]	"model.extract"	"model.frame"	"model.frame.default"
## [214]	"model.matrix"	"model.matrix.default"	"model.matrix.lm"
## [217]	"model.offset"	"model.response"	"model.tables"
## [220]	"model.weights"	"monthplot"	"mood.test"
## [223]	"mvfft"	"na.action"	"na.contiguous"
## [226]	"na.exclude"	"na.fail"	"na.omit"
## [229]	"na.pass"	"napredict"	"naprint"
## [232]	"naresid"	"nextn"	"nlm"
## [235]	"nlminb"	"nls"	"nls.control"
## [238]	"NLSstAsymptotic"	"NLSstClosestX"	"NLSstLfAsymptote"
## [241]	"NLSstRtAsymptote"	"nobs"	"numericDeriv"
## [244]	"offset"	"oneway.test"	"optim"
## [247]	"optimHess"	"optimise"	"optimize"
## [250]	"order.dendrogram"	"p.adjust"	"p.adjust.methods"
## [253]	"pacf"	"pairwise.prop.test"	"pairwise.t.test"
## [256]	"pairwise.table"	"pairwise.wilcox.test"	"pbeta"
## [259]	"pbinom"	"pbirthday"	"pcauchy"
## [262]	"pchisq"	"pexp"	"pf"
## [265]	"pgamma"	"pgeom"	"phyper"
## [268]	"plclust"	"plnorm"	"plogis"
## [271]	"plot.ecdf"	"plot.spec.coherency"	"plot.spec.phase"
## [274]	"plot.stepfun"	"plot.ts"	"pnbinom"
## [277]	"pnorm"	"poisson"	"poisson.test"
## [280]	"poly"	"polym"	"power"
## [283]	"power.anova.test"	"power.prop.test"	"power.t.test"
## [286]	"PP.test"	"ppoints"	"ppois"
## [289]	"ppr"	"prcomp"	"predict"
## [292]	"predict.glm"	"predict.lm"	"preplot"
## [295]	"princomp"	"printCoefmat"	"profile"
## [298]	"proj"	"promax"	"prop.test"
## [301]	"prop.trend.test"	"psignrank"	"pt"
## [304]	"ptukey"	"punif"	"pweibull"
## [307]	"pwilcox"	"qbeta"	"qbinom"
## [310]	"qbirthday"	"qcauchy"	"qchisq"
## [313]	"qexp"	"qf"	"qgamma"
## [316]	"qgeom"	"qhyper"	"qlnorm"
## [319]	"qlogis"	"qnbinom"	"qnorm"
## [322]	"qpois"	"qqline"	"qqnorm"
## [325]	"qqplot"	"qsignrank"	"qt"
## [328]	"qtukey"	"quade.test"	"quantile"
## [331]	"quasi"	"quasibinomial"	"quasipoisson"
## [334]	"qunif"	"qweibull"	"qwilcox"
## [337]	"r2dtable"	"rbeta"	"rbinom"
## [340]	"rcauchy"	"rchisq"	"read.ftable"
## [343]	"rect.hclust"	"reformulate"	"relevel"
## [346]	"reorder"	"replications"	"reshape"
## [349]	"resid"	"residuals"	"residuals.glm"
## [352]	"residuals.lm"	"rexp"	"rf"
## [355]	"rgamma"	"rgeom"	"rhyper"
## [358]	"rlnorm"	"rlogis"	"rmultinom"
## [361]	"rnbinom"	"rnorm"	"rpois"
## [364]	"rsignrank"	"rstandard"	"rstudent"

