An introduction to the R platform
Functions

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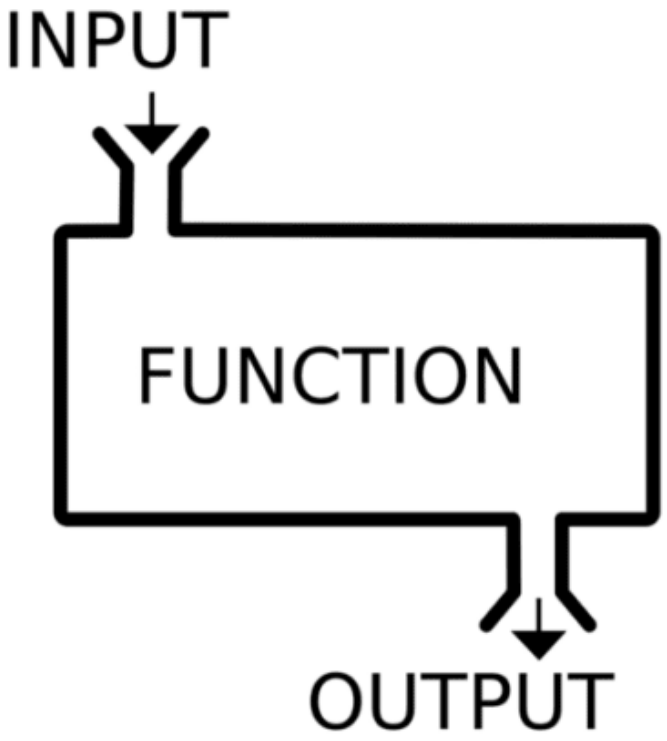
Outline

- What are functions?
- Why they are important
- When to use functions in R
- The power of writing your own
- What to do when you get stuck...

What is a function?



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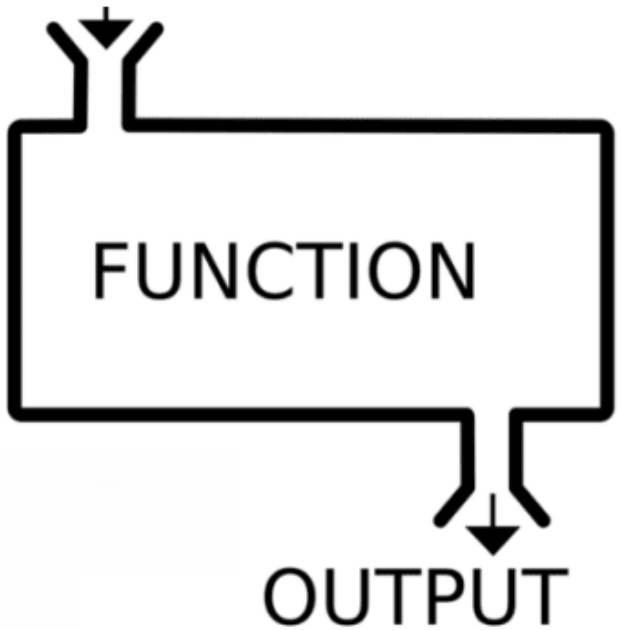

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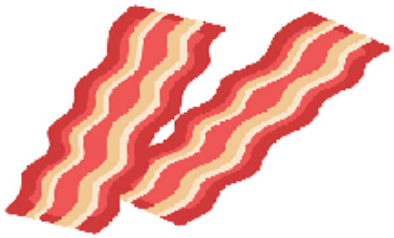

