

Functions

Writing your own functions

So far we've seen many functions, like `c()`, `class()`, `filter()`, `dim()` ...

Why create your own functions?

- Cut down on repetitive code (easier to fix things!)
- Organize code into manageable chunks
- Avoid running code unintentionally
- Use names that make sense to you

Writing your own functions

Here we will write a function that multiplies some number (x) by 2:

```
times_2 <- function(x) x * 2
```

When you run the line of code above, you make it ready to use (no output yet!).
Let's test it!

```
times_2(x = 10)
```

```
[1] 20
```

Writing your own functions: { }

Adding the curly brackets - {} - allows you to use functions spanning multiple lines:

```
times_2 <- function(x) {  
  x * 2  
}  
times_2(x = 10)
```

```
[1] 20
```

Writing your own functions: return

If we want something specific for the function's output, we use `return()`:

```
times_2 <- function(x) {  
  output <- x * 2  
  return(output)  
}  
times_2(x = 10)
```

```
[1] 20
```

Writing your own functions

Review: The syntax for a function is:

```
functionName <- function(inputs) {  
  <function body>  
  return(value)  
}
```

Writing your own functions: multiple inputs

Functions can take multiple inputs:

```
times_2_plus_y <- function(x, y) x * 2 + y  
times_2_plus_y(x = 10, y = 3)
```

```
[1] 23
```

Writing your own functions: defaults

Functions can have “default” arguments. This lets us use the function without using an argument later:

```
times_2_plus_y <- function(x = 10, y = 3) x * 2 + y  
times_2_plus_y()
```

```
[1] 23
```


Writing another simple function

Let's write a function, `sqdif`, that:

1. takes two numbers `x` and `y` with default values of 2 and 3.
2. takes the difference
3. squares this difference
4. then returns the final value

Writing another simple function

```
sqdif <- function(x = 2, y = 3) (x - y)^2
```

```
sqdif()
```

```
[1] 1
```

```
sqdif(x = 10, y = 5)
```

```
[1] 25
```

```
sqdif(10, 5)
```

```
[1] 25
```

Writing your own functions: characters

Functions can have any kind of input. Here is a function with characters:

```
loud <- function(word) {  
  output <- rep(toupper(word), 5)  
  return(output)  
}  
loud(word = "hooray!")
```

```
[1] "HOORAY!" "HOORAY!" "HOORAY!" "HOORAY!" "HOORAY!"
```

Functions for tibbles

We can use `filter(row_number()==n)` to extract a row of a tibble:

```
cars <- read_kaggle()
```

```
get_row <- function(dat, row) dat %>% filter(row_number() == row)
```

```
get_row(dat = cars, row = 10)
```

```
# A tibble: 1 × 10
```

| | RefId | IsBadBuy | PurchDate | Auction | VehYear | VehicleAge | Make | Model | Trim | SubModel |
|---|-------|----------|-----------|---------|---------|------------|-------|---------|-------|------------|
| | <dbl> | <dbl> | <chr> | <chr> | <dbl> | <dbl> | <chr> | <chr> | <chr> | <chr> |
| 1 | 10 | 0 | 12/7/2009 | ADESA | 2007 | 2 | FORD | FIVE... | SEL | 4D SEDA... |

Functions for tibbles

`select(n)` will choose column `n`:

```
get_index <- function(dat, row, col) {  
  dat %>%  
    filter(row_number() == row) %>%  
    select(col)  
}
```

```
get_index(dat = cars, row = 10, col = 8)
```

```
# A tibble: 1 × 1  
  Model  
  <chr>  
1 FIVE HUNDRED
```

Functions for tibbles

Including default values for arguments:

```
get_top <- function(dat, row = 1, col = 1) {  
  dat %>%  
    filter(row_number() == row) %>%  
    select(col)  
}
```

```
get_top(dat = cars)
```

```
# A tibble: 1 × 1  
  RefId  
  <dbl>  
1      1
```

Using your custom functions: **sapply()**

Now that you've made a function... You can “apply” functions easily with `sapply()`!

