Logic in Excel

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Pilot version

KIND Learning Network

Welcome

- this session is for 🌶🌶🌶 advanced Excel users, who are confident writing formulas
- if you can’t access the chat, you might need to join our Teams channel: tinyurl.com/kindnetwork
- you can find session materials at tinyurl.com/kindtrp

The KIND network

- a social learning space for staff working with **k**nowledge, **i**nformation, and **d**ata across health, social care, and housing in Scotland
- we offer social support, free training, mentoring, community events, …
- Teams channel / mailing list

KIND Learning Network
NHS Education for Scotland

Session outline

- intro to logic in Excel
  - five minutes of Boolean algebra
  - basic logical functions (`NOT`, `AND`, `OR`)
  - putting logical functions to work with `IF` and `IFS`
- using logic in Excel
  - dealing with errors and missing values (`IFERROR`, `IFNA`, and friends)
  - managing different data types (`ISNUMBER` and friends)
  - conditional summarising (`SUMIF`, `COUNTIFS`, and friends)
  - nesting `IF` statements and future-proofing your work

Boolean algebra

- the standard way of working with truth-values
  - found all over mathematics, logic, computer science…
- think of a statement like `"my cat is blue"`
  - call that `P` to save writing it every time
- assume that `P` is either completely `TRUE` or completely `FALSE`

NOT

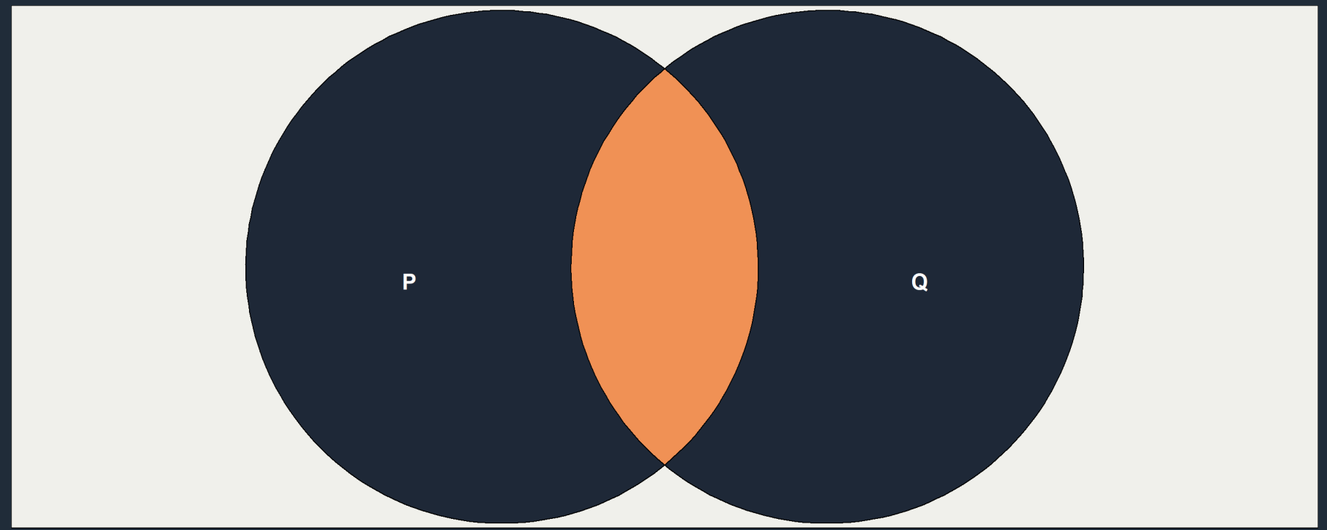
- `NOT` gives us the opposite truth-value
- if `P` is `FALSE`, then `NOT P` is `TRUE`
- a useful shorthand: the **truth table**:

P	NOT P
TRUE	FALSE
FALSE	TRUE

AND

- we also have functions to understand what happens when we're dealing with two statements
- AND is a great example - it's TRUE when both the statements are TRUE