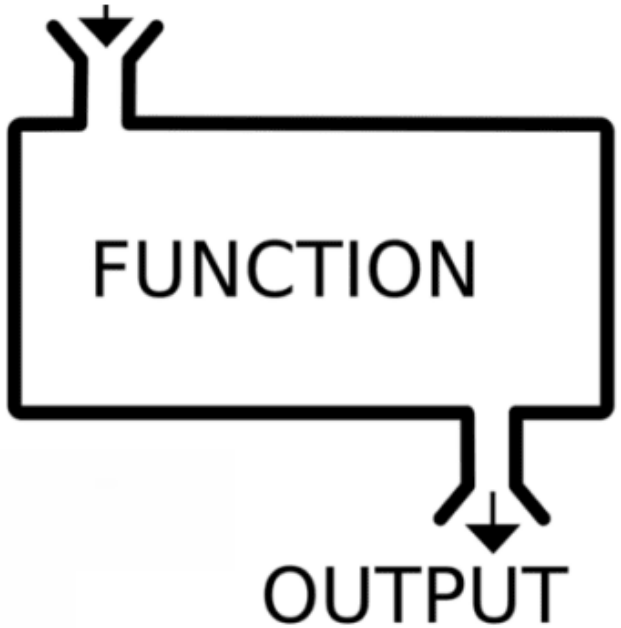

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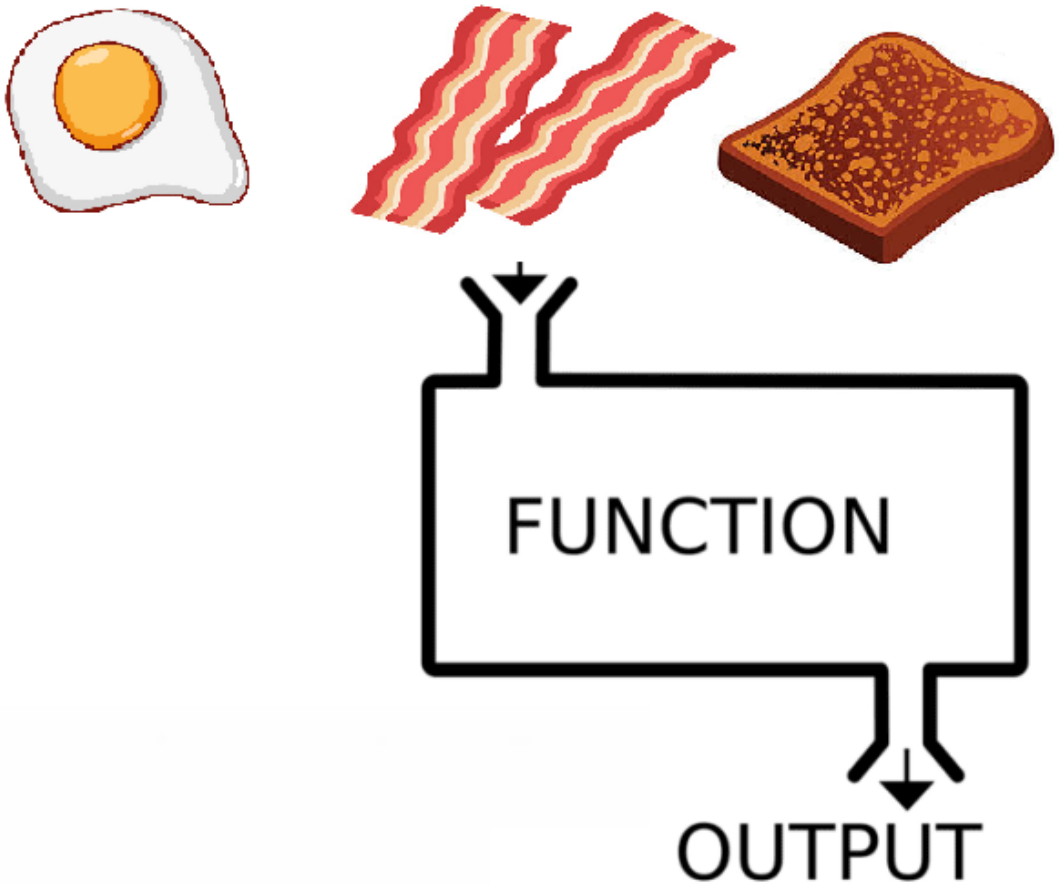