## [367] "rt"	"runif"	"runmed"
## [370] "rweibull"	"rwilcox"	"rWishart"
## [373] "scatter.smooth"	"screeplot"	"sd"
## [376] "se.contrast"	"selfStart"	"setNames"
## [379] "shapiro.test"	"sigma"	"simulate"
## [382] "smooth"	"smooth.spline"	"smoothEnds"
## [385] "sortedXyData"	"spec.ar"	"spec.pgram"
## [388] "spec.taper"	"spectrum"	"spline"
## [391] "splinefun"	"splinefunH"	"SSasyp"
## [394] "SSasypOff"	"SSasypOrig"	"SSbiexp"
## [397] "SSD"	"SSfol"	"SSfpl"
## [400] "SSgompertz"	"SSlogis"	"SSmicmen"
## [403] "SSweibull"	"start"	"stat.anova"
## [406] "step"	"stepfun"	"stl"
## [409] "StructTS"	"summary.aov"	"summary.glm"
## [412] "summary.lm"	"summary.manova"	"summary.stepfun"
## [415] "supsmu"	"symnum"	"t.test"
## [418] "termplot"	"terms"	"terms.formula"
## [421] "time"	"toeplitz"	"ts"
## [424] "ts.intersect"	"ts.plot"	"ts.union"
## [427] "tsdiag"	"tsp"	"tsp<-"
## [430] "tsSmooth"	"TukeyHSD"	"uniroot"
## [433] "update"	"update.default"	"update.formula"
## [436] "var"	"var.test"	"variable.names"
## [439] "varimax"	"vcov"	"weighted.mean"
## [442] "weighted.residuals"	"weights"	"wilcox.test"
## [445] "window"	"window<-"	"write.ftable"
## [448] "xtabs"		

```
attach(e)    # attaches to search path
```

```
a
```

```
## [1] 7
```

```
a <- 8
```

```
e$a
```

```
## [1] 7
```

```
a
```

```
## [1] 8
```

```
get("a")
```

```
## [1] 8
```

```
get("a", envir = e)
```

```
## [1] 7
```

```
e$.hidden <- "hello from hidden"
```

```
ls(e)
```

```
## [1] "a" "b"
```

```
ls(e, all.names = TRUE)
```

```
## [1] ".hidden" "a"      "b"
```

```

e$.hidden

## [1] "hello from hidden"
ls.str(e, all.names = TRUE)

## .hidden : chr "hello from hidden"
## a : num 7
## b : num 5
e[[".hidden"]]

## [1] "hello from hidden"
# get(".hidden") # will not find (unless attached again!)

a

## [1] 8
rm(a, envir = e)
e$a

## NULL
a

## [1] 8
exists("a")

## [1] TRUE
exists("a", envir = e) # but is taken from global env

## [1] TRUE
exists("a", envir = e, inherits = FALSE)

## [1] FALSE
where("a")

## <environment: R_GlobalEnv>
df <- data.frame(c = "hello", d = "world")
?what

## No documentation for 'what' in specified packages and libraries:
## you could try '??what'
attach(df) # can be a data.frame, list, env, datafile
c

## [1] hello
## Levels: hello

```

Function environments

- The enclosing env determines how the function finds values.
- The binding env determines how we find the function.
- Every exported function in a package is bound into the package env but enclosed by the namespace env.

```

# TODO: how to switch working env (aka interactive workspace)?

f <- function(x) x + 1
environment(f)      # enclosing env (env where function was created - can be changed though...)

## <environment: R_GlobalEnv>

e$g <- function() y
environment(e$g)     # enclosing is globalenv! BUT binding env is e

## <environment: R_GlobalEnv>

e$y <- 8
y <- 7
e$g()

## [1] 7

environment(e$g) <- e # change enclosing env!
e$g()

## [1] 8

# REMEMBER:
# The enclosing env determines how the function finds values.
# The binding env determines how we find the function.
# Every exported function in a package is bound into the package env but
# enclosed by the namespace env.
environment(sd)      # enclosing env

## <environment: namespace:stats>

where("sd")          # binding env

## <environment: package:stats>
## attr("name")
## [1] "package:stats"
## attr("path")
## [1] "/Library/Frameworks/R.framework/Versions/3.6/Resources/library/stats"

ls(as.environment("package:stats"))

##      [1] "acf"                "acf2AR"                "add.scope"
##      [4] "add1"               "addmargins"            "aggregate"
##      [7] "aggregate.data.frame" "aggregate.ts"          "AIC"
##     [10] "alias"              "anova"                 "ansari.test"
##     [13] "aov"                "approx"                "approxfun"
##     [16] "ar"                 "ar.burg"               "ar.mle"
##     [19] "ar.ols"             "ar.yw"                 "arima"
##     [22] "arima.sim"          "arima0"                "arima0.diag"
##     [25] "ARMAacf"            "ARMAtoMA"              "as.dendrogram"
##     [28] "as.dist"            "as.formula"            "as.hclust"
##     [31] "as.stepfun"         "as.ts"                 "asOneSidedFormula"
##     [34] "ave"                "bandwidth.kernel"      "bartlett.test"
##     [37] "BIC"                "binom.test"            "binomial"
##     [40] "biplot"             "Box.test"              "bw.bcv"
##     [43] "bw.nrd"             "bw.nrd0"               "bw.SJ"

