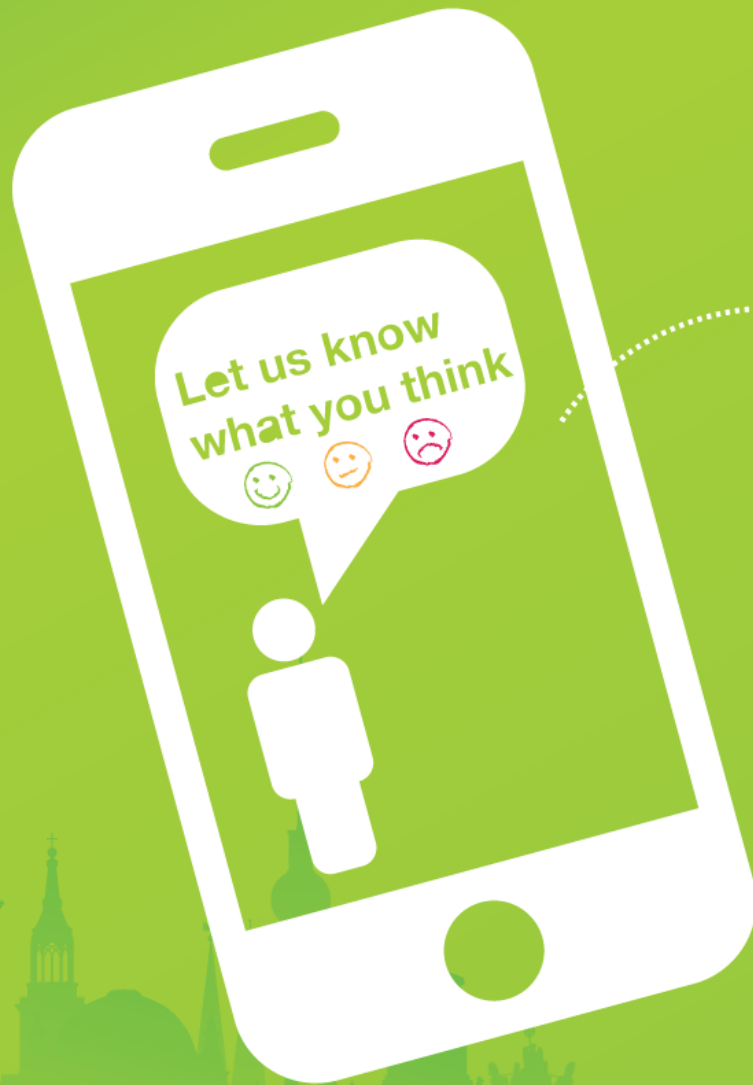
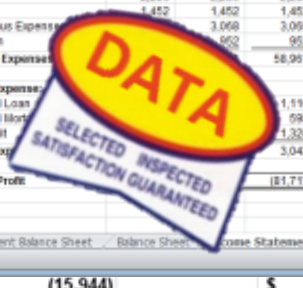


goto;
conference



**Click 'engage'
to rate sessions
and ask questions**



Spreadsheets are code



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Clipboard Font Alignment Number Styles Cells Editing

G35 F21^2

	A	B	C	D	E	F	G	H	I
20									
21		Enter the annualized standard deviation in reinvestment				61.25%	(in %)		
22									
23		Inputs relating to the option							
24		Enter reinvestment needs that can be financed without				5.00%	(in currency)		
25		Enter maximum reinvestment that can be financed with				17.00%			
26		General Inputs							
27		Enter the riskless rate that corresponds to the option life				6.00%	(in %)		
28									
29		Capital Inputs							
30		Enter the current cost of capital for the firm =				12.22%			
31		Enter the firm's current return on capital =				18.69%			
32									
33	Output								
34	Stock Price =		9.13%		T.Bond rate =		6.00%		
35	Strike Price =		5.00%		Variance =		0.3751616		
36	Expiration (in years) =		1		Annualized dividend yield =		0.00%		
37	Annual Excess Return =		6.47%		Cost of Capital =		12.22%		
38	Maximum Flexibility =		17.00%						

Reinvestment Needs Value of Flexibility

Ready 100%

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Clipboard Font Alignment Number Styles Cells Editing

General

Conditional Formatting

Format as Table

Cell Styles

Insert

Delete

Format

Sort & Filter

Find & Select

G35

=F21^2

	A	B	C	D	E	F	G	H	I	
20										
21		Enter the annualized standard deviation in reinvestment				61.25%	(in %)			
22										
23		Inputs relating to the option								
24		Enter reinvestment needs that can be financed without				5.00%	(in currency)			
25		Enter maximum reinvestment that can be financed with				17.00%				
26		General Inputs								
27		Enter the riskless rate that corresponds to the option life				6.00%	(in %)			
28										
29		Capital Inputs								
30		Enter the current cost of capital for the firm =				12.22%				
31		Enter the firm's current return on capital =				18.69%				
32										
33	Output									
34	Stock Price=		9.13%		T.Bond rate=		6.00%			
35	Strike Price=		5.00%		Variance=		0.3751616			
36	Expiration (in years) =		1		Annualized dividend yield=		0.00%			
37	Annual Excess Return=		6.47%		Cost of Capital =		12.22%			
38	Maximum Flexibility =		17.00%							

Reinvestment Needs Value of Flexibility

Ready

100%

Spreadsheet_5.xlsx - Microsoft Excel

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Clipboard Font Alignment Number Styles Cells Editing

General

Conditional Formatting

Format as Table

Cell Styles

Insert

Delete

Format

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Find & Select

G35

$=F21^2$

	A	B	C	D	E	F	G	H	I
20									
21		Enter the annualized standard deviation in reinvestment				61.25%	(in %)		
22									
23		Inputs relating to the option							
24		Enter reinvestment needs that can be financed without				5.00%	(in currency)		
25		Enter maximum reinvestment that can be financed with				17.00%			
26		General Inputs							
27		Enter the riskless rate that corresponds to the option life				6.00%	(in %)		
28									
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36	Expiration (in years) =		1		Annualized dividend yield=		0.00%		
37	Annual Excess Return=		6.47%		Cost of Capital =		12.22%		
38	Maximum Flexibility =		17.00%						

Reinvestment Needs Value of Flexibility

Ready

100%

Turing Machine_Successor.xlsx - Microsoft Excel

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Clipboard Font Alignment Number Styles Cells Editing

Calibri 11 A A

B I U

General

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Conditional Formatting as Table Cell Styles

Insert Delete Format

Σ Sort & Find & Filter Select

A1 fx

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1																	
2			14	4 <---													
3																	
4	4 S1	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
5	5 S1	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
6	6 S1	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
7	7 S1	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
8	8 S2	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
9	9 S2	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
10	10 S2	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
11	9 S3	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
12	8 S3	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
13	7 S3	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
14	6 S3	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
15	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
16	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
17	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
18	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
19	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
20	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
21	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
22	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
23	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
24	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
25	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
26	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
27	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
28	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
29	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
30	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-

Machine State Table Directions

Ready Calculate

90%

Turing Machine_Successor.xlsx - Microsoft Excel

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Clipboard Font Alignment Number Styles Cells Editing

Calibri 11 General \$ % , .0 .00

Conditional Formatting as Table Cell Styles Insert Delete Format Sort & Find & Filter Select

A1 fx

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1																	
2			14	4 <---													
3																	
4	4 S1	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
5	5 S1	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
6	6 S1	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
7	7 S1	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
8	8 S2	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
9	9 S2	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
10	10 S2	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
11	9 S3	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
12	8 S3	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
13	7 S3	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
14	6 S3	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
15	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
16	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
17	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
18	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
19	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
20	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
21	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
22	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
23	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
24	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
25	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
26	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
27	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
28	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
29	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-
30	7 S4	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-

Machine State Table Directions

Ready Calculate 90%

2) Formulas are Turing complete



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Implementing a Turing machine in Excel

Cory Doctorow at 2:20 pm Fri, Sep 20, 2013

74

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142

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GOT 99 PROBLEMS



3) They suffer from the same problems



PROBLEMS

VOLVO XC90
OWNER'S MANUAL

Only 33% of spreadsheets has
a manual

3) They suffer from the same problems

PROBLEMS

Only 33% of
a manual



Average sheet is used by 12 different people

3) They suffer from the same problems

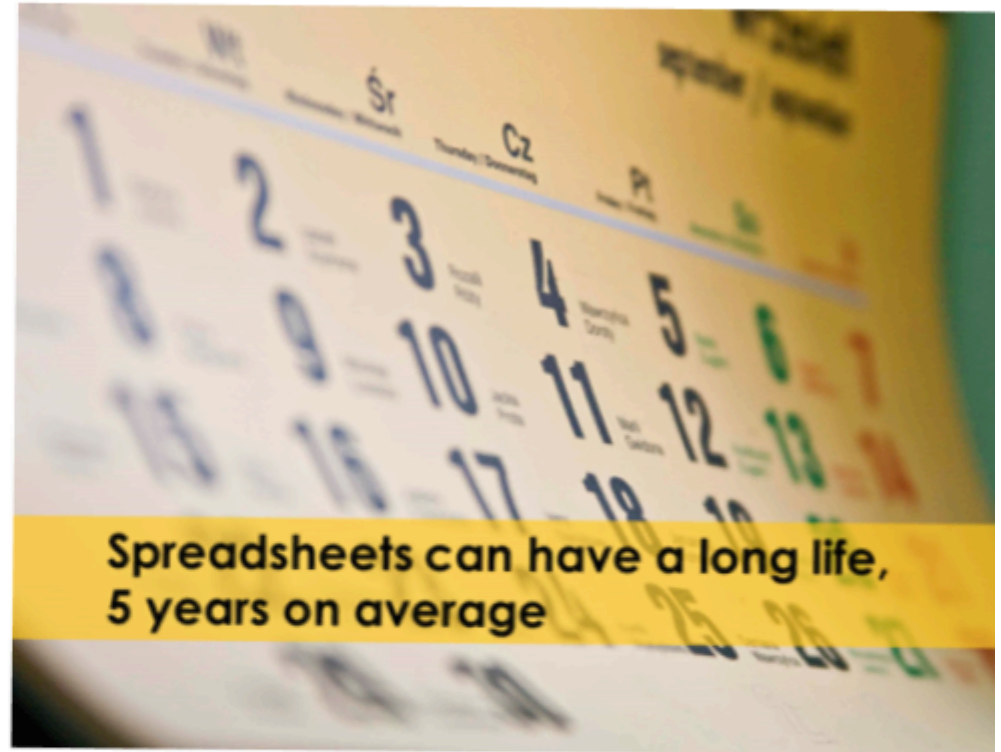


VOLVO XC
OWNER

Only 33% of
a manual



Average sheet is used by
people



Spreadsheets can have a long life,
5 years on average

3) They suffer from the same problems





**In summary: both the activities,
complexity and problems are the same**


A group of gospel singers, mostly men, are performing on a stage. They are wearing gold and white robes. Several of them are holding microphones and singing with their mouths open. The background is dark, and there are stage lights visible. The overall mood is energetic and spiritual.