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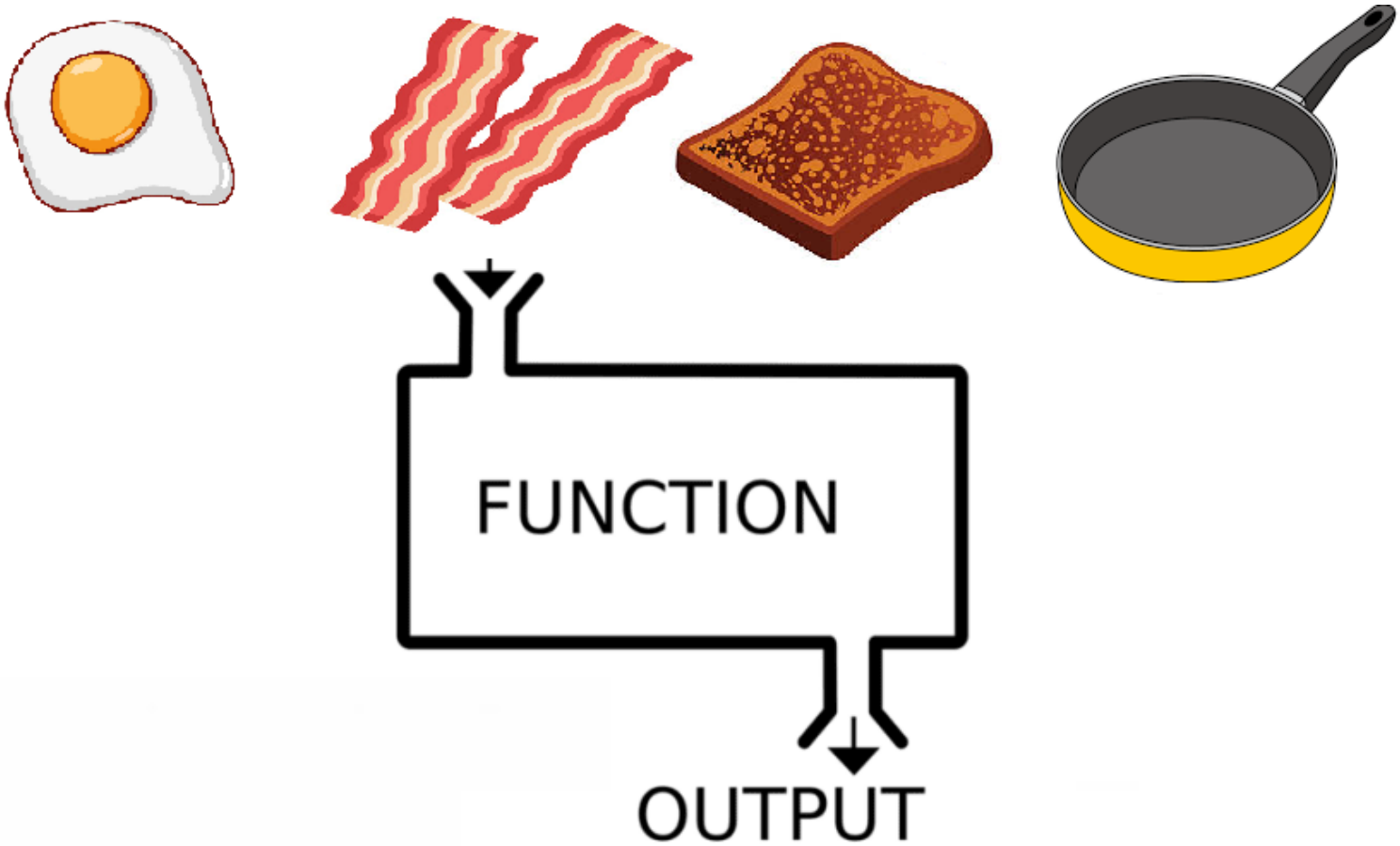

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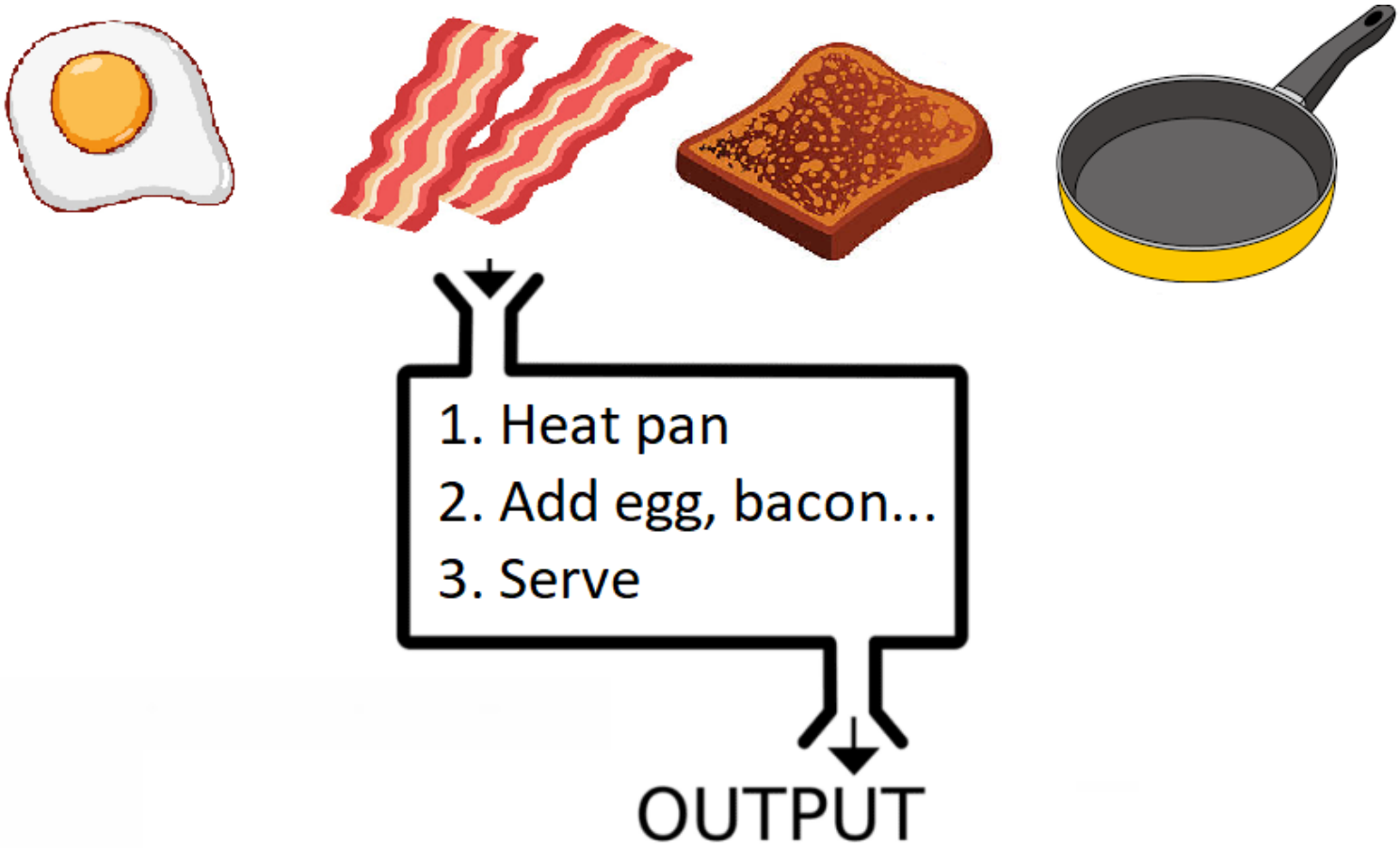

