

# Functions

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## Vectorised

```
df <- mtcars %>%  
  as_tibble(rownames = "car") %>%  
  mutate(across(c(am, gear, carb), as.factor))
```

```
colMeans(mtcars)
```

```
##      mpg      cyl    disp      hp      drat      wt      qsec  
## 20.090625  6.187500 230.721875 146.687500  3.596563  3.217250 17.848750  
##      vs      am      gear      carb  
##  0.437500  0.406250  3.687500  2.812500
```

```
rowSums(mtcars) # diff from rowsum***
```

```
##      Mazda RX4      Mazda RX4 Wag      Datsun 710      Hornet 4 Drive  
##      328.980      329.795      259.580      426.135  
##      Hornet Sportabout      Valiant      Duster 360      Merc 240D  
##      590.310      385.540      656.920      270.980  
##      Merc 230      Merc 280      Merc 280C      Merc 450SE  
##      299.570      350.460      349.660      510.740  
##      Merc 450SL      Merc 450SLC      Cadillac Fleetwood      Lincoln Continental  
##      511.500      509.850      728.560      726.644  
##      Chrysler Imperial      Fiat 128      Honda Civic      Toyota Corolla  
##      725.695      213.850      195.165      206.955  
##      Toyota Corona      Dodge Challenger      AMC Javelin      Camaro Z28  
##      273.775      519.650      506.085      646.280  
##      Pontiac Firebird      Fiat X1-9      Porsche 914-2      Lotus Europa  
##      631.175      208.215      272.570      273.683  
##      Ford Pantera L      Ferrari Dino      Maserati Bora      Volvo 142E  
##      670.690      379.590      694.710      288.890
```

```
cumsum(mtcars)
```

##	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
## Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
## Mazda RX4 Wag	42.0	12	320.0	220	7.80	5.495	33.48	0	2	8	8
## Datsun 710	64.8	16	428.0	313	11.65	7.815	52.09	1	3	12	9
## Hornet 4 Drive	86.2	22	686.0	423	14.73	11.030	71.53	2	3	15	10
## Hornet Sportabout	104.9	30	1046.0	598	17.88	14.470	88.55	2	3	18	12
## Valiant	123.0	36	1271.0	703	20.64	17.930	108.77	3	3	21	13
## Duster 360	137.3	44	1631.0	948	23.85	21.500	124.61	3	3	24	17
## Merc 240D	161.7	48	1777.7	1010	27.54	24.690	144.61	4	3	28	19
## Merc 230	184.5	52	1918.5	1105	31.46	27.840	167.51	5	3	32	21
## Merc 280	203.7	58	2086.1	1228	35.38	31.280	185.81	6	3	36	25
## Merc 280C	221.5	64	2253.7	1351	39.30	34.720	204.71	7	3	40	29
## Merc 450SE	237.9	72	2529.5	1531	42.37	38.790	222.11	7	3	43	32
## Merc 450SL	255.2	80	2805.3	1711	45.44	42.520	239.71	7	3	46	35
## Merc 450SLC	270.4	88	3081.1	1891	48.51	46.300	