Spreadsheets are code

**In summary: both the activities,
complexity and problems are the same**

2001financialstatements.xlsx - Microsoft Excel											
AF52											
	A	B	C	D	E	F	G	H	I	J	K
1	Consolidated Statements of Shareholders' Equity										
2	[DOLLARS IN THOUSANDS]										
3											
4											
5											
6											
7											
8		Number	Par Value	Capital	Earnings	Treasury	Accumulated	Income (Loss)	Other	Total	
9	Balance, January 1, 1999	69,494,483	\$ 86,868	\$ 43,281	\$ 604,227	\$ (21,902)		\$ (12,802)	\$ (549)	\$ 699,123	
10											
11	Net income				128,856		\$ 128,856			128,856	
12	Translation adjustment						9,558			9,558	
13	Pensions						614			614	
14	Unrealized loss on investment securities						(3,235)			(3,235)	
15	Other comprehensive income						6,937	6,937			
16	Comprehensive income						\$ 135,793				
17	Stock options exercised	108,104	134	1,918						2,052	
18	Unearned compensation	149,799	188	3,933					(3,485)	636	
19	Performance shares	20,397	26	686						712	
20	Procomp and Nexus acquisitions	1,710,214	2,138	37,351		9,487				48,976	
21	Dividends declared and paid				(41,668)					(41,668)	
22	Treasury shares					(1,229)				(1,229)	
23											
24	Balance, December 31, 1999	71,482,997	\$ 89,354	\$ 87,169	\$ 691,415	\$ (13,644)		\$ (5,865)	\$ (4,034)	\$ 844,395	
25	Net income				136,919		\$ 136,919			136,919	
26	Translation adjustment						(7,904)			(7,904)	
27	Pensions						1,507			1,507	
28	Unrealized loss on investment securities						(396)			(396)	
29	Other comprehensive loss						(6,793)	(6,793)			
30	Comprehensive income						\$ 130,126				
31	Stock options exercised	273,238	343	5,444						5,787	
32	Unearned compensation	247,635	308	5,583					(3,915)	1,976	
33	Performance shares	15,335	19	334						353	
34	Dividends declared and paid				(44,271)					(44,271)	
35	Treasury shares					(2,300)				(2,300)	
36											
37	Balance, December 31, 2000	536,208	\$ 90,024	\$ 98,530	\$ 784,063	\$ (15,944)		\$ (12,658)	\$ (7,949)	\$ 936,066	
38	Net income				66,893		\$ 66,893			66,893	
39	Translation adjustment						(47,373)			(47,373)	
40	Pensions						(1,628)			(1,628)	
41	Unrealized gain on investment securities						1,213			1,213	
42	Other comprehensive loss						(47,788)	(47,788)			
43	Comprehensive income						\$ 19,105				
44	Stock options exercised	176,395	221	4,860						5,081	
45	Unearned compensation								1,412	1,412	
46	Dividends declared and paid				(45,774)					(45,774)	
47	Treasury shares					(12,780)				(12,780)	
48											
49	Balance, December 31, 2001	712,603	\$ 90,245	\$ 103,390	\$ 805,182	\$ (28,724)		\$ (60,446)	\$ (6,537)	\$ 903,110	
50											
51											

And not just a programming language!



**The next language
to learn**

Resistance is futile!

live programming



```
canvasHeight = parseInt(canvas.getAttribute("height"));

drawSky();
drawMountains();
drawTree();
}

//-----
//
// sky
//

function drawSky () {
  ctx.save();

  var gradient = ctx.createLinearGradient(0,0,0,canvasHeight);
  gradient.addColorStop(0, "#b4e0fe");
  gradient.addColorStop(1, "#d3f8ff");

  ctx.fillStyle = gradient;
  ctx.fillRect(0,0,canvasWidth,canvasHeight);

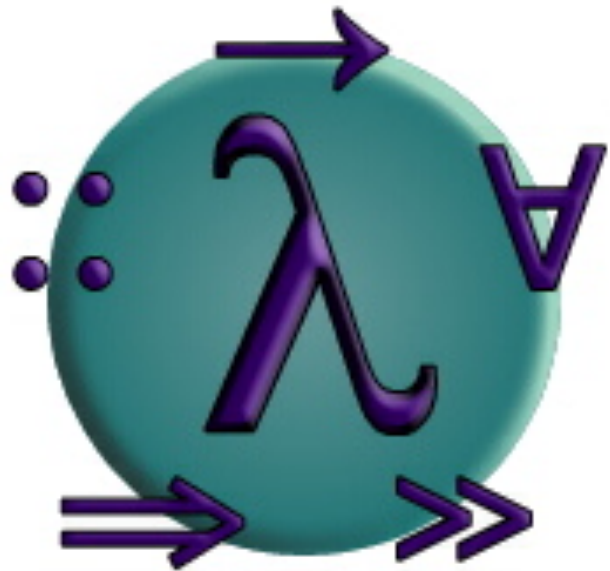
  ctx.restore();
}

//-----
//
// mountains
//

function drawMountains () {
  resetRandom();

  drawMountain(130, "#8bb2bb");
  drawMountain(50, "#618087");
}
```


pure functional



Haskell

A Purely Functional Language

featuring static typing, higher-order functions,
polymorphism, type classes and monadic effects

pure functional

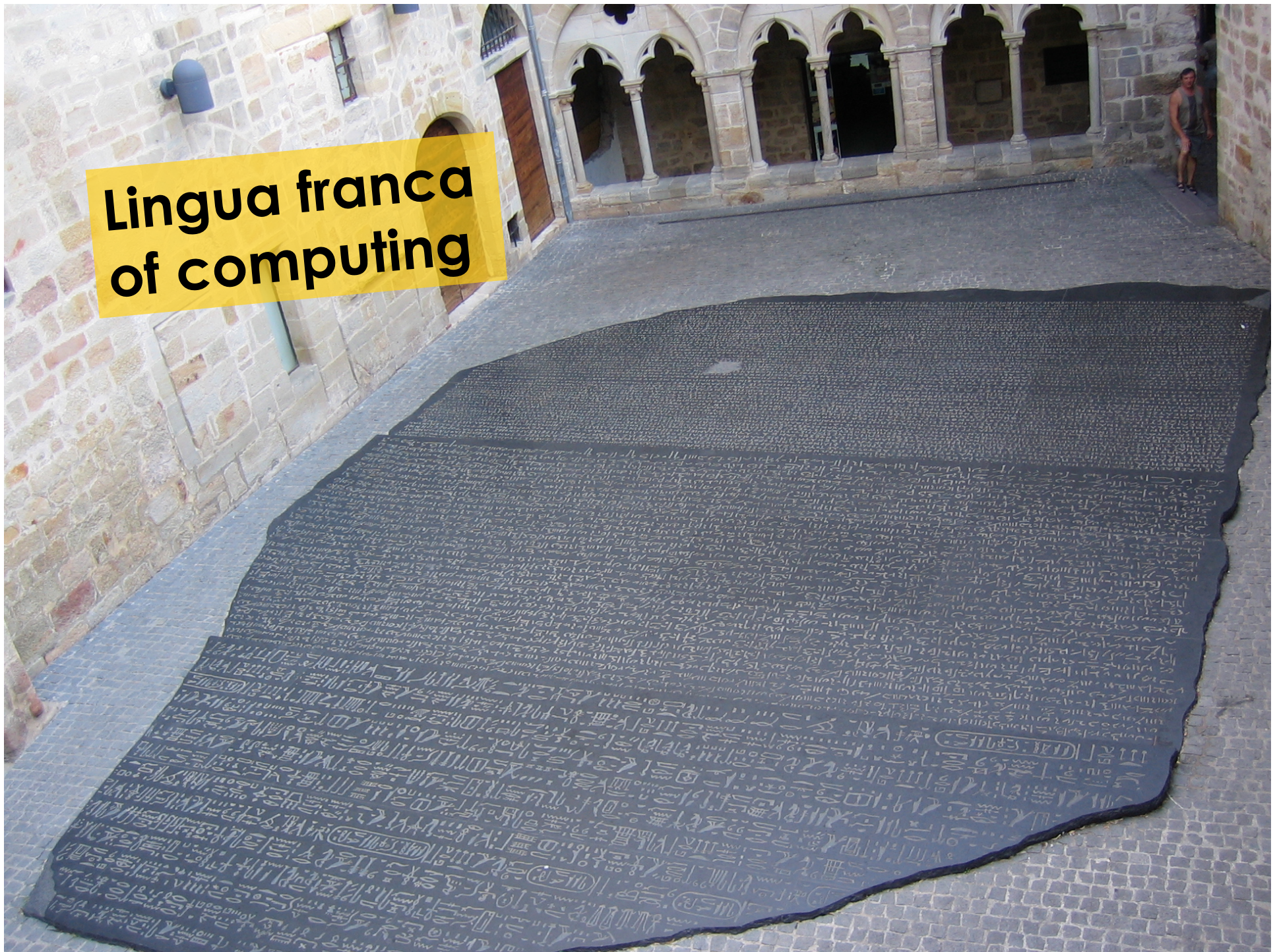


Excel

A Purely Functional Language

featuring static typing, higher-order functions,
polymorphism, type classes and monadic effects