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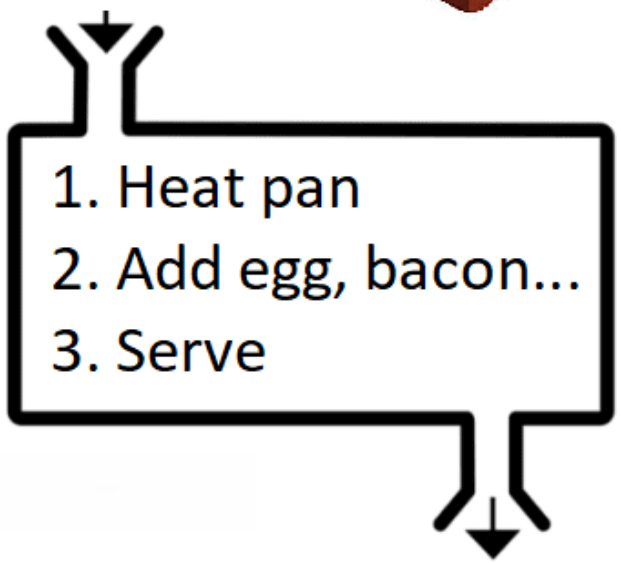


What is a function?

A set of instructions that performs a specific task

Examples:

- to print characters
- to sum numbers together
- to calculate the mean
- to run a linear regression model

When to use them?

- You are already using functions **all the time!**
- R is a *functional* programming language
- In R, you can used the functions:
  1. 'pre-baked' in R language (base R, utils)
  2. within packages (i.e. dyplr, tidyr) (!)
  3. write your own

Perhaps you already recognise these base R functions?