257.71	7	3	49	38
## Cadillac Fleetwood	280.8	96	3553.1	2096	51.44	51.550	275.69	7	3	52	42
## Lincoln Continental	291.2	104	4013.1	2311	54.44	56.974	293.51	7	3	55	46
## Chrysler Imperial	305.9	112	4453.1	2541	57.67	62.319	310.93	7	3	58	50
## Fiat 128	338.3	116	4531.8	2607	61.75	64.519	330.40	8	4	62	51
## Honda Civic	368.7	120	4607.5	2659	66.68	66.134	348.92	9	5	66	53
## Toyota Corolla	402.6	124	4678.6	2724	70.90	67.969	368.82	10	6	70	54
## Toyota Corona	424.1	128	4798.7	2821	74.60	70.434	388.83	11	6	73	55
## Dodge Challenger	439.6	136	5116.7	2971	77.36	73.954	405.70	11	6	76	57
## AMC Javelin	454.8	144	5420.7	3121	80.51	77.389	423.00	11	6	79	59
## Camaro Z28	468.1	152	5770.7	3366	84.24	81.229	438.41	11	6	82	63
## Pontiac Firebird	487.3	160	6170.7	3541	87.32	85.074	455.46	11	6	85	65
## Fiat X1-9	514.6	164	6249.7	3607	91.40	87.009	474.36	12	7	89	66
## Porsche 914-2	540.6	168	6370.0	3698	95.83	89.149	491.06	12	8	94	68
## Lotus Europa	571.0	172	6465.1	3811	99.60	90.662	507.96	13	9	99	70
## Ford Pantera L	586.8	180	6816.1	4075	103.82	93.832	522.46	13	10	104	74
## Ferrari Dino	606.5	186	6961.1	4250	107.44	96.602	537.96	13	11	109	80
## Maserati Bora	621.5	194	7262.1	4585	110.98	100.172	552.56	13	12	114	88
## Volvo 142E	642.9	198	7383.1	4694	115.09	102.952	571.16	14	13	118	90

```
cummax(mtcars)
```

```
##           mpg cyl  disp  hp  drat    wt  qsec vs  am  gear  carb
## Mazda RX4      21.0   6  160 110  3.90 2.620 16.46  0   1    4    4
## Mazda RX4 Wag  21.0   6  160 110  3.90 2.875 17.02  0   1    4    4
## Datsun 710     22.8   6  160 110  3.90 2.875 18.61  1   1    4    4
## Hornet 4 Drive  22.8   6  258 110  3.90 3.215 19.44  1   1    4    4
## Hornet Sportabout 22.8   8  360 175  3.90 3.440 19.44  1   1    4    4
## Valiant        22.8   8  360 175  3.90 3.460 20.22  1   1    4    4
## Duster 360     22.8   8  360 245  3.90 3.570 20.22  1   1    4    4
## Merc 240D      24.4   8  360 245  3.90 3.570 20.22  1   1    4    4
## Merc 230       24.4   8  360 245  3.92 3.570 22.90  1   1    4    4
## Merc 280       24.4   8  360 245  3.92 3.570 22.90  1   1    4    4
## Merc 280C      24.4   8  360 245  3.92 3.570 22.90  1   1    4    4
## Merc 450SE     24.4   8  360 245  3.92 4.070 22.90  1   1    4    4
## Merc 450SL     24.4   8  360 245  3.92 4.070 22.90  1   1    4    4
## Merc 450SLC    24.4   8  360 245  3.92 4.070 22.90  1   1    4    4
## Cadillac Fleetwood 24.4   8  472 245  3.92 5.250 22.90  1   1    4    4
## Lincoln Continental 24.4   8  472 245  3.92 5.424 22.90  1   1    4    