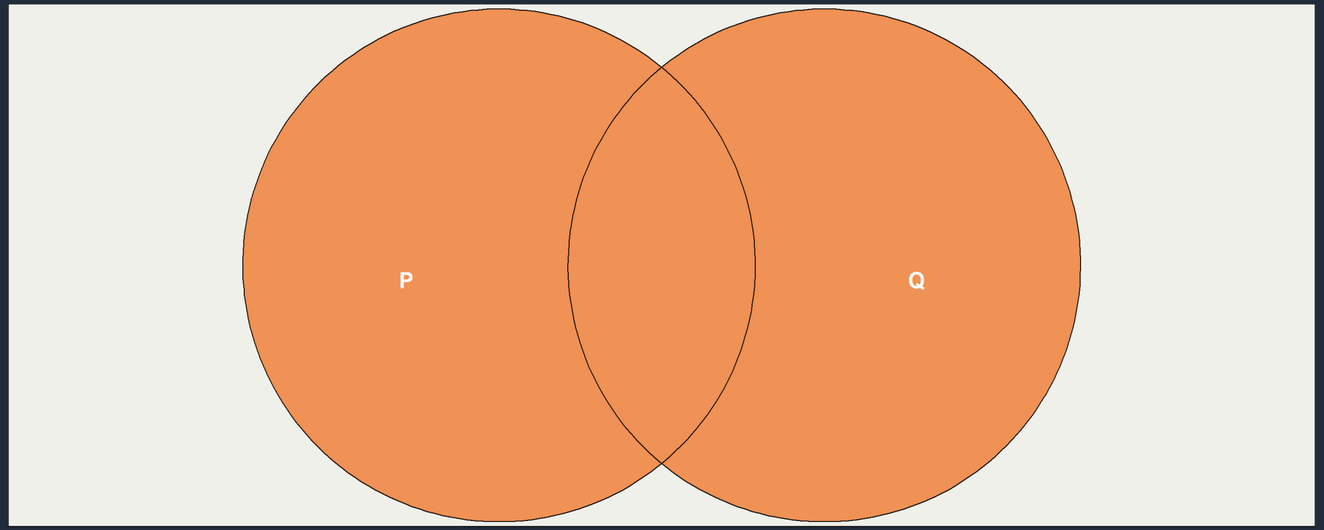
P	Q	P AND Q
TRUE	TRUE	TRUE
TRUE	FALSE	FALSE
FALSE	TRUE	FALSE
FALSE	FALSE	FALSE



OR

- OR is TRUE when either of the statements are TRUE

P	Q	P OR Q
TRUE	TRUE	TRUE
TRUE	FALSE	TRUE
FALSE	TRUE	TRUE
FALSE	FALSE	FALSE



NOT in Excel

- sweet relief: please open the sample workbook for this session in Excel
- have a look at the `NOT` worksheet
  - `NOT()` function inputs in the truth-table
  - example use about inhalers
    - note that `NOT()` will treat **any** number as `TRUE`, and 0 as `FALSE`

Task

- please add a formula to decide whether a person is a **non-user** of inhalers or not
- it should return `TRUE`/`FALSE` based on the number of inhalers used

AND and OR in Excel

- have a look at the `AND / OR` worksheet
  - have a look at the truth-table for `AND` and `OR`
  - specifically, look at the formulas and the way they use `AND()` and `OR()`

Task

- in the hypertension/diabetes table, you've got several rows of data where each represents a person. Please write two formulas:
  - for diet and lifestyle, you'll want to return `TRUE` if a person has either hypertension and/or diabetes
  - for statins, you'll want to return `TRUE` is a person has both hypertension and diabetes

IF

- unfortunately our data usually doesn't come neatly coded into `TRUE` and `FALSE`
- that mean we'll usually need to use our basic logical functions in combination with other functions
- `IF` is a great example of a function that helps you convert to logical values
- here's an example formula: `=IF(B3 > 150, "Hypertension", "No hypertension")`
  - if the value in B3 is over 150, the formula returns `"Hypertension"`
  - otherwise it returns `"No hypertension"`

IF

- this is useful in its own right, but gets even more powerful when you return logical values
- have a look at the top table on the `IF` worksheet

Task

- in the `IF` worksheet, there's an incomplete table of blood pressure values
- please write a formula to return `TRUE` if those values are over 150, and `FALSE` otherwise
- there's a named cell on this sheet called `Cutoff` - please now change that 150 in your `IF` formula to use the value of the named cell

TRUE and FALSE are 1 and 0

- many other tools let you add up `TRUE`/`FALSE` values as if they were 1s and 0s
- this can be very useful - say, to quickly count matching values
- Excel needs a minor workaround: add `--` before a logical value to treat it as a number:
  `=SUM(--Table1[Hypertension?])`

IFS

- `IFS` allows you to check for the presence of several conditions fairly concisely
- an example: `=IFS(B4 = TRUE,"High",C4 = "CRD","High", D4 > 20,"High", TRUE,"Low")`
  - read this horror as pairs of arguments, like `B4 = TRUE`, `"High"`
  - each pair contains
    - a logical test - like `B4 = TRUE`
    - a return value if that test is `TRUE` - like `"High"`
  - the final pair of arguments are a catch-all to pick up all non-matched values

Public service announcement

- just because you can, doesn’t mean you should
- `IFS` get pathologically complicated
- pivot tables might be better for more complicated cases