These functions take the form:

```
sapply(<a vector or list>, some_function)
```

Using your custom functions: **sapply()**

▯ There are no parentheses on the functions! ▯

```
sapply(cars, class)
```

| | |
|-----------------------------------|---------------------------------|
| RefId | IsBadBuy |
| "numeric" | "numeric" |
| PurchDate | Auction |
| "character" | "character" |
| VehYear | VehicleAge |
| "numeric" | "numeric" |
| Make | Model |
| "character" | "character" |
| Trim | SubModel |
| "character" | "character" |
| Color | Transmission |
| "character" | "character" |
| WheelTypeID | WheelType |
| "character" | "character" |
| VehOdo | Nationality |
| "numeric" | "character" |
| Size | TopThreeAmericanName |
| "character" | "character" |
| MMRAcquisitionAuctionAveragePrice | MMRAcquisitionAuctionCleanPrice |
| "character" | "character" |
| MMRAcquisitionRetailAveragePrice | MMRAcquisitonRetailCleanPrice |
| "character" | "character" |
| MMRCurrentAuctionAveragePrice | MMRCurrentAuctionCleanPrice |
| "character" | "character" |
| MMRCurrentRetailAveragePrice | MMRCurrentRetailCleanPrice |

Using your custom functions “on the fly” to iterate

```
supply(pull(cars, Veh0do), function(x) x / 1000)
```

| | | | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| [1] | 89.046 | 93.593 | 73.807 | 65.617 | 69.367 | 81.054 | 65.328 | 65.805 | 49.921 |
| [10] | 84.872 | 80.080 | 75.419 | 79.315 | 71.254 | 74.722 | 72.132 | 80.736 | 75.156 |
| [19] | 65.925 | 84.498 | 54.586 | 66.536 | 98.130 | 59.789 | 65.663 | 52.106 | 88.958 |
| [28] | 76.173 | 65.393 | 80.064 | 77.694 | 56.300 | 78.241 | 57.723 | 78.434 | 82.944 |
| [37] | 76.304 | 55.711 | 76.586 | 65.078 | 65.403 | 86.889 | 68.990 | 80.949 | 52.774 |
| [46] | 72.191 | 59.858 | 79.576 | 73.291 | 50.227 | 82.146 | 58.024 | 40.919 | 87.643 |
| [55] | 80.968 | 50.308 | 80.795 | 62.239 | 87.008 | 64.060 | 77.677 | 58.888 | 63.557 |
| [64] | 90.026 | 89.705 | 64.511 | 75.513 | 80.608 | 95.558 | 35.796 | 83.501 | 70.148 |
| [73] | 76.052 | 72.479 | 84.542 | 61.081 | 86.483 | 43.898 | 57.338 | 59.425 | 79.957 |
| [82] | 78.559 | 48.386 | 80.117 | 65.795 | 51.145 | 88.366 | 55.909 | 86.702 | 81.424 |
| [91] | 65.379 | 74.954 | 49.328 | 73.810 | 43.412 | 78.412 | 74.026 | 64.822 | 80.491 |
| [100] | 85.003 | 65.711 | 56.064 | 62.230 | 62.190 | 67.426 | 75.806 | 88.991 | 89.849 |
| [109] | 81.338 | 80.077 | 77.233 | 66.681 | 82.526 | 81.930 | 74.131 | 72.417 | 64.118 |
| [118] | 71.423 | 64.650 | 85.388 | 95.443 | 69.337 | 46.563 | 84.905 | 71.062 | 80.999 |
| [127] | 66.545 | 67.785 | 71.952 | 70.741 | 94.318 | 69.440 | 54.268 | 59.072 | 86.028 |
| [136] | 64.677 | 68.874 | 64.554 | 73.988 | 23.881 | 50.532 | 60.554 | 91.558 | 63.377 |
| [145] | 59.391 | 44.367 | 44.515 | 83.238 | 92.532 | 68.165 | 87.775 | 86.414 | 36.142 |
| [154] | 80.788 | 93.346 | 73.963 | 68.183 | 64.839 | 75.484 | 59.287 | 63.151 | 46.695 |
| [163] | 58.897 | 65.363 | 75.237 | 85.042 | 87.701 | 92.816 | 97.221 | 73.726 | 47.550 |
| [172] | 63.079 | 64.064 | 88.027 | 82.164 | 84.763 | 52.113 | 49.893 | 92.782 | 46.001 |
| [181] | 62.990 | 78.992 | 64.458 | 60.522 | 73.725 | 71.214 | 60.530 | 66.695 | 89.030 |
| [190] | 36.425 | 58.823 | 72.592 | 79.015 | 88.667 | 58.499 | 95.025 | 50.644 | 88.832 |
| [199] | 68.040 | 58.384 | 79.284 | 80.906 | 94.011 | 86.875 | 61.319 | 79.333 | 92.897 |
| [208] | 59.801 | 75.108 | 67.696 | 50.385 | 58.450 | 75.070 | 73.870 | 43.535 | 55.683 |
| [217] | 58.681 | 62.795 | 77.178 | 69.430 | 86.466 | 69.480 | 86.344 | 79.030 | 94.506 |
| [226] | 77.786 | 67.430 | 73.409 | 60.201 | 49.296 | 61.315 | 84.454 | 85.262 | 72.993 |
| [235] | 89.769 | 68.550 | 62.955 | 75.101 | 88.173 | 52.791 | 85.334 | 69.030 | 64.555 |
| [244] | 66.433 | 77.050 | 84.388 | 52.866 | 45.680 | 63.496 | 78.593 | 93.395 | 53.463 |