```

## [46]	"bw.ucv"	"C"	"cancor"
## [49]	"case.names"	"ccf"	"chisq.test"
## [52]	"cmdscale"	"coef"	"coefficients"
## [55]	"complete.cases"	"confint"	"confint.default"
## [58]	"confint.lm"	"constrOptim"	"contr.helmert"
## [61]	"contr.poly"	"contr.SAS"	"contr.sum"
## [64]	"contr.treatment"	"contrasts"	"contrasts<-"
## [67]	"convolve"	"cooks.distance"	"cophenetic"
## [70]	"cor"	"cor.test"	"cov"
## [73]	"cov.wt"	"cov2cor"	"covratio"
## [76]	"cpgram"	"cutree"	"cycle"
## [79]	"D"	"dbeta"	"dbinom"
## [82]	"dcauchy"	"dchisq"	"decompose"
## [85]	"delete.response"	"deltat"	"dendrapply"
## [88]	"density"	"density.default"	"deriv"
## [91]	"deriv3"	"deviance"	"dexp"
## [94]	"df"	"df.kernel"	"df.residual"
## [97]	"DF2formula"	"dfbeta"	"dfbetas"
## [100]	"dffits"	"dgamma"	"dgeom"
## [103]	"dhyper"	"diffinv"	"dist"
## [106]	"dlnorm"	"dlogis"	"dmultinom"
## [109]	"dnbinom"	"dnorm"	"dpois"
## [112]	"drop.scope"	"drop.terms"	"drop1"
## [115]	"dsignrank"	"dt"	"dummy.coef"
## [118]	"dummy.coef.lm"	"dunif"	"dweibull"
## [121]	"dwilcox"	"ecdf"	"eff.aovlist"
## [124]	"effects"	"embed"	"end"
## [127]	"estVar"	"expand.model.frame"	"extractAIC"
## [130]	"factanal"	"factor.scope"	"family"
## [133]	"fft"	"filter"	"fisher.test"
## [136]	"fitted"	"fitted.values"	"fivenum"
## [139]	"fligner.test"	"formula"	"frequency"
## [142]	"friedman.test"	"ftable"	"Gamma"
## [145]	"gaussian"	"get_all_vars"	"getCall"
## [148]	"getInitial"	"glm"	"glm.control"
## [151]	"glm.fit"	"hasTsp"	"hat"
## [154]	"hatvalues"	"hclust"	"heatmap"
## [157]	"HoltWinters"	"influence"	"influence.measures"
## [160]	"integrate"	"interaction.plot"	"inverse.gaussian"
## [163]	"IQR"	"is.empty.model"	"is.leaf"
## [166]	"is.mts"	"is.stepfun"	"is.ts"
## [169]	"is.tskernel"	"isoreg"	"KalmanForecast"
## [172]	"KalmanLike"	"KalmanRun"	"KalmanSmooth"
## [175]	"kernapply"	"kernel"	"kmeans"
## [178]	"knots"	"kruskal.test"	"ks.test"
## [181]	"ksmooth"	"lag"	"lag.plot"
## [184]	"line"	"lm"	"lm.fit"
## [187]	"lm.influence"	"lm.wfit"	"loadings"
## [190]	"loess"	"loess.control"	"loess.smooth"
## [193]	"logLik"	"loglin"	"lowess"
## [196]	"ls.diag"	"ls.print"	"lsfit"
## [199]	"mad"	"mahalanobis"	"make.link"
## [202]	"makeARIMA"	"makepredictcall"	"manova"
## [205]	"mantelhaen.test"	"mauchly.test"	"mcnemar.test"