Lingua franca of computing



SelectionSort.xlsx - Microsoft Excel

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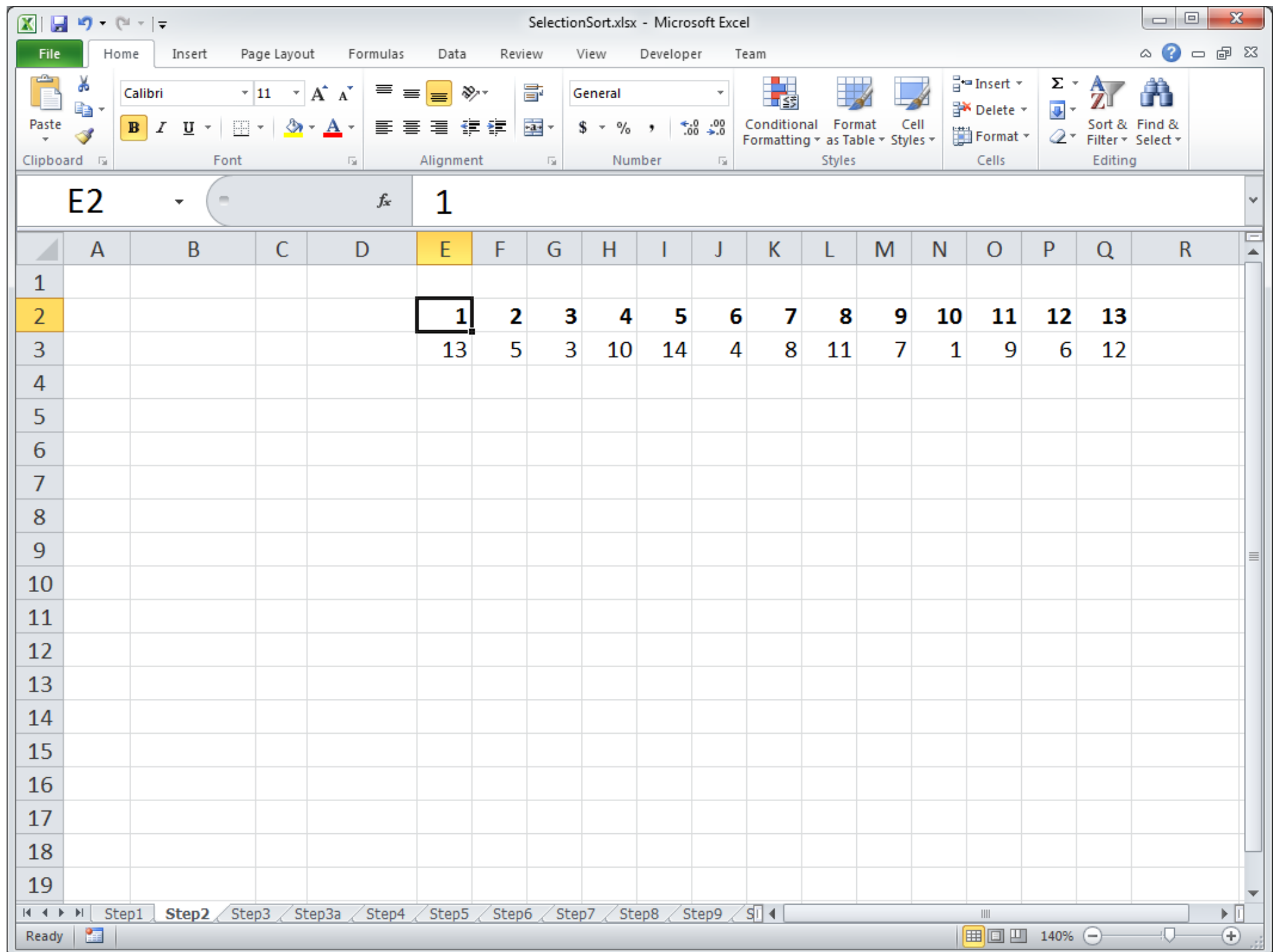
E3 13

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1																		
2																		
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
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Selection Sort

Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

Ready 140%



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SUM \times \checkmark f_x =MIN(E3:Q3)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min															
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			=MIN															
5																		
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

Edit 140%

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Paste Font Alignment Number Styles Cells Editing

SUM x ✓ fx =MIN(3:3)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min															
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			=MIN()															
5																		
6																		
7																		
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

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Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =MATCH(C4,E3:Q3,0)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			1	=MATCH(C														
5																		
6																		
7																		
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

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Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =MATCH(C4,E3:Q3,0)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			1	10														
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

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Paste Font Alignment Number Styles Cells Editing

SUM x ✓ fx =IF(E2=D4,"X","_")

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			1	10	=IF(E													
5																		
6																		
7																		
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

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Clipboard Font Alignment Number Styles Cells Editing

Calibri 11 A A

B I U

General

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Conditional Formatting Format as Table Cell Styles

Insert Delete Format

Σ Sort & Filter Find & Select

E4 =IF(E2=D4,"X","_")

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			1	10														
5																		
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

Ready Count: 13 140%

SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Clipboard Font Alignment Number Styles Cells Editing

E4 =IF(E2=D4,"X","_")

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			1	10														
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Awww, what went wrong?

Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

Ready Count: 13 140%

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Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =IF(N2=M4,"X","_")

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			1	10	_	_	_	_	_	_	_	_		=IF(N	_	_	_	
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

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SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Paste Font Alignment Number Styles Cells Editing

SUM x ✓ fx =IF(E2=\$D4,"X","_")

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			1	10	=IF(E	-	-	-	-	-	-	-	-	-	-	-	-	
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1 140%

SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =IF(N2=\$D4,"X","_")

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			1	10	_	_	_	_	_	_	_	_	_	X	_	_	_	
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

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SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =IF(N2=\$D4,"X","_")

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			1	10	-	-	-	-	-	-	-	-	-	=IF(N	-	-	-	
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

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SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =IF(N\$2=\$D4,"X","_")

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1			Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4			1	10	-	-	-	-	-	-	-	-	-	F(N\$	-	-	-	
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

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Clipboard Font Alignment Number Styles Cells Editing

B4 1

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1		IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4		1	1	10	-	-	-	-	-	-	-	-	-	X	-	-	-	
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 S1

Ready 140%

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Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =INDEX(E3:Q3,1,B4)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	=INDE	1	1	10	-	-	-	-	-	-	-	-	X	-	-	-		
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Step1 Step2 Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9

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Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =IF(E\$2=\$D4,"X","_")

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13		1	1	10	"_")	-	-	-	-	-	-	-	X	-	-	-	
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Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 Step10 Step11

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SelectionSort.xlsx - Microsoft Excel

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Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =IF(E\$2=\$D4,"X",IF(E\$2=\$B4,"X","_"))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	=IF(E	-	-	-	-	-	-	-	-	X	-	-	-	
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Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 Step10 Step11

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SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Clipboard Font Alignment Number Styles Cells Editing

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General

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Conditional Formatting as Table Cell Styles

Insert Delete Format

Sort & Filter Find & Select

E4 =IF(E\$2=\$D4,"X",IF(E\$2=\$B4,"X","_"))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13		1	1	10	X	-	-	-	-	-	-	-	X	-	-	-	
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Step3 Step3a Step4 Step5 Step6 Step7 Step8 Step9 Step10 Step11

Ready 140%

SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =IF(E\$2=\$D4,"X",IF(E\$2=\$B4,"X","_"))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	=IF(E	-	-	-	-	-	-	-	-	X	-	-	-	
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Step3a Step4 Step5 Step6 Step7 Step8 Step9 Step10 Step11 Step12

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SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Clipboard Font Alignment Number Styles Cells Editing

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General

Conditional Formatting as Table Cell Styles

Insert Delete Format

Sort & Filter Find & Select

E4 =IF(E\$2=\$D4,"X",IF(E\$2=\$B4,"X",E3))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
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Step3a Step4 Step5 Step6 Step7 Step8 Step9 Step10 Step11 Step12

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SelectionSort.xlsx - Microsoft Excel

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Clipboard Font Alignment Number Styles Cells Editing

E3 13

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	6	7	9	8	11	14	1	4	10	12	
4	13		1	1	10 X	5	3	6	7	9	8	11	14 X		4	10	12	
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Conditional Formatting Rules Manager

Show formatting rules for: Current Selection

New Rule... Edit Rule... Delete Rule

Rule (applied in order shown)	Format	Applies to	Stop If True
Formula: =E3=\$A4	AaBbCcYv	=E\$3:\$Q\$4	<input type="checkbox"/>
Formula: =E3=\$C4	AaBbCcYv	=E\$3:\$Q\$4	<input type="checkbox"/>

OK Close Apply

Step6 Step7 Step8 Step9 Step10 Step11 Step12 Step13 Step14 Step15

Ready 140%

SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =IF(E\$2=\$D4,"X",IF(E\$2=\$B4,"X",E3))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	6	7	9	8	11	14	1	4	10	12	
4	13	1	1	10	=IF(E	5	3	6	7	9	8	11	14	X	4	10	12	
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Step6 Step7 Step8 Step9 Step10 Step11 Step12 Step13 Step14 Step15

Edit 140%

SelectionSort.xlsx - Microsoft Excel

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Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =IF(E\$2=\$D4,"X",IF(E\$2=\$B4,\$C4,E3))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	6	7	9	8	11	14	1	4	10	12	
4	13	1	1	10	=IF(E	5	3	6	7	9	8	11	14	X	4	10	12	
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Step6 Step7 Step8 Step9 Step10 Step11 Step12 Step13 Step14 Step15

Edit 140%

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Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =IF(E\$2=\$D4,\$A4,IF(E\$2=\$B4,\$C4,E3))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	6	7	9	8	11	14	1	4	10	12	
4	13	1	1	10	=IF(E	5	3	6	7	9	8	11	14	X	4	10	12	
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Step6 Step7 Step8 Step9 Step10 Step11 Step12 Step13 Step14 Step15

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SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Clipboard Font Alignment Number Styles Cells Editing

E4 =IF(E\$2=\$D4,\$A4,IF(E\$2=\$B4,\$C4,E3))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	6	7	9	8	11	14	1	4	10	12	
4	13		1	1	10	1	5	3	6	7	9	8	11	14	13	4	10	12
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Step6 Step7 Step8 Step9 Step10 Step11 Step12 Step13 Step14 Step15

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SelectionSort.xlsx - Microsoft Excel

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Clipboard Font Alignment Number Styles Cells Editing