Using your custom functions: `sapply()`.

```
cars_dbl <- cars %>% select(Make, Model, where(is.double))

Odo_updated <- sapply(pull(cars_dbl, VehOdo), times_2_plus_y)

cars_dbl %>%
  mutate(Odo_2_y = Odo_updated) %>%
  select(c(1:2, 7:13))
```

```
# A tibble: 72,983 × 9
```

| | Make | Model | VehOdo | BYRNO | VNZIP1 | VehBCost | IsOnlineSale | WarrantyCost | Odo_2_y |
|----|------------|---------|--------|-------|--------|----------|--------------|--------------|---------|
| | <chr> | <chr> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> |
| 1 | MAZDA | MAZD... | 89046 | 21973 | 33619 | 7100 | 0 | 1113 | 178095 |
| 2 | DODGE | 1500... | 93593 | 19638 | 33619 | 7600 | 0 | 1053 | 187189 |
| 3 | DODGE | STRA... | 73807 | 19638 | 33619 | 4900 | 0 | 1389 | 147617 |
| 4 | DODGE | NEON | 65617 | 19638 | 33619 | 4100 | 0 | 630 | 131237 |
| 5 | FORD | FOCUS | 69367 | 19638 | 33619 | 4000 | 0 | 1020 | 138737 |
| 6 | MITSUBI... | GALA... | 81054 | 19638 | 33619 | 5600 | 0 | 594 | 162111 |
| 7 | KIA | SPEC... | 65328 | 19638 | 33619 | 4200 | 0 | 533 | 130659 |
| 8 | FORD | TAUR... | 65805 | 19638 | 33619 | 4500 | 0 | 825 | 131613 |
| 9 | KIA | SPEC... | 49921 | 21973 | 33619 | 5600 | 0 | 482 | 99845 |
| 10 | FORD | FIVE... | 84872 | 21973 | 33619 | 7700 | 0 | 1633 | 169747 |

```
# ... with 72,973 more rows
```

Applying functions with **across** from **dplyr**

`across()` makes it easy to apply the same transformation to multiple columns, allowing you to use `select()` semantics inside functions like `summarize()` and `mutate()`.

```
across( .cols = <columns>, .fns = function, ... )
```

- List columns first: `.cols =`
- List function next: `.fns =`
- Then list any arguments for the function

Applying functions with **across** from **dplyr**.

Combining with `summarize()`:

```
cars_dbl %>%
  group_by(Make) %>%
  summarize(across(.cols = everything(), .fns = mean))
```

A tibble: 33 × 12

| | Make | Model | RefId | IsBadBuy | VehYear | VehicleAge | VehOdo | BYRNO | VNZIP1 | VehBCost |
|----|----------|-------|--------|----------|---------|------------|--------|--------|--------|----------|
| | <chr> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> |
| 1 | ACURA | NA | 36021. | 0.273 | 2003. | 6.52 | 81732. | 21851. | 61217. | 9039. |
| 2 | BUICK | NA | 35431. | 0.157 | 2004. | 5.65 | 76238. | 19755. | 51298. | 6169. |
| 3 | CADIL... | NA | 34173. | 0.152 | 2004. | 5.24 | 73770. | 20383. | 50775. | 10958. |
| 4 | CHEVR... | NA | 35417. | 0.0975 | 2006. | 3.97 | 73390. | 26912. | 58874. | 6835. |
| 5 | CHRY... | NA | 37614. | 0.129 | 2006. | 3.65 | 66814. | 31268. | 58562. | 6507. |
| 6 | DODGE | NA | 36851. | 0.103 | 2006. | 3.75 | 68261. | 36094. | 58788. | 7047. |
| 7 | FORD | NA | 36866. | 0.154 | 2005. | 4.75 | 76749. | 19887. | 59427. | 6403. |
| 8 | GMC | NA | 35245. | 0.116 | 2004. | 5.61 | 79273. | 18802. | 58113. | 8342. |
| 9 | HONDA | NA | 35109. | 0.109 | 2004. | 5.33 | 77877. | 24161. | 52659. | 8350. |
| 10 | HUMMER | NA | 19533 | 0 | 2006 | 3 | 70809 | 21053 | 95673 | 11920 |

... with 23 more rows, and 2 more variables: IsOnlineSale <dbl>,
WarrantyCost <dbl>

Applying functions with **across** from **dp1yr**.

