Spreadsheets

Spreadsheets are a powerful abstraction for organizing data and computation

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An Array of Cells

A spreadsheet is a 2 dimensional array of cells … it's 3D with multiple sheets

∗ The idea is that the rows or columns represent a common kind of data
- **They will be operated upon similarly, so that's easy to do**
- **Adding more data of the same type means adding more rows or columns**
- **Often spreadsheets contain numbers, but text-only spreadsheets are useful, too**

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Looking for Similar Ideas

Spreadsheets are not so unusual …

∗ The position (row/column) names the data, as with memory locations, variables, forms…
∗ Operating on all elements of a column (or row) is an iteration, though not usually a WFI
∗ Setting a cell to a formula is an (unevaluated) *assignment statement* with cells as variables
∗ The formula is an expression
∗ Functions are (built-in) functions

Think of spreadsheets as a handier interface for computing ideas than JS

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Familiar Terminology

Microsoft Excel - grade378.xls

L2   fx =0.4*(E2+F2*0.667+G2+H2+J2)/(39+110*0.667+300) + 0.2*D2/65+0.4*I2/95

	D	E	F	G	H	I	J	K	L	M
1	MT	HW1	HW2	HW3	HW4	FINAL	HW5			
2	52	39	105	100	100	90	100		0.935712	
3	59	39	110	100	95	87	100		0.949004	
4	62	32	110	98	100	86	100		0.944144	
5	62	36	110	100	95	88	100		0.953536	
6	58	39	110	100	100	92	100		0.96583	
7	53	39	106	100	95	88	100		0.927459	
8	50	38	110	100	100	89	100		0.927613	

row name   cell
column name   formula   referenced cell L2
column heading

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Formulas

The data in a spreadsheet can be manipulated using formulas

H2   fx =F2*0.621

	B	F	G	H	I
1	Common Name	Distance (km	Body Len (m	Distance (Mi)	
2	Swainson's Hawk	13500	0.52	8383.5	
3	Wheatear	13500	0.16		
4	Willow Warbler	15500	0.11		
5	Short-tailed Shearwa	12500	0.43		
6	Long-tailed Skua	16000	0.51		
7	Arctic Tern	19000	0.35		
8					
9					

The value in H2 (selected cell) is the value in F2 times 0.621 … the result is shown, but the cell has the formula

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Apply Formula Again

One way to repeat the formula is to copy-and-paste

H3   fx =F3*0.621

	B	F	G	H	I
1	Common Name	Distance (km	Body Len (m	Distance (Mi)	
2	Swainson's Hawk	13500	0.52	8383.5	
3	Wheatear	13500	0.16	8383.5	
4	Willow Warbler	15500	0.11	9625.5	
5	Short-tailed Shearwa	12500	0.43	7762.5	
6	Long-tailed Skua	16000	0.51	9936	
7	Arctic Tern	19000	0.35	11799	
8					
9					

Notice the formula

Filling Replicates Formulas

Fill is a spreadsheet shortcut for copy-and-paste

	B	F	G	H
1	Common Name	Distance (km	Body Len (m	Distance (Mi)
2	Swainson's Hawk	13500	0.52	8383.5
3	Wheatear	13500	0.16	
4	Willow Warbler	15500	0.11	
5	Short-tailed Shearwa	12500	0.43	
6	Long-tailed Skua	16000	0.51	
7	Arctic Tern	19000	0.35	
8				

G	H
Len (m	Distance (Mi)
0.52	8383.5
	8383.5
0.11	9625.5
0.43	7762.5
0.51	9936
0.35	11799

fill tab

 * Grab the fill tab with the cursor and pull in the direction to be pasted It's Magic!

Relative & Absolute Addr

Reference to cells happens in 2 ways: Relative and Absolute (with $)
 * F2   relative column, relative row
 * F$2   relative column, absolute row
 * $F2   absolute column, relative row
 * F2 absolute column, absolute row

Relative references change when pasted/filled; absolute references do not change Your intent determines which to pick

A Powerful Translation

	B	F	G	H
1	Common Name	Distance (km)	Body Len (m)	Distance (Mi)
2	Swainson's hawk	13500	0.52 =F2*0.621	
3	Wheatear	13500	0.16 =F3*0.621	
4	Willow warbler	15500	0.11 =F4*0.621	
5	Short-tailed shearwater	12500	0.43 =F5*0.621	
6	Long-tailed skua	16000	0.51 =F6*0.621	
7	Arctic tern	19000	0.35 =F7*0.621	
8				

birds.xls
Sheet1 Sheet2 Sheet3
Ready

The graphic shows the equations in the cells with the translation: The row changes going down, but the column doesn't

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A Example

Creating a discount table is case of using both relative and absolute refs
 * Consider store credit of $1 per $10 spent
 * $3 store credit for every 2 CDs (1 earns $1)

	1	2	3	4	5	6	7	8
$10.00	$2.00	$4.00	$5.00	$7.00	$8.00	$10.00	$11.00	$13.00
$20.00	$3.00	$5.00	$6.00	$8.00	$9.00	$11.00	$12.00	$14.00
$30.00	$4.00	$6.00	$7.00	$9.00	$10.00	$12.00	$13.00	$15.00
$40.00	$5.00	$7.00	$8.00	$10.00	$11.00	$13.00	$14.00	$16.00
$50.00	$6.00	$8.00	$9.00	$11.00	$12.00	$14.00	$15.00	$17.00
$60.00	$7.00	$9.00	$10.00	$12.00	$13.00	$15.00	$16.00	$18.00

A cell is based on first column, top row data *in that row and column* … must mix relative and absolute references 10

Series

Another handy property of fill is that it can make a series based on constants
 * Fill Sunday => Monday, Tuesday, Wed…
 * Fill 22 Feb => 23 Feb, 24 Feb, 25 Feb, …

More generally
 * Series fill will even count using a constant
 * Counting by odd sizes: give 1st two items

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Demo

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