A4 =INDEX(E3:Q3,1,B4)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	1	1	5	1	3	10	14	4	8	11	7	13	9	6	12	
6	3	3	1	2	5	3	1	10	14	4	8	11	7	13	9	6	12	
7	10	4	1	3	5	3	10	1	14	4	8	11	7	13	9	6	12	
8	14	5	1	4	5	3	10	14	1	4	8	11	7	13	9	6	12	
9	4	6	1	5	5	3	10	14	4	1	8	11	7	13	9	6	12	
10	8	7	1	6	5	3	10	14	4	8	1	11	7	13	9	6	12	
11	11	8	1	7	5	3	10	14	4	8	11	1	7	13	9	6	12	
12	7	9	1	8	5	3	10	14	4	8	11	7	1	13	9	6	12	
13	13	10	1	9	5	3	10	14	4	8	11	7	13	1	9	6	12	
14	9	11	1	10	5	3	10	14	4	8	11	7	13	9	1	6	12	
15	6	12	1	11	5	3	10	14	4	8	11	7	13	9	6	1	12	
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17																		
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Step6 Step7 Step8 Step9 Step10 Step11 Step12 Step13 Step14 Step15

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SelectionSort.xlsx - Microsoft Excel

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Clipboard Font Alignment Number Styles Cells Editing

A4 =INDEX(E3:Q3,1,B4)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	1	1	5	1	3	10	14	4	8	11	7	13	9	6	12	
6	3	3	1	2	5	3	1	10	14	4	8	11	7	13	9	6	12	
7	10	4	1	3	5	3	10	1	14	4	8	11	7	13	9	6	12	
8	14	5	1	4	5	3	10	14	1	4	8	11	7	13	9	6	12	
9	4	6	1	5	5	3	10	14	4	8	11	7	13	9	6	12		
10	8	7	1	6	5	3	10	14	4	8	11	7	13	9	6	12		
11	11	8	1	7	5	3	10	14	4	8	11	7	13	9	6	12		
12	7	9	1	8	5	3	10	14	4	8	11	7	1	13	9	6	12	
13	13	10	1	9	5	3	10	14	4	8	11	7	13	1	9	6	12	
14	9	11	1	10	5	3	10	14	4	8	11	7	13	9	1	6	12	
15	6	12	1	11	5	3	10	14	4	8	11	7	13	9	6	1	12	
16																		
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Awww, what went wrong?

Step6 Step7 Step8 Step9 Step10 Step11 Step12 Step13 Step14 Step15

Ready Average: 7.37745098 Count: 204 Sum: 1505 140%

SelectionSort.xlsx - Microsoft Excel

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Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =MIN(E3:Q3)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	=MIN	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	1	1	5	1	3	10	14	4	8	11	7	13	9	6	12	
6	3	3	1	2	5	3	1	10	14	4	8	11	7	13	9	6	12	
7	10	4	1	3	5	3	10	1	14	4	8	11	7	13	9	6	12	
8	14	5	1	4	5	3	10	14	1	4	8	11	7	13	9	6	12	
9	4	6	1	5	5	3	10	14	4	1	8	11	7	13	9	6	12	
10	8	7	1	6	5	3	10	14	4	8	1	11	7	13	9	6	12	
11	11	8	1	7	5	3	10	14	4	8	11	1	7	13	9	6	12	
12	7	9	1	8	5	3	10	14	4	8	11	7	1	13	9	6	12	
13	13	10	1	9	5	3	10	14	4	8	11	7	13	1	9	6	12	
14	9	11	1	10	5	3	10	14	4	8	11	7	13	9	1	6	12	
15	6	12	1	11	5	3	10	14	4	8	11	7	13	9	6	1	12	
16																		
17																		
18																		
19																		

Step7 Step8 Step9 Step10 Step11 Step12 Step13 Step14 Step15 A

Edit 140%

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File Home Insert Page Layout Formulas Data Review View Developer Team

Paste Font Alignment Number Styles Cells Editing

SUM \times \checkmark f_x =MIN(OFFSET(E3:Q3,0,B4-1))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	=MIN	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	1	1	5	1	3	10	14	4	8	11	7	13	9	6	12	
6	3	3	1	2	5	3	1	10	14	4	8	11	7	13	9	6	12	
7	10	4	1	3	5	3	10	1	14	4	8	11	7	13	9	6	12	
8	14	5	1	4	5	3	10	14	1	4	8	11	7	13	9	6	12	
9	4	6	1	5	5	3	10	14	4	1	8	11	7	13	9	6	12	
10	8	7	1	6	5	3	10	14	4	8	1	11	7	13	9	6	12	
11	11	8	1	7	5	3	10	14	4	8	11	1	7	13	9	6	12	
12	7	9	1	8	5	3	10	14	4	8	11	7	1	13	9	6	12	
13	13	10	1	9	5	3	10	14	4	8	11	7	13	1	9	6	12	
14	9	11	1	10	5	3	10	14	4	8	11	7	13	9	1	6	12	
15	6	12	1	11	5	3	10	14	4	8	11	7	13	9	6	1	12	
16																		
17																		
18																		
19																		

Step7 Step8 Step9 Step10 Step11 Step12 Step13 Step14 Step15 A1 140%

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File Home Insert Page Layout Formulas Data Review View Developer Team

Clipboard Font Alignment Number Styles Cells Editing

Calibri 11 A A

General

Conditional Formatting as Table Cell Styles

Insert Delete Format

Sort & Filter Find & Select

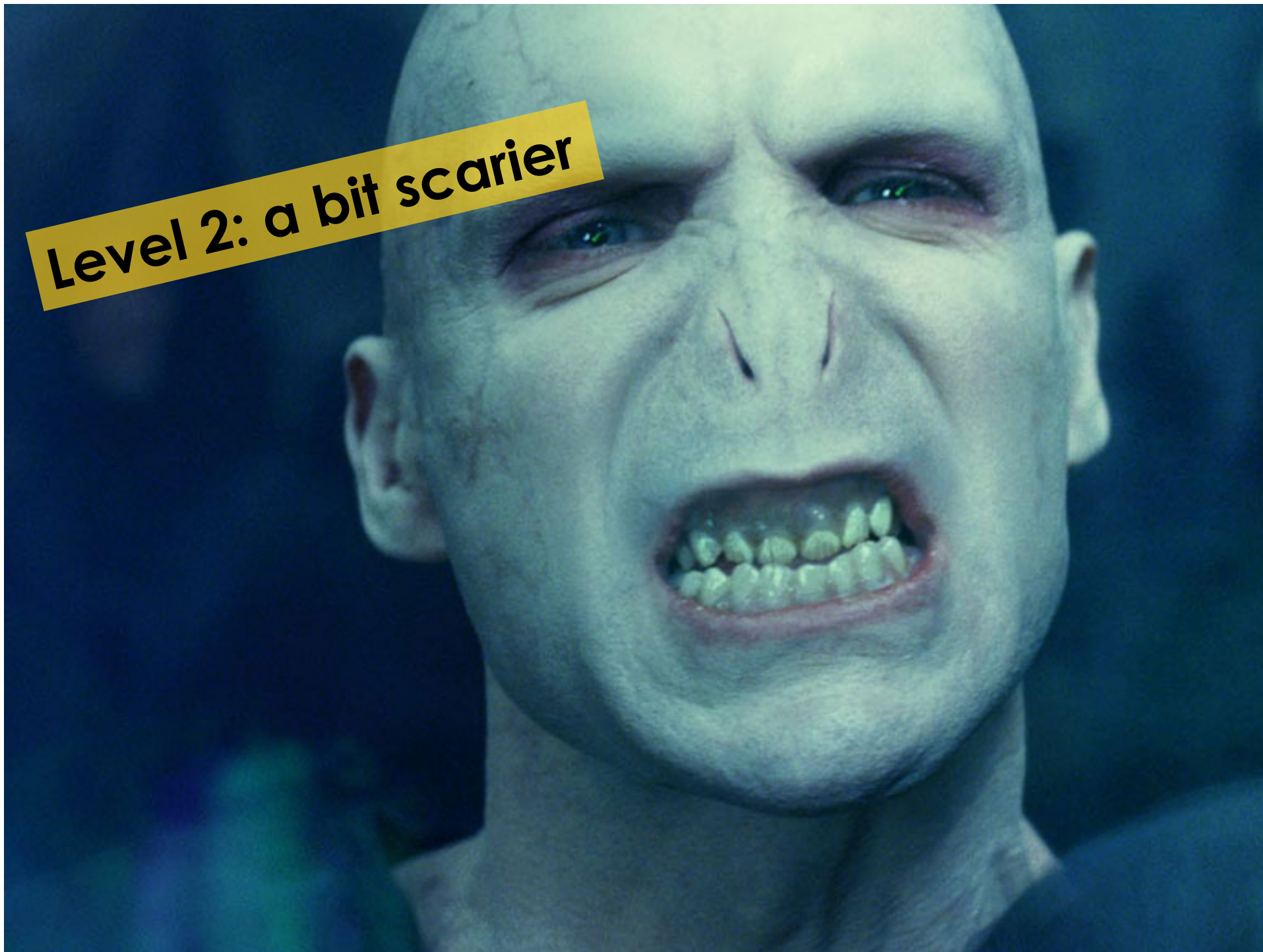
C4 =MIN(OFFSET(E3:Q3,0,B4-1))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		
19																		

Step7 Step8 Step9 Step10 Step11 Step12 Step13 Step14 Step15 A

Ready Average: 7.41666667 Count: 12 Sum: 89 140%

Level 2: a bit scarier



SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Watch Window Calculation Options

D3 =A5:Q5 C1:C15

What does this mean?