Adding arguments to the function (`quantile()`) at the end:

```
cars_dbl %>%
  group_by(Make) %>%
  summarize(across(.cols = where(is.double), .fns = quantile, probs = 0.95))
```

A tibble: 33 × 11

| | Make | RefId | IsBadBuy | VehYear | VehicleAge | Veh0do | BYRNO | VNZIP1 | VehBCost |
|----|-----------|--------|----------|---------|------------|--------|--------|--------|----------|
| | <chr> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> |
| 1 | ACURA | 67522. | 1 | 2005 | 8 | 93338. | 36099. | 92807 | 12093 |
| 2 | BUICK | 67803. | 1 | 2007 | 8.05 | 95049. | 52117 | 92337 | 8345. |
| 3 | CADILLAC | 68611. | 1 | 2006 | 7 | 87267. | 34482. | 85115. | 11094 |
| 4 | CHEVROLET | 68895. | 1 | 2008 | 7 | 92505 | 99750 | 94544 | 9170 |
| 5 | CHRYSLER | 69029. | 1 | 2008 | 7 | 89784. | 99761 | 92504 | 9280 |
| 6 | DODGE | 68446. | 1 | 2008 | 7 | 91557. | 99761 | 92504 | 10265 |
| 7 | FORD | 69731. | 1 | 2007 | 8 | 95213. | 52117 | 92807 | 9834 |
| 8 | GMC | 69012. | 1 | 2006 | 8 | 94470 | 25100 | 92504 | 10912 |
| 9 | HONDA | 69827 | 1 | 2007 | 8 | 93811 | 99740 | 92504 | 10440 |
| 10 | HUMMER | 19533 | 0 | 2006 | 3 | 70809 | 21053 | 95673 | 11920 |

... with 23 more rows, and 2 more variables: IsOnlineSale <dbl>,
WarrantyCost <dbl>

Applying functions with **across** from **dplyr**.

Using different `tidyselect()` options:

```
cars_dbl %>%  
  group_by(Make) %>%  
  summarize(across(.cols = starts_with("Veh"), .fns = mean))
```

A tibble: 33 × 5

| | Make | VehYear | VehicleAge | Veh0do | VehBCost |
|----|-----------|---------|------------|--------|----------|
| | <chr> | <dbl> | <dbl> | <dbl> | <dbl> |
| 1 | ACURA | 2003. | 6.52 | 81732. | 9039. |
| 2 | BUICK | 2004. | 5.65 | 76238. | 6169. |
| 3 | CADILLAC | 2004. | 5.24 | 73770. | 10958. |
| 4 | CHEVROLET | 2006. | 3.97 | 73390. | 6835. |
| 5 | CHRYSLER | 2006. | 3.65 | 66814. | 6507. |
| 6 | DODGE | 2006. | 3.75 | 68261. | 7047. |
| 7 | FORD | 2005. | 4.75 | 76749. | 6403. |
| 8 | GMC | 2004. | 5.61 | 79273. | 8342. |
| 9 | HONDA | 2004. | 5.33 | 77877. | 8350. |
| 10 | HUMMER | 2006 | 3 | 70809 | 11920 |

... with 23 more rows

Applying functions with **across** from **dp1yr**.

Combining with `mutate()`:

```
cars_dbl %>%  
  mutate(across(.cols = starts_with("Veh"), .fns = round, digits = -3))  
  
# A tibble: 72,983 × 12  
  Make      Model RefId IsBadBuy VehYear VehicleAge VehOdo BYRNO VNZIP1 VehBCost  
  <chr>    <chr> <dbl>   <dbl>   <dbl>      <dbl>   <dbl> <dbl> <dbl>    <dbl>  
1 MAZDA    MAZD...   1       0    2000         0  89000 21973 33619    7000  
2 DODGE    1500...   2       0    2000         0  94000 19638 33619    8000  
3 DODGE    STRA...   3       0    2000         0  74000 19638 33619    5000  
4 DODGE    NEON      4       0    2000         0  66000 19638 33619    4000  
5 FORD     FOCUS     5       0    2000         0  69000 19638 33619    4000  
6 MITSUBI... GALA...   6       0    2000         0  81000 19638 33619    6000  
7 KIA      SPEC...   7       0    2000         0  65000 19638 33619    4000  
8 FORD     TAUR...   8       0    2000         0  66000 19638 33619    4000  
9 KIA      SPEC...   9       0    2000         0  50000 21973 33619    6000  
10 FORD    FIVE...  10       0    2000         0  85000 21973 33619    8000  
# ... with 72,973 more rows, and 2 more variables: IsOnlineSale <dbl>,  
#   WarrantyCost <dbl>
```

Applying functions with **across** from **dplyr**.