## [208]	"median"	"median.default"	"medpolish"
## [211]	"model.extract"	"model.frame"	"model.frame.default"
## [214]	"model.matrix"	"model.matrix.default"	"model.matrix.lm"
## [217]	"model.offset"	"model.response"	"model.tables"
## [220]	"model.weights"	"monthplot"	"mood.test"
## [223]	"mvfft"	"na.action"	"na.contiguous"
## [226]	"na.exclude"	"na.fail"	"na.omit"
## [229]	"na.pass"	"napredict"	"naprint"
## [232]	"naresid"	"nextn"	"nlm"
## [235]	"nlminb"	"nls"	"nls.control"
## [238]	"NLSstAsymptotic"	"NLSstClosestX"	"NLSstLfAsymptote"
## [241]	"NLSstRtAsymptote"	"nobs"	"numericDeriv"
## [244]	"offset"	"oneway.test"	"optim"
## [247]	"optimHess"	"optimise"	"optimize"
## [250]	"order.dendrogram"	"p.adjust"	"p.adjust.methods"
## [253]	"pacf"	"pairwise.prop.test"	"pairwise.t.test"
## [256]	"pairwise.table"	"pairwise.wilcox.test"	"pbeta"
## [259]	"pbinom"	"pbirthday"	"pcauchy"
## [262]	"pchisq"	"pexp"	"pf"
## [265]	"pgamma"	"pgeom"	"phyper"
## [268]	"plclust"	"plnorm"	"plogis"
## [271]	"plot.ecdf"	"plot.spec.coherency"	"plot.spec.phase"
## [274]	"plot.stepfun"	"plot.ts"	"pnbinom"
## [277]	"pnorm"	"poisson"	"poisson.test"
## [280]	"poly"	"polym"	"power"
## [283]	"power.anova.test"	"power.prop.test"	"power.t.test"
## [286]	"PP.test"	"ppoints"	"ppois"
## [289]	"ppr"	"prcomp"	"predict"
## [292]	"predict.glm"	"predict.lm"	"preplot"
## [295]	"princomp"	"printCoefmat"	"profile"
## [298]	"proj"	"promax"	"prop.test"
## [301]	"prop.trend.test"	"psignrank"	"pt"
## [304]	"ptukey"	"punif"	"pweibull"
## [307]	"pwilcox"	"qbeta"	"qbinom"
## [310]	"qbirthday"	"qcauchy"	"qchisq"
## [313]	"qexp"	"qf"	"qgamma"
## [316]	"qgeom"	"qhyper"	"qlnorm"
## [319]	"qlogis"	"qnbinom"	"qnorm"
## [322]	"qpois"	"qqline"	"qqnorm"
## [325]	"qqplot"	"qsignrank"	"qt"
## [328]	"qtukey"	"quade.test"	"quantile"
## [331]	"quasi"	"quasibinomial"	"quasipoisson"
## [334]	"qunif"	"qweibull"	"qwilcox"
## [337]	"r2dtable"	"rbeta"	"rbinom"
## [340]	"rcauchy"	"rchisq"	"read.ftable"
## [343]	"rect.hclust"	"reformulate"	"relevel"
## [346]	"reorder"	"replications"	"reshape"
## [349]	"resid"	"residuals"	"residuals.glm"
## [352]	"residuals.lm"	"rexp"	"rf"
## [355]	"rgamma"	"rgeom"	"rhyper"
## [358]	"rlnorm"	"rlogis"	"rmultinom"
## [361]	"rnbinom"	"rnorm"	"rpois"
## [364]	"rsignrank"	"rstandard"	"rstudent"
## [367]	"rt"	"runif"	"runmed"