- print("hello")
- sum(2,3)
- mean(1:5)
- lm() *stats

Let's delve a little deeper into *lm*

```
> lm
function (formula, data, subset, weights, na.action, method = "qr",
    model = TRUE, x = FALSE, y = FALSE, qr = TRUE, singular.ok = TRUE,
    contrasts = NULL, offset, ...)
{
    ret.x <- x
    ret.y <- y
    cl <- match.call()
    mf <- match.call(expand.dots = FALSE)
    m <- match(c("formula", "data", "subset",
        "weights", "na.action", "offset"),
        names(mf), 0L)
    mf <- mf[c(1L, m)]
    mf$drop.unused.levels <- TRUE
    mf[[1L]] <- quote(stats::model.frame)
    mf <- eval(mf, parent.frame())
    if (method == "model.frame")
        return(mf)
    else if (method != "qr")
        warning(gettextf("method = '%s' is not supported. Using 'qr'",
            method), domain = NA)
    mt <- attr(mf, "terms")
    y <- model.response(mf, "numeric")
    w <- as.vector(model.weights(mf))
    if (!is.null(w) && !is.numeric(w))
        stop("'weights' must be a numeric vector")
    offset <- model.offset(mf)
    mlm <- is.matrix(y)
    ny <- if (mlm)
        nrow(y)
    else length(y)
    if (!is.null(offset)) {
        if (!mlm)
            offset <- as.vector(offset)
        if (NROW(offset) != ny)
            stop(gettextf("number of offsets is %d, should equal %d (number of observations)",
                NROW(offset), ny), domain = NA)
    }
    if (is.empty.model(mt)) {
        x <- NULL
        z <- list(coefficients = if (mlm) matrix(NA_real_, 0,
            ncol(y)) else numeric(), residuals = y, fitted.values = 0 *
            y, weights = w, rank = 0L, df.residual = if (!is.null(w)) sum(w !=
            0) else ny)
        if (!is.null(offset)) {
            z$fitted.values <- offset
            z$residuals <- y - offset
        }
    }
    else {
        x <- model.matrix(mt, mf, contrasts)
        z <- if (is.null(w))
            lm.fit(x, y, offset = offset, singular.ok = singular.ok,
                ...)
        else lm.wfit(x, y, w, offset = offset, singular.ok = singular.ok,
            ...)
    }
    class(z) <- c(if (mlm) "mlm", "lm")
    z$na.action <- attr(mf, "na.action")
    z$offset <- offset
    z$contrasts <- attr(x, "contrasts")
    z$xlevels <- .getXlevels(mt, mf)
    z$call <- cl
    z$terms <- mt
    if (model)
        z$model <- mf
    if (ret.x)
        z$x <- x
    if (ret.y)
        z$y <- y
    if (!qr)
        z$qr <- NULL
    z
}
<bytecode: 0x00000293a0e8f558>
<environment: namespace:stats>
```

lm(pHw ~ pHCaCl, data = data.df)

Why use functions?

The main purpose of functions is to break up **complex code into simpler digestable chunks**

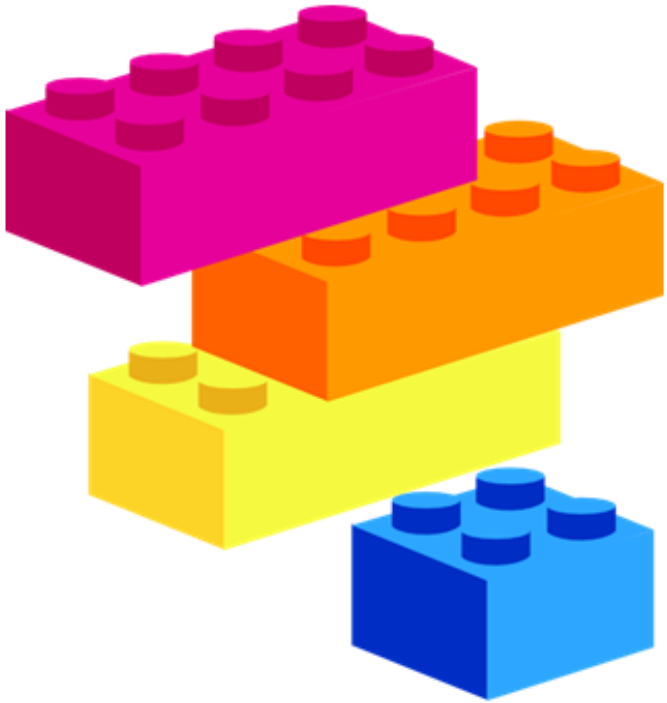
Advantages:

- Reduces code redundancy
- Improves modularity (changes are isolated)
- Resuable
- Debugging

Disadvantages:

- Thinking of a name! *(Functions names are usually verbs - as functions ”do” things)*
- Functions *should* do ONE thing - ”Uncle Bob”, Robert Martin

Function modularity



The power of writing your own

- There are things that you are doing over and over and over again...
- Can contruct your own algorithm. What is it that *you* need to do?
- You get to become a creator
- Combine your functions into your own package! For yourself and others too

You can go as far as you would like to with this...

Where to go if I get stuck?

- Book: The Art of R Programming (Norman Matloff)
- Book: The Pragmatic Programmer (Andrew Hunt & David Thomas)
- Stackoverflow
- Google / Duck Duck Go

Chances are somebody else has struggled too...

- Resist the temptation to just copy and paste a solution.
- Aim to *understand* the solution.
- There's fun to be had in programming. It's a *skill* that can be developed over time - not everything is 'intuitive'.