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3				3	13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13		1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12
5	5		2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12
6	5		3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12
7	10		4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12
8	14		5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12
9	10		6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12
10	8		7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12
11	11		8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12
12	10		9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12
13	13		10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12
14	13		11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13
15	14		12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14
16																		
17																		
18																		

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3

Ready 140%

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File Home Insert Page Layout Formulas Data Review View Developer Team

fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library

Name Manager Define Name Use in Formula Create from Selection Defined Names

Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing

Watch Window Calculation Options Calculation

SUM x ✓ fx =A5:Q5 C1:C15

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3				=A5:Q5 C1	13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3

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SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Insert Function AutoSum Logical Lookup & Reference Define Name Trace Precedents Show Formulas
 Recently Used Text Math & Trig Use in Formula Trace Dependents Error Checking Watch Window
 Financial Date & Time More Functions Name Manager Create from Selection Remove Arrows Evaluate Formula Calculation Options
 Function Library Defined Names Formula Auditing Calculation

D3 =A5:Q5 C1:C15

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3				3	13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step10 Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3

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File Home Insert Page Layout Formulas Data Review View Developer Team

fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library

Name Manager Define Name Use in Formula Create from Selection Defined Names

Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing

Watch Window Calculation Options Calculation

SUM x ✓ fx =Index

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4

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Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions

Function Library

Name Manager Define Name Use in Formula Create from Selection Defined Names

Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing

Watch Window Calculation Options Calculation

SUM x ✓ fx =IF(E\$2=\$D4,\$A4,IF(E\$2=\$B4,\$C4,E3))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	=IF(E	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step10 Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation

SUM x ✓ fx =IF(Index E:E=\$D4,\$A4,IF(E\$2=\$B4,\$C4,E3))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	=IF(In	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step10 Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3

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File Home Insert Page Layout Formulas Data Review View Developer Team

fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

SUM x ✓ fx =IF(Index=\$D4,\$A4,IF(E\$2=\$B4,\$C4,E3))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	=IF(In	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4

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File Home Insert Page Layout Formulas Data Review View Developer Team

Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation Formula Auditing

SUM Min

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2	↓	↓	↓	↓	1	2	3	4	5	6	7	8	9	10	11	12	13	
3	↓	↓	↓	↓	13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4

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SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation

SUM x ✓ fx =IF(Index=\$D4,\$A4,IF(E\$2=\$B4,\$C4,E3))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	=IF(In	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4

Edit 140%

SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation

SUM \times \checkmark fx =IF(Index=IndexMin,Swap,IF(Index=IndexSwap,Min,E3))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	=IF(In	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4

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SUM \times \checkmark fx $=IF(Index=IndexMin,Swap,IF(Index=IndexSwap,Min,E3))$

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	=IF(In	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4

Edit 140%

More named ranges

HELLO.

my name is

A2:B7

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library

Name Manager Define Name Use in Formula Create from Selection Defined Names

Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing

Watch Window Calculation Options Calculation

B3

A B C D E F G H I J K

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

New Name

Name: AllYouNeed

Scope: Workbook

Comment:

Refers to: =BStep5!\$B\$3

OK Cancel

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready 140%

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File Home Insert Page Layout Formulas Data Review View Developer Team

fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

B3

A B C D E F G H I J K

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

New Name

Name: AllYouNeed

Scope: Workbook

Comment:

Refers to: =

OK Cancel

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Enter 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

B3

A B C D E F G H I J K

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

New Name

Name: AllYouNeed

Scope: Workbook

Comment:

Refers to: ="Love"

OK Cancel

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Enter 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

SUM x ✓ fx =AllYouNeed

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		ouNeed									
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

B3 =AllYouNeed

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready 140%

Paolo Nutini

these streets



However much I love you,
you will always love me
more

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

C3 =MyLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Edit Name

Name: MyLove

Scope: Workbook

Comment:

Refers to: =15

OK Cancel

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Enter 140%

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File Home Insert Page Layout Formulas Data Review View Developer Team

Insert Function AutoSum Logical Lookup & Reference Define Name Trace Precedents Show Formulas
Recently Used Text Math & Trig Use in Formula Trace Dependents Error Checking
Financial Date & Time More Functions Name Manager Create from Selection Remove Arrows Evaluate Formula Watch Window Calculation Options
Function Library Defined Names Formula Auditing Calculation

C3 =MyLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

New Name

Name: YourLove

Scope: Workbook

Comment:

Refers to: =

OK Cancel

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Enter 140%

SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

C3 15

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

New Name

Name: YourLove

Scope: Workbook

Comment:

Refers to: =1.3*MyLove

OK Cancel

Formula into a named range

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

SUM x ✓ fx =YourLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love	15								
4		YourLove	=YourLove								
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation

C4 =YourLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love	15								
4		YourLove	19.5								
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready 140%

armin van buuren
feat. racoon love you more

Everyday I love you more



ARMIN
VAN BUUREN

.org

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Insert Function AutoSum Logical Lookup & Reference Define Name Trace Precedents Show Formulas
Recently Used Text Math & Trig Use in Formula Trace Dependents Error Checking Watch Window
Financial Date & Time More Functions Create from Selection Remove Arrows Evaluate Formula Calculation Options

Function Library Defined Names Formula Auditing Calculation

C5

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4		Day 1	15								
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready 140%

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Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation Formula Auditing

SUM x ✓ fx =ROW

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4		Day 1		15							
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation

F3 =ROW()

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love				3					
4		Day 1	15								
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

C5 =YesterdaysLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4		Day 1									
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Edit Name

Name: YesterdaysLove

Scope: Workbook

Comment:

Refers to: =ADDRESS(ROW()-1,COLUMN())

OK Cancel

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Enter 140%

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File Home Insert Page Layout Formulas Data Review View Developer Team

fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation Formula Auditing

C5 =YesterdaysLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4		Day 1	15								
5			\$C\$4								
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

The cell above

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

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SelectionSort.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Team

fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

SUM x ✓ fx =INDIRECT("B3")

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love			=INDIRECT("B3")						
4		Day 1		15							
5			\$C\$4								
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6 140%

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fx Insert Function AutoSum Logical Lookup & Reference Define Name Trace Precedents Show Formulas
Recently Used Text Math & Trig Use in Formula Trace Dependents Error Checking Watch Window
Financial Date & Time More Functions Create from Selection Remove Arrows Evaluate Formula Calculation Options

Function Library Defined Names Formula Auditing Calculation

E3 =INDIRECT("B3")

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love			Love						
4		Day 1		15							
5			\$C\$4								
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready 140%

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E4 =B3

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love			Love						
4		Day 1	15		Love						
5			\$C\$4								
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready 140%

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Insert Function AutoSum Logical Lookup & Reference Define Name Trace Precedents Show Formulas
Recently Used Text Math & Trig Use in Formula Trace Dependents Error Checking
Financial Date & Time More Functions Name Manager Create from Selection Remove Arrows Evaluate Formula Watch Window
Function Library Defined Names Formula Auditing Calculation Options Calculation

C4 =YesterdaysLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4		Day 1									
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Edit Name

Name: YesterdaysLove

Scope: Workbook

Comment:

Refers to: =INDIRECT(ADDRESS(ROW()-1,COLUMN

OK Cancel

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Point 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation

C5 =YesterdaysLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4		Day 1	15								
5			15								
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

The value in the cell above

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

C5 =YesterdaysLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4		Day 1									
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

New Name

Name: TodaysLove

Scope: Workbook

Comment:

Refers to: =

OK Cancel

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Enter 140%

SelectionSort.xlsx - Microsoft Excel

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Insert Function AutoSum Logical Lookup & Reference Define Name Trace Precedents Show Formulas
Recently Used Text Math & Trig Use in Formula Trace Dependents Error Checking Watch Window
Financial Date & Time More Functions Name Manager Create from Selection Remove Arrows Evaluate Formula Calculation Options
Function Library Defined Names Formula Auditing Calculation

C5 =YesterdaysLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4		Day 1									
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

New Name

Name: TodaysLove

Scope: Workbook

Comment:

Refers to: =YesterdaysLove*1.004

OK Cancel

Just add the 'van Buuren factor'

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Enter 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing Watch Window Calculation Options Calculation

SUM x ✓ fx =TodaysLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4		Day 1	15								
5			=TodaysLc								
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Edit 140%

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Insert Function AutoSum Logical Lookup & Reference Define Name Trace Precedents Show Formulas
Recently Used Text Math & Trig Use in Formula Trace Dependents Error Checking Watch Window Calculation Options
Financial Date & Time More Functions Name Manager Create from Selection Remove Arrows Evaluate Formula Formula Auditing Calculation

Function Library

Defined Names

Formula Auditing

Calculation

C5 =TodaysLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love									
4		Day 1	15								
5		Day 2	15.06								
6		Day 3	15.1202								
7		Day 4	15.1807								
8		Day 5	15.2414								
9		Day 6	15.3024								
10		Day 7	15.3636								
11		Day 8	15.4251								
12		Day 9	15.4868								
13		Day 10	15.5487								
14		Day 11	15.6109								
15		Day 12	15.6734								
16											
17											
18											

Formula in a named range that depends on the cell above it

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready Average: 15.36484348 Count: 11 Sum: 169.0132783 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation

SUM \times \checkmark fx $=IF(Index=IndexMin,Swap,IF(Index=IndexSwap,Min,E3))$

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	$=IF(In$	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4

Edit 140%

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fx Insert Function AutoSum Logical Lookup & Reference Recently Used Text Math & Trig Financial Date & Time More Functions Function Library Name Manager Define Name Use in Formula Create from Selection Defined Names Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Watch Window Calculation Options Calculation Formula Auditing

A3 =PreviousRow

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13		1	1						4	8	11	7	13	9	6	12	
5	5		2	3						4	8	11	7	13	9	6	12	
6	5		3	4						5	8	11	7	13	9	6	12	
7	10		4	5						10	8	11	7	13	9	6	12	
8	14		5	6						10	8	11	7	13	9	14	12	
9	10		6	7						7	8	11	10	13	9	14	12	
10	8		7	8						7	8	11	10	13	9	14	12	
11	11		8	9						7	8	9	10	13	11	14	12	
12	10		9	10						7	8	9	10	13	11	14	12	
13	13		10	11						7	8	9	10	11	13	14	12	
14	13		11	12						7	8	9	10	11	12	14	13	
15	14		12	13						7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Edit Name

Name: PreviousRow

Scope: Workbook

Comment:

Refers to: =INDIRECT(ROW()-1 & ":" & ROW()-1)

OK Cancel

Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Point 140%

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E4 =IF(Index=IndexMin,Swap,IF(Index=IndexSwap,Min,PreviousRow))

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17																		
18																		

Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready 140%

File Edit Format Options Windows Help

```
def selectionSort(List):  
    for IndexSwap in range(len(List)):  
  
        Min = min(List[IndexSwap:])  
        IndexMin = List.index(Min)  
  
        Swap = List[IndexSwap]  
  
        for Index in range(IndexSwap, len(List)):  
  
            if Index == IndexMin:  
                List[Index] = Swap  
  
            elif Index == IndexSwap:  
                List[Index] = Min  
  
    return List
```


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Expector

Editing

[illegible]

Expector



Editing



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C

Translation of Fortran

```
#include <stdio.h>

void pascaltriangle(unsigned int n)
{
    unsigned int c, i, j, k;

    for(i=0; i < n; i++) {
        c = 1;
        for(j=1; j <= 2*(n-1-i); j++) printf(" ");
        for(k=0; k <= i; k++) {
            printf("%3d ", c);
            c = c * (i-k)/(k+1);
        }
        printf("\n");
    }
}

int main()
{
    pascaltriangle(8);
    return 0;
}
```

