

# Spreadsheet Programs

- automatic (re)calculation
- most convenient way of data automation

# Spreadsheet Basics

- *sheet*: a tabular form where its cells might have relations
- rows and columns
- address of a cell:  $(c, r)$
- a spreadsheet file may have one or more sheets

# Spreadsheet Basics

- cells contain data
- data has types
  - numbers
  - text
  - date
  - ...

# Expressions

- *expression*: a calculation on operands
  - $34 + 8$
  - $6 * 7$
  - $5 * 8 + 2$
- *formula*: an expression used to calculate a result
  - $= 34 + 8$
  - $= 5 * 8 + 2$
- on changes, formulae will be automatically recalculated on every sheet

# Basic Cell Addressing

- letters enumerate columns:

A, .. Z, AA, .. ZZ, AAA, ... XFD

- numbers enumerate rows:

1, 2, .. 1048576

- first indicate column, then row, no spacing

- A1: first column, first row
- K9: eleventh column, ninth row

# Cell Reference

- a cell may use the data of another cell in formulae
- formulae may use constant values:

- $= 5 + 2$

- formulae may refer cell addresses:

- $= A1 + B1$

# Relative Addressing

- plain addresses are relative
- relative addresses are calculated automatically
  - $D2 = A1 + B2$
  - $(c, r) = (c-3, r-1) + (c-2, r)$
- copy / pasting the formula preserves the relation
  - when pasted into E5:
  - $(E, 5) = (E-3, 5-1) + (E-2, 5)$
  - $= B4 + C5$

# Absolute Addressing

- if an axis starts with a \$, it's absolute
  - $D2 = A\$1 + \$B2$
  - $(c, r) = (c-3, 1) + (B, r)$
- address doesn't change when pasted
  - if pasted into E5:
  - $(E, 5) = (E-3, 1) + (B, 5)$
  - $= B1 + B5$



# Referencing another sheet

- if a file includes many sheets,  
each sheet may be referred by its name
  - `D2 = SheetOne!A1 + SheetTwo!$B$2`
- Sheet references are absolute
- when sheet name omitted, an address refers the sheet it resides in

# Ranges

- *range*: block of consecutive cells
- `start:end`
- a range may define
  - a horizontal block on a row
  - a vertical block on a column
  - a rectangular block spread over many rows and columns

# Functions

- take parameters, return a result
- parameters put inside paranthesis
- examples:
  - ABS: 1 parameter
  - SQRT: 1 parameter
  - ROUND: 2 parameters
  - RAND: no parameters

# Math Functions

- many functions to evaluate math
- names are mostly predictable
  - SIN
  - ACOS
  - ATANH
  - LOG10
  - GCD

# Engineering Functions

- many functions to evaluate engineering tasks
  - DEC2HEX
  - COMPLEX: complex number from real and imaginary parts
  - IMCOS: cosine of a complex number
  - IMCONJUGATE: conjugate of a complex number

# Text Functions

- many functions to edit text
  - **TRIM**: trims whitespace in the beginning and in the end
  - **LEFT, MID, RIGHT**: returns leftmost/middle/rightmost characters
  - **REPLACE**: replaces a substring with the given substring
  - **CONCATENATE**: concatenates text

# Date Functions

- many functions to manipulate date & time
  - **DATE**: to define a date
  - **TODAY**: returns today's date
  - **WEEKDAY**: returns the order of the day in a week

# Information & Reference Functions

- many functions for advanced referencing and lookup
  - **ISBLANK**: **TRUE** if a cell is blank
  - **ISODD**: **TRUE** if a cell value is odd
  - **CELL**: information of a cell
  - **INDEX**: the value of the cell in (c, r)
  - **MATCH**: the order of a value in an array
  - **OFFSET**: choose a sub-array in an array



# Logical Functions

- many functions to infer logical expressions
  - AND
  - OR
  - XOR: eXclusive OR
  - NOT: negation of a logical expression
  - IF: conditional value

# Logical Functions

- select one of the two values based on a condition:
  - `IF(condition, value_if_true, value_if_false)`
  - `IF(A1 >= 18, "Adult", "Minor")`

# Statistical Functions

- many functions for statistics
  - COUNT, COUNTA: count numbers/any
  - SUM, AVERAGE, STDDEV, CORREL
  - SMALL, LARGE: smallest/largest k-th value
  - RANK: find the rank in an array

# Selection Functions

- functions to evaluate selectively

- SUMIF

- COUNTIF

- CHOOSE

```
COUNTIF(A3:A50, "=Adult")
```

```
CHOOSE(A1, F1, F2, F3, F4)
```

# Advanced Operations

- filtering
- sorting
- charts

# CSV

- comma separated values
- only the active sheet is exported
- values can be exported, not the formulae
- style can not be exported
- settings: separator, text delimited, character set

# Style

- fonts, colours
- borders
- column width, row height
- alignment: horizontal and vertical
- cell merging