4
## Chrysler Imperial 24.4   8  472 245  3.92 5.424 22.90  1   1    4    4
## Fiat 128       32.4   8  472 245  4.08 5.424 22.90  1   1    4    4
## Honda Civic     32.4   8  472 245  4.93 5.424 22.90  1   1    4    4
## Toyota Corolla  33.9   8  472 245  4.93 5.424 22.90  1   1    4    4
## Toyota Corona   33.9   8  472 245  4.93 5.424 22.90  1   1    4    4
## Dodge Challenger 33.9   8  472 245  4.93 5.424 22.90  1   1    4    4
## AMC Javelin     33.9   8  472 245  4.93 5.424 22.90  1   1    4    4
## Camaro Z28      33.9   8  472 245  4.93 5.424 22.90  1   1    4    4
## Pontiac Firebird 33.9   8  472 245  4.93 5.424 22.90  1   1    4    4
## Fiat X1-9       33.9   8  472 245  4.93 5.424 22.90  1   1    4    4
## Porsche 914-2   33.9   8  472 245  4.93 5.424 22.90  1   1    5    4
## Lotus Europa    33.9   8  472 245  4.93 5.424 22.90  1   1    5    4
## Ford Pantera L  33.9   8  472 264  4.93 5.424 22.90  1   1    5    4
## Ferrari Dino    33.9   8  472 264  4.93 5.424 22.90  1   1    5    6
## Maserati Bora   33.9   8  472 335  4.93 5.424 22.90  1   1    5    8
## Volvo 142E     33.9   8  472 335  4.93 5.424 22.90  1   1    5    8
```

```
pmin(mtcars$hp, 200) # compare to
```

```
## [1] 110 110  93 110 175 105 200  62  95 123 123 180 180 180 200 200 200  66  52
## [20]  65  97 150 150 200 175  66  91 113 200 175 200 109
```

```
apply(mtcars, 2, max)
```

```
##      mpg      cyl    disp      hp      drat      wt      qsec      vs      am      gear
## 33.900    8.000 472.000 335.000    4.930    5.424    22.900    1.000    1.000    5.000
##      carb
##    8.000
```

```
sapply(mtcars, mean)
```

```
##      mpg      cyl      disp      hp      drat      wt      qsec
## 20.090625  6.187500 230.721875 146.687500  3.596563  3.217250 17.848750
##      vs      am      gear      carb
##  0.437500  0.406250  3.687500  2.812500
```

```
lapply(mtcars, quantile, probs = c(.25, .5, .75))
```

```
## $mpg
##      25%      50%      75%
## 15.425 19.200 22.800
##
## $cyl
## 25% 50% 75%
##   4   6   8
##
## $disp
##      25%      50%      75%
## 120.825 196.300 326.000
##
## $hp
##      25%      50%      75%
##   96.5 123.0 180.0
##
## $drat
##      25%      50%      75%
##  3.080  3.695  3.920
##
## $wt
##      25%      50%      75%
##  2.58125  3.32500  3.61000
##
## $qsec
##      25%      50%      75%
## 16.8925 17.7100 18.9000
##
## $vs
## 25% 50% 75%
##   0   0   1
##
## $am
## 25% 50% 75%
##   0   0   1
##
## $gear
## 25% 50% 75%
##   3   4   4
##
## $carb
## 25% 50% 75%
##   2   2   4
```