Combining with `mutate()`:

```
cars_dbl %>%
  mutate(across(
    .cols = everything(),
    .fns = str_replace_all,
    pattern = "A",
    replacement = "a"
  ))
```

A tibble: 72,983 × 12

| | Make | Model | RefId | IsBadBuy | VehYear | VehicleAge | VehOdo | BYRNO | VNZIP1 | VehBCost |
|----|------------|---------|-------|----------|---------|------------|--------|-------|--------|----------|
| | <chr> | <chr> | <chr> | <chr> | <chr> | <chr> | <chr> | <chr> | <chr> | <chr> |
| 1 | MaZDa | MaZD... | 1 | 0 | 2006 | 3 | 89046 | 21973 | 33619 | 7100 |
| 2 | DODGE | 1500... | 2 | 0 | 2004 | 5 | 93593 | 19638 | 33619 | 7600 |
| 3 | DODGE | STRa... | 3 | 0 | 2005 | 4 | 73807 | 19638 | 33619 | 4900 |
| 4 | DODGE | NEON | 4 | 0 | 2004 | 5 | 65617 | 19638 | 33619 | 4100 |
| 5 | FORD | FOCUS | 5 | 0 | 2005 | 4 | 69367 | 19638 | 33619 | 4000 |
| 6 | MITSUBI... | GaLa... | 6 | 0 | 2004 | 5 | 81054 | 19638 | 33619 | 5600 |
| 7 | KIa | SPEC... | 7 | 0 | 2004 | 5 | 65328 | 19638 | 33619 | 4200 |
| 8 | FORD | TaUR... | 8 | 0 | 2005 | 4 | 65805 | 19638 | 33619 | 4500 |
| 9 | KIa | SPEC... | 9 | 0 | 2007 | 2 | 49921 | 21973 | 33619 | 5600 |
| 10 | FORD | FIVE... | 10 | 0 | 2007 | 2 | 84872 | 21973 | 33619 | 7700 |

... with 72,973 more rows, and 2 more variables: IsOnlineSale <chr>,
WarrantyCost <chr>

Applying functions with **across** from **dplyr**.

Combining with `mutate()`:

```
# Child mortality data
```

```
mort <- read_mortality() %>% rename(country = `...1`)
```

```
mort %>%
```

```
  select(country, starts_with("194")) %>%
```

```
  mutate(across(
```

```
    .cols = c(`1943`, `1944`, `1945`),
```

```
    .fns = replace_na,
```

```
    replace = 0
```

```
  ))
```

```
# A tibble: 197 × 11
```

| | country | `1940` | `1941` | `1942` | `1943` | `1944` | `1945` | `1946` | `1947` | `1948` | `1949` |
|----|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | <chr> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> | <dbl> |
| 1 | Afghan... | NA | NA | NA | 0 | 0 | 0 | NA | NA | NA | NA |
| 2 | Albania | 1.53 | 1.31 | 1.48 | 1.46 | 1.43 | 1.40 | 1.37 | 1.41 | 1.37 | 1.34 |
| 3 | Algeria | NA | NA | NA | 0 | 0 | 0 | NA | NA | NA | NA |
| 4 | Angola | 4.46 | 4.46 | 4.46 | 4.34 | 4.34 | 4.34 | 4.33 | 4.22 | 4.22 | 4.21 |
| 5 | Argent... | 0.641 | 0.603 | 0.602 | 0.558 | 0.551 | 0.510 | 0.503 | 0.496 | 0.494 | 0.492 |
| 6 | Armenia | NA | NA | NA | 0 | 0 | 0 | NA | NA | NA | NA |
| 7 | Aruba | NA | NA | NA | 0 | 0 | 0 | NA | NA | NA | NA |
| 8 | Austra... | 0.263 | 0.275 | 0.276 | 0.299 | 0.260 | 0.271 | 0.295 | 0.279 | 0.271 | 0.271 |
| 9 | Austria | 0.504 | 0.474 | 0.417 | 0.389 | 0.360 | 0.311 | 0.311 | 0.312 | 0.274 | 0.274 |
| 10 | Azerba... | NA | NA | NA | 0 | 0 | 0 | NA | NA | NA | NA |

```
# ... with 187 more rows
```

Website

Website