C

Translation of: Fortran

```
#include <stdio.h>

void pascaltriangle(unsigned int n)
{
    unsigned int c, i, j, k;

    for(i=0; i < n; i++) {
        c = 1;
        for(j=1; j <= 2*(n-1-i); j++) printf(" ");
        for(k=0; k <= i; k++) {
            printf("%3d ", c);
            c = c * (i-k)/(k+1);
        }
        printf("\n");
    }
}

int main()
{
    pascaltriangle(8);
    return 0;
}
```

F#

```
let rec nextrow l =
    match l with
    | [] -> []
    | h :: [] -> [1]
    | h :: t -> h + t.Head :: nextrow t

let pascalTri n = List.scan(fun l i -> 1 :: nextrow l) [1] [1 .. n]

for row in pascalTri(10) do
    for i in row do
        printf "%s" (i.ToString() + ", ")
    printfn "%s" "\n"
```


[illegible]

C

```
#include <stdio.h>
#include <math.h>

#define max(x,y) ((x) > (y) ? (x) : (y))

int main(void)
{
    const int len = sizeof(tri) / sizeof(tri[0]);
    const int base = (sqrt(8*len + 1) - 1) / 2;
    int step      = base - 1;
    int stepc     = 0;

    int i;
    for (i = len - base - 1; i >= 0; --i) {
        tri[i] += max(tri[i + step], tri[i + step + 1]);
        if (++stepc == step) {
            step--;
            stepc = 0;
        }
    }

    printf("%d\n", tri[0]);
    return 0;
}
```

C

```
#include <stdio.h>
#include <math.h>

#define max(x,y) ((x) > (y) ? (x) : (y))

int main(void)
{
    const int len = sizeof(tri) / sizeof(tri[0]);
    const int base = (sqrt(8*len + 1) - 1) / 2;
    int step      = base - 1;
    int stepc     = 0;

    int i;
    for (i = len - base - 1; i >= 0; --i) {
        tri[i] += max(tri[i + step], tri[i + step + 1]);
        if (++stepc == step) {
            step--;
            stepc = 0;
        }
    }

    printf("%d\n", tri[0]);
    return 0;
}
```

Haskell

```
parse = map (map read . words) . lines
f x y z = x + max y z
g xs ys = zipWith3 f xs ys $ tail ys
solve = head . foldr1 g
main = readFile "triangle.txt" >>= print . solve . parse
```

2001financialstatements.xlsx - Microsoft Excel

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Font

Alignment

General

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Number

Conditional Formatting

Format as Table

Styles

Insert

Delete

Cells

Σ AutoSum

Fill

Clear

Sort & Filter

Find & Select

Editing

AF52

	A	B	C	D
1	Consolidated Statements of Shareholders' Equity			
2	[DOLLARS IN THOUSANDS]			
3				
4				
5				
6				
7		Common Shares		Additional
8		Number	Par Value	Capital
9	Balance, January 1, 1999	69,494,483	\$ 86,868	\$ 43,281
10				
11	Net income			
12	Translation adjustment			
13	Pensions			
14	Unrealized loss on investment securities			
15	Other comprehensive income			
16	Comprehensive income			
17	Stock options exercised	108,104	134	1,918
18	Unearned compensation	149,799	188	3,933
19	Performance shares	20,397	26	686
20	Procomp and Nexus acquisitions	1,710,214	2,138	37,351
21	Dividends declared and paid			
22	Treasury shares			
23				
24	Balance, December 31, 1999	71,482,997	\$ 89,354	\$ 87,169
25	Net income			
26	Translation adjustment			
27	Pensions			
28	Unrealized loss on investment securities			
29	Other comprehensive loss			
30	Comprehensive income			
31	Stock options exercised	273,238	343	5,444
32	Unearned compensation	247,635	308	5,583
33	Performance shares	15,335	19	334
34	Dividends declared and paid			
35	Treasury shares			
36				
37	Balance, December 31, 2000	536,208	\$ 90,024	\$ 98,530
38	Net income			
39	Translation adjustment			
40	Pensions			
41	Unrealized gain on investment securities			
42	Other comprehensive loss			
43	Comprehensive income			
44	Stock options exercised	176,395	221	4,860
45	Unearned compensation			
46	Dividends declared and paid			
47	Treasury shares			
48				
49	Balance, December 31, 2001	712,603	\$ 90,245	\$ 103,390
50				
51				

```

private static string HashRow(string tableName, Record rec
{
    int fieldCount = record.GetFieldCount();
    StringBuilder rowHash = new StringBuilder("|");

    for (int i = 1; i <= fieldCount; i++)
    {
        if (record.IsNull(i))
        {
            rowHash.Append("null|");
        }
        else
        {
            // skip the value of ProductCode
            if (tableName == "Property"
                && i == 2
                && "|ProductCode|" == rowHash.ToString())
            {
                continue;
            }
            else if (sequenceColumn == i) // skip seq
            {
                continue;
            }

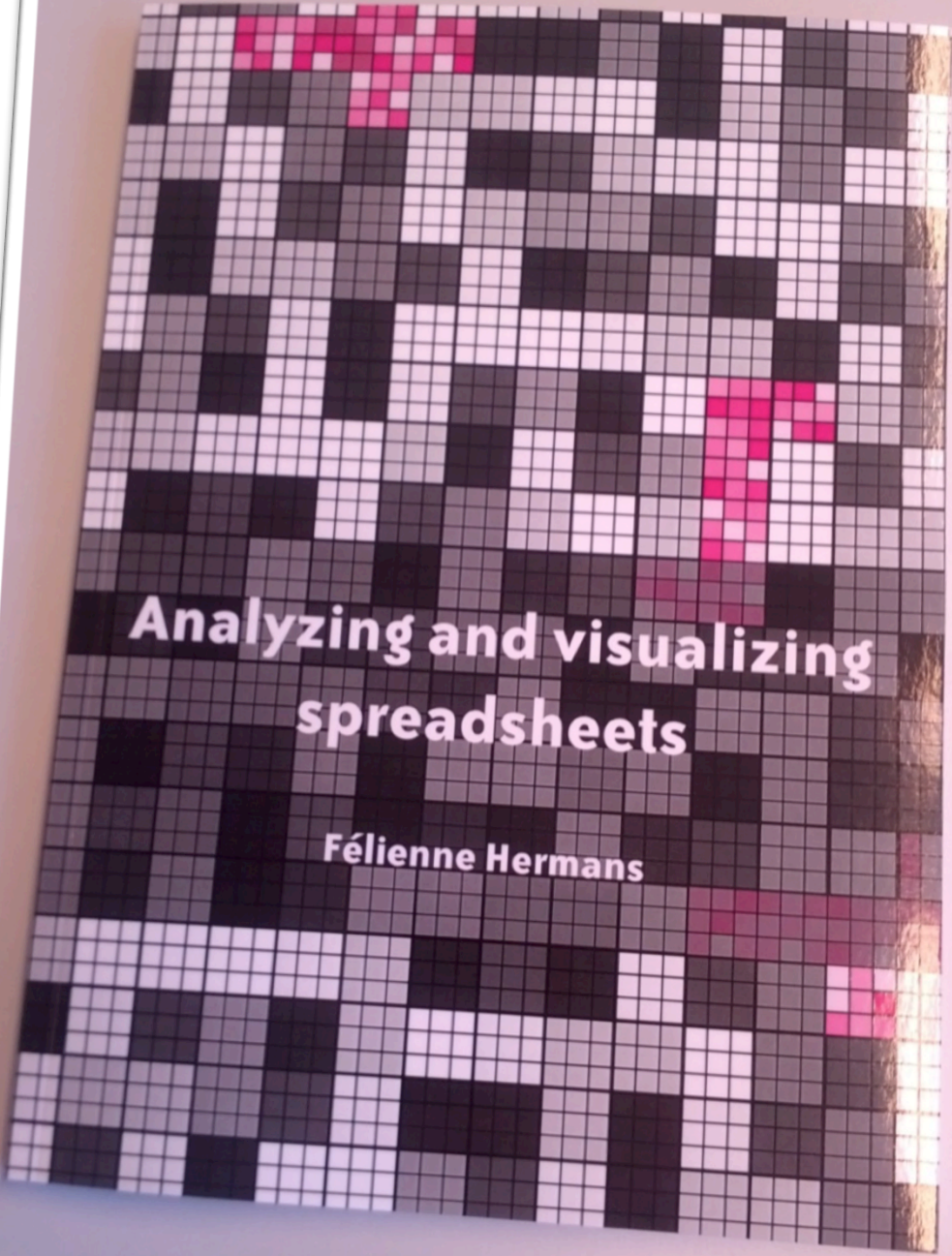
            rowHash.Append(record.GetString(i));
        }
    }

    rowHash.Append("binary|");

    return rowHash.ToString();
}

```

So if spreadsheets are code, can we apply software engineering methods?



Analyzing and visualizing spreadsheets

Félicienne Hermans

A stylized, high-contrast portrait of Barack Obama. The image uses a limited color palette of red, blue, and yellow. The background is split into a red upper right and a blue lower left. The text "YES WE CAN." is written in a bold, blue, sans-serif font with a white outline, positioned in the upper right quadrant. The portrait itself is composed of large, flat areas of color, with the face in yellow and blue, and the hair and suit in red and blue. The overall style is reminiscent of a political poster or a graphic design element.

**YES WE
CAN.**

A close-up, low-angle shot of Bumblebee's head and upper chest. The robot is primarily yellow with black and silver mechanical details. The background is dark and filled with out-of-focus mechanical parts, suggesting a workshop or a pile of scrap metal. The lighting is dramatic, highlighting the metallic textures and sharp angles of the robot's design.