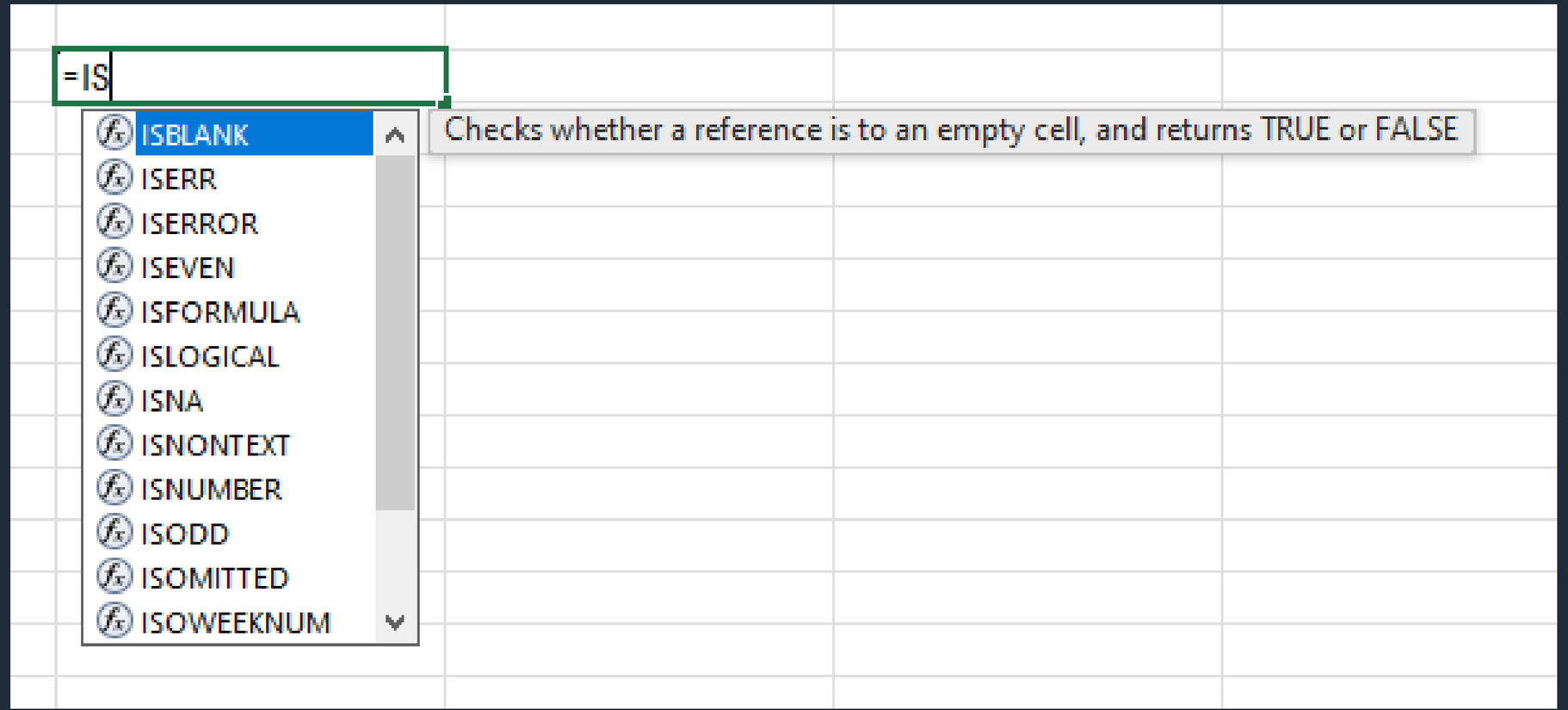
IFNA, IFERROR, and friends

- these functions are great for dealing with errors and missing values
- that's useful, because (understatement of the decade) Excel isn't very good at consistently dealing with errors and missing values

IS and IF functions

- IS**** functions detect errors and missing values and return TRUE/FALSE
- IF**** functions detect, and then:
  - if an error is found display a message of your choice
  - otherwise just repeat the value they refer to

What do they detect?



The important ones

- BLANK = “There’s no value in that cell”
- ERROR = “This formula doesn’t work properly”
- #N/A = “I can’t find what I was asked to find”
- ERR = “A non-N/A error has happened”

SUMIF and COUNTIF

- basically, `IF` plus summary functions
- three simple-ish examples to see

Real life examples

Sincere thanks and appreciation to people who volunteered formulas for this section:

- Gail Young (NHS GGC)
- Gail Donaldson (NHS Lanarkshire)
- Matthew Hooks (SAS)
- Susanna Kirk (NHS Fife)
- Hilary Guthrie (NHS Lothian)
- Irene Ventura (NHS Lanarkshire)

Feedback and resources

- please can I ask for some feedback - takes less than a minute, completely anonymous, helps people like you find the right training for them