```
lapply(df[, sapply(df, is.numeric)], summary)
```

```
## $mpg
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    10.40   15.43   19.20   20.09   22.80   33.90
##
## $cyl
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     4.000   4.000   6.000   6.188   8.000   8.000
##
## $disp
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     71.1   120.8   196.3   230.7   326.0   472.0
##
## $hp
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     52.0    96.5   123.0   146.7   180.0   335.0
##
## $drat
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     2.760   3.080   3.695   3.597   3.920   4.930
##
## $wt
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     1.513   2.581   3.325   3.217   3.610   5.424
##
## $qsec
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     14.50   16.89   17.71   17.85   18.90   22.90
##
## $vs
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     0.0000  0.0000  0.0000  0.4375  1.0000  1.0000
```

```
lapply(colnames(df), function(x) c(class(df[[x]]), x)) # lambda
```

```
## [[1]]
## [1] "character" "car"
##
## [[2]]
## [1] "numeric" "mpg"
##
## [[3]]
## [1] "numeric" "cyl"
##
## [[4]]
## [1] "numeric" "disp"
##
## [[5]]
## [1] "numeric" "hp"
##
## [[6]]
## [1] "numeric" "drat"
##
## [[7]]
## [1] "numeric" "wt"
##
## [[8]]
## [1] "numeric" "qsec"
##
## [[9]]
## [1] "numeric" "vs"
##
## [[10]]
## [1] "factor" "am"
##
## [[11]]
## [1] "factor" "gear"
##
## [[12]]
## [1] "factor" "carb"
```

```
sapply(mtcars, function(x) x * 2)
```

```
##      mpg cyl  disp  hp drat    wt  qsec vs  am gear carb
## [1,] 42.0  12 320.0 220 7.80  5.240 32.92  0  2    8    8
## [2,] 42.0  12 320.0 220 7.80  5.750 34.04  0  2    8    8
## [3,] 45.6   8 216.0 186 7.70  4.640 37.22  2  2    8    2
## [4,] 42.8  12 516.0 220 6.16  6.430 38.88  2  0    6    2
## [5,] 37.4  16 720.0 350 6.30  6.880 34.04  0  0    6    4
## [6,] 36.2  12 450.0 210 5.52  6.920 40.44  2  0    6    2
## [7,] 28.6  16 720.0 490 6.42  7.140 31.68  0  0    6    8
## [8,] 48.8   8 293.4 124 7.38  6.380 40.00  2  0    8    4
## [9,] 45.6   8 281.6 190 7.84  6.300 45.80  2  0    8    4
## [10,] 38.4  12 335.2 246 7.84  6.880 36.60  2  0    8    8
## [11,] 35.6  12 335.2 246 7.84  6.880 37.80  2  0    8    8
## [12,] 32.8  16 551.6 360 6.14  8.140 34.80  0  0    6    6
## [13,] 34.6  16 551.6 360 6.14  7.460 35.20  0  0    6    6
## [14,] 30.4  16 551.6 360 6.14  7.560 36.00  0  0    6    6
## [15,] 20.8  16 944.0 410 5.86 10.500 35.96  0  0    6    8
## [16,] 20.8  