**So, we built BumbleBee:
a refactoring tool for spreadsheets**

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Find applicable rewrites
Rewrites possible
Preview

Apply in Range
Apply in Sheet
Apply Everywhere

Basic Options

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2	StudentId	Homework	Classwork	Exam	TestsTaken	Total	Homework	Classwork	Exam	TestsTaken	Total	
3	4150		56	73	2	-	57	71	53	3	60.33333333	
4	5838	95	88	84	3	89	80	71	56	3	69	
5	8043	80		62	2	-	81		68	2	-	
6	2115	86	98	96	3	93.33333333	77	99	96	3	90.66666667	
7	8382	64	97	81	3	80.66666667	76	71	89	3	78.66666667	
8												
9	Statistics	Math	Chemistry									
10	Highest score	93.33333333	90.66666667									
11	Lowest score	80.66666667	60.33333333									
12	Average	87.66666667	74.66666667									
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												

Ready

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So, we built BumbleBee:
a refactoring tool for spreadsheets

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Find applicable rewrites
 Rewrites possible
 Preview

Apply in Range Initialize
 Apply in Sheet
 Apply Everywhere

Basic Options

A1

	A	B	C	D	E	F	G	H	I	J	K	L
1		Math					Chemistry					
2	StudentId	Homework	Classwork	Exam	TestsTaken	Total	Homework	Classwork	Exam	TestsTaken	Total	
3	4150		56	73	2	-	57	71	53	3	60.33333333	
4	5838	95	88	84	3	89	80	71	56	3	69	
5	8043	80		62	2	-	81		68	2	-	
6	2115	86	98	96	3	93.33333333	77	99	96	3	90.66666667	
7	8382	64	97	81	3	80.66666667	76	71	89	3	78.66666667	
8												
9	Statistics	Math	Chemistry									
10	Highest score	93.33333333	90.66666667									
11	Lowest score	80.66666667	60.33333333									
12	Average	87.66666667	74.66666667									
13												
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20												
21												
22												
23												
24												

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Find applicable rewrites
 Rewrites possible
 Preview

Apply in Range Initialize
 Apply in Sheet
 Apply Everywhere

Basic Options

B12 fx =SUM(F3:F7)/COUNT(F3:F7)

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
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24												

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Find applicable rewrites

Rewrites possible

Preview

Apply in Range Initialize

Apply in Sheet

Apply Everywhere

Basic Options

B12 $=SUM(F3:F7)/COUNT(F3:F7)$

	A	B	C	D	E	F	G	H	I	J	K	L
1		Math					Chemistry					
2	StudentId	Homework	Classwork	Exam	TestsTaken	Total	Homework	Classwork	Exam	TestsTaken	Total	
3	4150		56	73	2	-	57	71	53	3	60.33333333	
4	5838	95	88	84	3	89	80	71	56	3	69	
5	8043	80		62	2	-	81		68	2	-	
6	2115	86	98	96	3	93.33333333	77	99	96	3	90.66666667	
7	8382	64	97	81	3	80.66666667	76	71	89	3	78.66666667	
8												
9	Statistics	Math	Chemistry									
10	Highest score	93.33333333	90.66666667									
11	Lowest score	80.66666667	60.33333333									
12	Average	87.66666667	74.66666667									
13												
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24												

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Find applicable rewrites
 Rewrites possible SUM and COUNT to AVER...
 Preview AVERAGE(F3:F7)
 Basic Options

Apply in Range Initialize
 Apply in Sheet
 Apply Everywhere

B12 f_x =SUM(F3:F7)/COUNT(F3:F7)

	A	B	C	D	E	F	G	H	I	J	K	L
1		Math					Chemistry					
2	StudentId	Homework	Classwork	Exam	TestsTaken	Total	Homework	Classwork	Exam	TestsTaken	Total	
3	4150		56	73	2	-	57	71	53	3	60.33333333	
4	5838	95	88	84	3	89	80	71	56	3	69	
5	8043	80		62	2	-	81		68	2	-	
6	2115	86	98	96	3	93.33333333	77	99	96	3	90.66666667	
7	8382	64	97	81	3	80.66666667	76	71	89	3	78.66666667	
8												
9	Statistics	Math	Chemistry									
10	Highest score	93.33333333	90.66666667									
11	Lowest score	80.66666667	60.33333333									
12	Average	87.66666667	74.66666667									
13												
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Find applicable rewrites
 Rewrites possible SUM and COUNT to AVER...
 Preview AVERAGE(F3:F7)
 Basic Options

Apply in Range Initialize
 Apply in Sheet
 Apply Everywhere

B12 f_x =SUM(F3:F7)/COUNT(F3:F7)

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2												
3												
4												
5												
6												
7												
8												
9												
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File Home Insert Page Layout Formulas Data Review View Add-Ins VBA Load Test BumbleBee Expector

Find applicable rewrites
 Rewrites possible SUM and COUNT to AVER...
 Preview AVERAGE(F3:F7)
 Apply in Range Initialize
 Apply in Sheet
 Apply Everywhere

Basic Options

B12 fx =AVERAGE(F3:F7)

	A	B	C	D	E	F	G	H	I	J	K	L
1		Math					Chemistry					
2	StudentId	Homework	Classwork	Exam	TestsTaken	Total	Homework	Classwork	Exam	TestsTaken	Total	
3	4150		56	73	2	-	57	71	53	3	60.33333333	
4	5838	95	88	84	3	89	80	71	56	3	69	
5	8043	80		62	2	-	81		68	2	-	
6	2115	86	98	96	3	93.33333333	77	99	96	3	90.66666667	
7	8382	64	97	81	3	80.66666667	76	71	89	3	78.66666667	
8												
9	Statistics	Math	Chemistry									
10	Highest score	93.33333333	90.66666667									
11	Lowest score	80.66666667	60.33333333									
12	Average	87.66666667	74.66666667									
13												
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24												

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File Home Insert Page Layout Formulas Data Review View Add-Ins VBA Load Test BumbleBee Expector

Find applicable rewrites
Rewrites possible
Preview

Apply in Range Initialize
Apply in Sheet
Apply Everywhere

Basic Options

	A	B	C	D	E	F	G	H	I
1	[c]	ROUND([c],0)	5	ROUND					
2	[c]/[d]	IF([d]<>0,[c]/[d],"cannot divide by 0")	4	Add guard					
3	IF([c]<[d],[c],[d])	MIN([c],[d])	3	IF to MIN					
4	IF([c]>[d],[c],[d])	MAX([c],[d])	3	IF to MAX					
5	SUM({r})/COUNT({r})	AVERAGE({r})	2	SUM and COUNT to AVERAGE					
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16	<h1>The transformations are entirely programmable, with a small language</h1>								
17									
18									
19									
20									
21									
22									
23									
24									
25									

Ready

2011 2012 2013 Transformations

100%



REFACTORING

IMPROVING THE DESIGN
OF EXISTING CODE

MARTIN FOWLER

With contributions by Robert Kelsey, Andrew Hunt,
William S. Opersky, and others

Foreword by Bruce Eckstein

**And of course, if you say refactoring,
you say ...**



**And of course, if you say refactoring,
you say testing**

assetmanagement.xlsx - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA VIEW DEVELOPER Expecter Felienne Hermans

Paste Font Alignment Number Styles Cells Editing

D10 : \times \checkmark fx =IF(SUM(D4:D8)<>100%,"ERROR","100%")

	A	B	C	D	E	F	G
1	Name of Program: Asset Management of Federally-Owned Real Property						
2	Section I: Program Purpose & Design (Yes,No)						
3		Questions	Ans.	Weighting	Weighted Score		
4	1	Is the program purpose clear?	Yes	20%	0.2		
5	2	Does the program address a specific interest, problem or need?	Yes	20%	0.2		
6	3	Is the program designed to have a significant impact in addressing the interest, problem or need?	No	20%	0.0		
7	4	Is the program designed to make a unique contribution in addressing the interest, problem or need (i.e., not needlessly redundant of any other Federal, state, local or private efforts)?	No	20%	0.0		
8	5	Is the program optimally designed to address the interest, problem or need?	Yes	20%	0.2		
9							
10	Total Section Score			100%	60%		
11							
12							

Questionnaire

READY 80%

assetmanagement.xlsx - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA VIEW DEVELOPER **Expector** Felienne Hermans

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9							
10	Total Section Score			100%	60%		
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12							

Questionnaire

READY 80%

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Find existing tests in this spreadsheet
Run all tests
Color tests (green = passing, red = failing)
Find and run tests

Show me what is tested
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How well is this spreadsheet tested?
Understand quality of tests

I want to test a complex formula
I want to test a formula with a big value
I want to test a formula with many precedents
Add new tests

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9							
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9							
10	Total Section Score				100%	60%	
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	A	B	C	D	E	F	G
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3		Questions	Ans.	Weighting	Weighted Score		
4	1	Is the program purpose clear?	Yes	20%	0.2		
5	2	Does the program address a specific interest, problem or need?	Yes	20%	0.2		
6	3	Is the program designed to have a significant impact in the community?	No	20%	0.0		
7	4	Is the program designed to address the needs of the private sector?			0.0		
8	5	Is the program optimally designed to address the interest, problem or need?	Yes	20%	0.2		
9	Total Section Score				100%	60%	

All tests detected

Save tests Deselect all

The cell on Questionnaire!D10 expresses that SUM(D4:D8) should be 100% ☒

Questionnaire

READY 80%

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1	Name of Program: Asset Management of Federally-Owned Real Property						
2	Section I: Program Purpose & Design (Yes,No)						
3					Weighting	Weighted Score	
4	1	Is the program purpose...			20%	0.2	
5	2	Does the program need?			20%	0.2	
6	3	Is the program designed addressing the inter...			20%	0.0	
7	4	Is the program designed addressing the inter needlessly redundant private efforts)?			20%	0.0	
8							
9	5	Is the program optimally designed to address the interest, problem or need?	Yes		20%	0.2	
10	Total Section Score				100%	60%	
11							
12							

Tests passed: (1/1)
=NOT(SUM(Questionnaire!D4:D8) <> 100%)
Tests failed: (0/1)
OK

Questionnaire Expector-Tests

READY 80%

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3				Ans.	Weighting	Weighted Score	
4	1	Is the program purpose...	Yes	20%	0.2		
5	2	Does the program address the need?	Yes	20%	0.2		
6	3	Is the program design addressing the interest...	No	20%	0.0		
7	4	Is the program design addressing the interest (needlessly redundant private efforts)?	No	20%	0.0		
8	5	Is the program optimally designed to address the interest, problem or need?	Yes	20%	0.2		
9							
10	Total Section Score				100%	60%	
11							
12							

Tests passed: (1/1)
=SUM(Questionnaire!D4:D8) = 100%
Tests failed: (0/1)

OK

Questionnaire Expector-Tests

READY 80%

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SUM : \times \checkmark f_x =IF(SUM(D4:D8)<>100%,"ERROR","100%")

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9							
10	Total Section Score				=IF(SUM(D4:D8)<>100%	60%	
11							
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Questionnaire Expector-Tests

EDIT 80%

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10	Total Section Score			100%	60%		
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12							

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9							
10	Total Section Score			100%	60%		
11							
12							