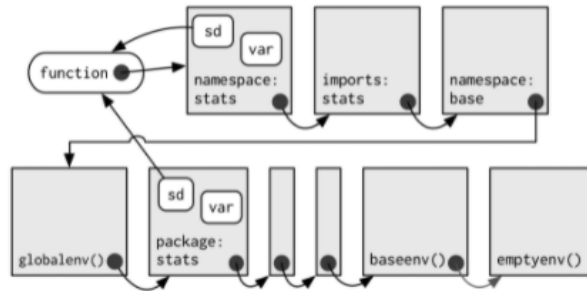


Figure 1: Namespace env

## [370] "rweibull"	"rwilcox"	"rWishart"
## [373] "scatter.smooth"	"screepplot"	"sd"
## [376] "se.contrast"	"selfStart"	"setNames"
## [379] "shapiro.test"	"sigma"	"simulate"
## [382] "smooth"	"smooth.spline"	"smoothEnds"
## [385] "sortedXyData"	"spec.ar"	"spec.pgram"
## [388] "spec.taper"	"spectrum"	"spline"
## [391] "splinefun"	"splinefunH"	"SSasymp"
## [394] "SSasympOff"	"SSasympOrig"	"SSbiexp"
## [397] "SSD"	"SSfol"	"SSfpl"
## [400] "SSgompertz"	"SSlogis"	"SSmicmen"
## [403] "SSweibull"	"start"	"stat.anova"
## [406] "step"	"stepfun"	"stl"
## [409] "StructTS"	"summary.aov"	"summary.glm"
## [412] "summary.lm"	"summary.manova"	"summary.stepfun"
## [415] "supsmu"	"symnum"	"t.test"
## [418] "termplot"	"terms"	"terms.formula"
## [421] "time"	"toeplitz"	"ts"
## [424] "ts.intersect"	"ts.plot"	"ts.union"
## [427] "tsdiag"	"tsp"	"tsp<="
## [430] "tsSmooth"	"TukeyHSD"	"uniroot"
## [433] "update"	"update.default"	"update.formula"
## [436] "var"	"var.test"	"variable.names"
## [439] "varimax"	"vcov"	"weighted.mean"
## [442] "weighted.residuals"	"weights"	"wilcox.test"
## [445] "window"	"window<="	"write.ftable"
## [448] "xtabs"		

So basically, the enclosing env is where a function finds its values (also other functions it calls)! Therefore the NAMESPACE can be created which simply defines an env which is then set to be the enclosing env of all functions within a package! That ensures, that we don't overwrite the behaviour of a function (f.ex. `stats::sd` calling `stats::var`): "Every exported function in a package is bound into the package environment, but enclosed by the namespace environment."

```
e$f <- function() {
  parent.frame()    # returns env where function was called! (unfortunate naming convention)
}

e$f()
```

```
## <environment: R_GlobalEnv>
```

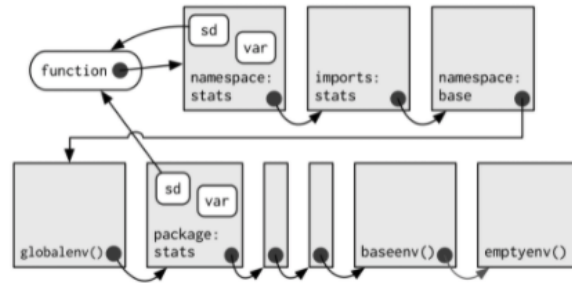



Figure 2: Package env

Looking up variables in the calling environment rather than in the enclosing environment is called **dynamic scoping**. However, R's regular scoping rules only use the enclosing environment for value lookup!

Binding names to values

```
"%<d-%"      # delayed binding: evaluates expression when needed

## [1] "%<d-%"
x %<a-% runif(1)  # active bindings: not bound to a constant object
x

## [1] 0.09486156
x

## [1] 0.7882817
```

Environments as data structures

Useful in their own rights since environments use **reference semantics**, i.e. when you modify an environment, it does not make a copy. You can use environments to track (package) states, pass values between functions... In the latter case, set `parent = emptyenv()` such that you don't accidentally inherit unwanted values!

- Avoiding copies of large data
- Managing state within a package
- Efficiently looking up values from names (hashmap)