16 920.0 430 6.00 10.848 35.64  0  0    6    8
## [17,] 29.4  16 880.0 460 6.46 10.690 34.84  0  0    6    8
## [18,] 64.8   8 157.4 132 8.16  4.400 38.94  2  2    8    2
## [19,] 60.8   8 151.4 104 9.86  3.230 37.04  2  2    8    4
## [20,] 67.8   8 142.2 130 8.44  3.670 39.80  2  2    8    2
## [21,] 43.0   8 240.2 194 7.40  4.930 40.02  2  0    6    2
## [22,] 31.0  16 636.0 300 5.52  7.040 33.74  0  0    6    4
## [23,] 30.4  16 608.0 300 6.30  6.870 34.60  0  0    6    4
## [24,] 26.6  16 700.0 490 7.46  7.680 30.82  0  0    6    8
## [25,] 38.4  16 800.0 350 6.16  7.690 34.10  0  0    6    4
## [26,] 54.6   8 158.0 132 8.16  3.870 37.80  2  2    8    2
## [27,] 52.0   8 240.6 182 8.86  4.280 33.40  0  2   10    4
## [28,] 60.8   8 190.2 226 7.54  3.026 33.80  2  2   10    4
## [29,] 31.6  16 702.0 528 8.44  6.340 29.00  0  2   10    8
## [30,] 39.4  12 290.0 350 7.24  5.540 31.00  0  2   10   12
## [31,] 30.0  16 602.0 670 7.08  7.140 29.20  0  2   10   16
## [32,] 42.8   8 242.0 218 8.22  5.560 37.20  2  2    8    4
```

# Functionals

1. parameters, arguments, default, return.
2. variable scoping.
3. function factory.
4. meta programming.
5. "", NSE, ..., ~, .,
6. parallel processing.

```
map_dbl(mtcars, ~ length(unique(.x)))
```

```
##  mpg   cyl  disp    hp  drat    wt  qsec    vs  am  gear carb
##   25     3   27     22   22     29   30     2   2    3    6
```

```
reduce(mtcars$mpg, paste, sep = "|")
```

```
## [1] "21|21|22.8|21.4|18.7|18.1|14.3|24.4|22.8|19.2|17.8|16.4|17.3|15.2|10.4|10.4|14.7  
|32.4|30.4|33.9|21.5|15.5|15.2|13.3|19.2|27.3|26|30.4|15.8|19.7|15|21.4"
```

```
my_summarise <- function(df, grouping, col){  
  df %>%  
    group_by({{grouping}}) %>%  
    summarise("{{col}}_mean" := mean({{col}}))  
}  
  
mtcars %>%  
  my_summarise(am, mpg)
```

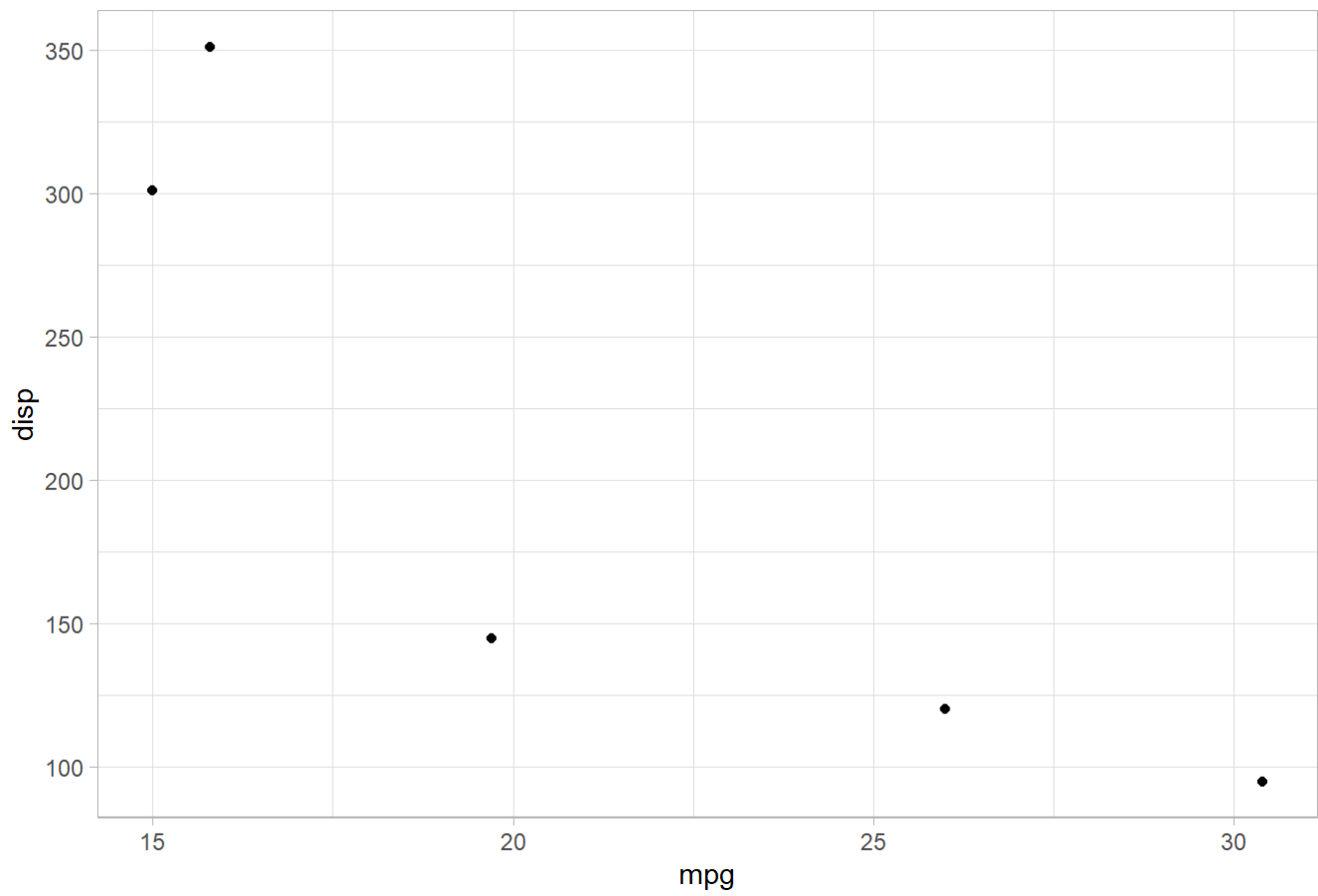
```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
## # A tibble: 2 x 2  
##       am mpg_mean  
##   <dbl>   <dbl>  
## 1     0    17.1  
## 2     1    24.4
```

```
myplot <- function(df, customer, xvar, yvar){  
  x_label = rlang::as_label(quo({{xvar}})) # {{get var}}, quotation, as_label are string  
s.  
  y_label = rlang::as_label(quo({{yvar}}))  
  df %>%  
    filter(gear == customer) %>%  
    ggplot(aes({{xvar}}, {{yvar}})) +  
    geom_point() +  
    labs(title = paste0(x_label, " vs ", y_label, " in ", customer)) +  
    theme_light()  
}  
  
myplot(mtcars, 5, mpg, disp)
```



mpg vs disp in 5



```
debugonce(myplot)
```

```
knitr::knit_exit()
```