Questionnaire Expector-Tests

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E4 : \times \checkmark fx =IF(C4="yes",(1*D4),IF(C4="no",(0*D4),""))

	A	B	C	D	E	F	G
1	Name of Program: Asset Management of Federally-Owned Real Property						
2	Section I: Program Purpose & Design (Yes,No)						
3		Questions	Ans.	Weighting	Weighted Score		
4	1			%	0.2		
5	2			%	0.2		
6	3			%	0.0		
7	4			%	0.0		
8		addressing the interest, problem or need (i.e., not needlessly redundant of any other Federal, state, local or private efforts)?					
9	5	Is the program optimally designed to address the interest, problem or need?	Yes	20%	0.2		
10	Total Section Score				100%	60%	
11							
12							

Add new tests

You could a a test for the cell on 'Questionnaire'!E4: =IF(C4="yes",(1*D4),IF(C4="no",(0*D4),""))

Yes, make tests No, thanks

Questionnaire Expector-Tests

READY 80%

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3		Questions	Ans.	Weighting	Weighted Score		
4	1			%	0.2		
5	2			%	0.2		
6	3			%	0.0		
7	4			%	0.0		
8	5			%	0.2		
9				%			
10	Total			%	60%		
11							
12							

Add new tests

You could a a test for the cell on 'Questionnaire'!E4: =IF(C4="yes",(1*D4),IF(C4="no",(0*D4),""))

Yes, make tests No, thanks

☐ This cell should be a number

☒ Value should be above 0

☒ Value should be below 1

Save

Questionnaire Expector-Tests

READY 80%

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$=IF(C4="yes",(1*D4),IF(C4="no",(0*D4),""))$

	A	B	C	D	E	F	G
1	Name of Program: Asset Management of Federally-Owned Real Property						
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3		Questions	Ans.	Weighting	Weighted Score		
4	1			%	0.2		
5	2			%	0.2		
6	3			%	0.0		
7	4			%	0.0		
8	5			%	0.2		
9				%			
10	Total			%	60%		

Add new test

You could add a test to this spreadsheet

Yes, make test

☐ This cell

☒ Value should be above 0

☒ Value should be below 1

Save

Wonderful, you have increased coverage from 6% to 8%

OK

Questionnaire Expecter-Tests

READY 80%

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3					Weighting	Weighted Score	
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5	2	Does the program need?			20%	0.2	
6	3	Is the program designed addressing the interest, problem or need?			20%	0.0	
7	4	Is the program designed addressing the interest, problem or need (needlessly redundant private efforts)?			20%	0.0	
8	5	Is the program optimally designed to address the interest, problem or need?	Yes		20%	0.2	
9							
10	Total Section Score				100%	60%	
11							
12							

Tests passed: (3/3)
=NOT(SUM(Questionnaire!D4:D8) <> 100%)
=Questionnaire!E4 > 0
=Questionnaire!E4 < 1

Tests failed: (0/3)

OK

Questionnaire Expector-Tests

READY 80%



**Available from my website:
felienn.com/expector**

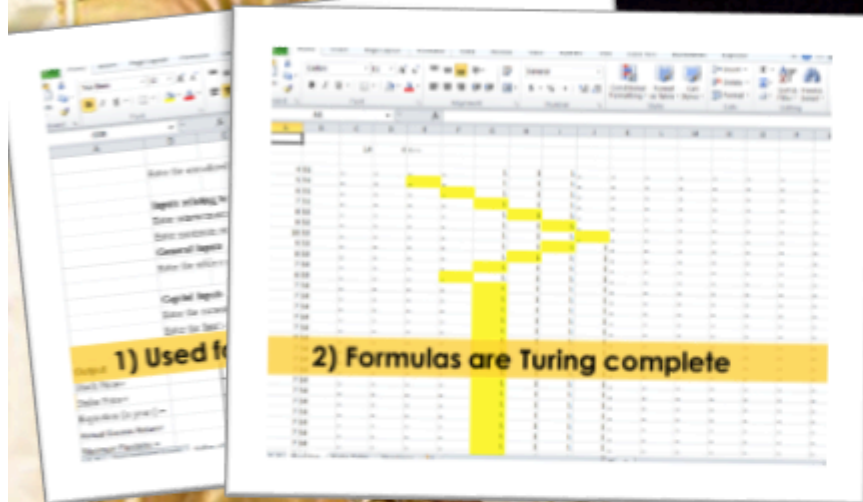
Spreadsheets are code



Spreadsheets are code

1) Used for similar problems

Spreadsheets are code



Spreadsheets are code

Only 33% of people use spreadsheets. Average sheet is 5 years old. Spreadsheets can have a long life 5 years on average.

- 1) Used for
- 2) Formulas
- 3) They suffer from the same problems

The image displays two overlapping screenshots of a Microsoft Excel spreadsheet. The left screenshot shows a 'New Report' dialog box with a tree view on the left. The tree view has a root node 'Sales' with several sub-nodes: 'Sales for extended', 'Reports relating to', 'Sales information', 'Sales statistics', 'General Reports', 'Sales for all years', 'Capital Reports', 'Sales for income', and 'Sales for Dept'. The right screenshot shows a data table with columns for 'Sales' and 'Profit' across various categories. The table has a header row with 'Sales' and 'Profit' and a data row with 'Sales' and 'Profit'.

The screenshot shows a Microsoft Excel spreadsheet. The title bar at the top reads 'Microsoft Excel - [Book1]'. The ribbon is set to 'Formulas'. The spreadsheet has a yellow header row (row 1) and a yellow footer row (row 10). The data is organized into columns A, B, C, and D. Column A contains names, and columns B, C, and D contain numerical values. The title '2) Formulas' is overlaid on the bottom half of the image.

	A	B	C	D
1				
2				
3				
4				
5				
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99				
100				

Only 33% of a manual

Average sheet is used by 3 people

Spreadsheets can have a long life. 5 years on average

3) They suffer from the same problems

Spreadsheets are code



Spreadsheets are code

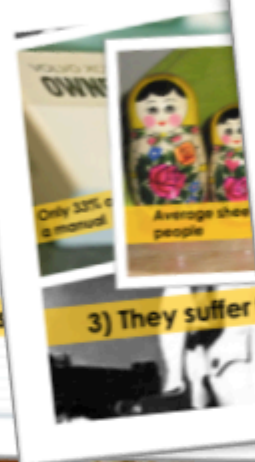
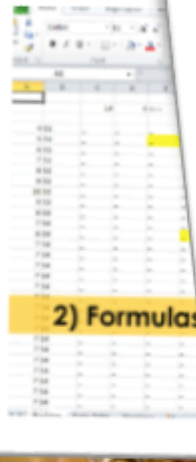
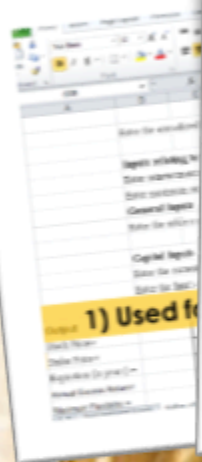
The collage includes several elements:

- A screenshot of an Excel spreadsheet with a table of data.
- A screenshot of an Excel spreadsheet showing a formula bar with the text "1) Used for".
- A screenshot of an Excel spreadsheet showing a formula bar with the text "2) Formulas".
- A screenshot of a document with the text "3) They suffer".
- A graphic with the text "live programming" and an illustration of a tree.
- A graphic with the text "pure functional" and the Excel logo.
- A graphic with the text "Excel" and "A Purely Functional Language" followed by a list of features: "featuring static typing, higher-order function polymorphism, type classes and monadic effect".

Spreadsheets are code



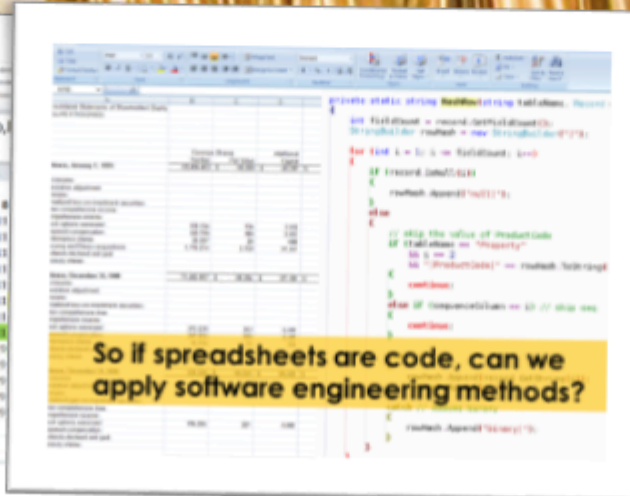
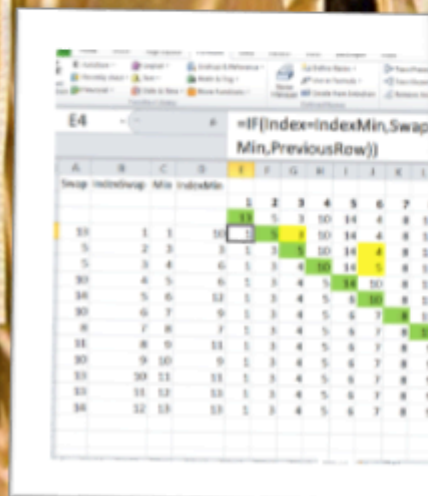
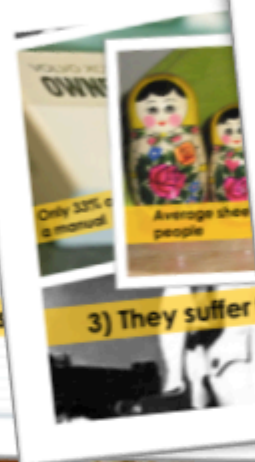
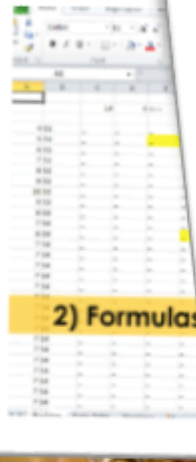
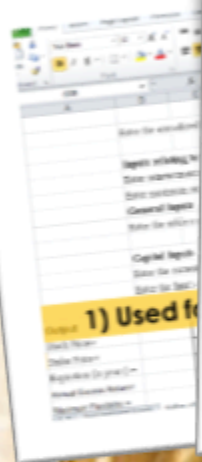
Spreadsheets are code



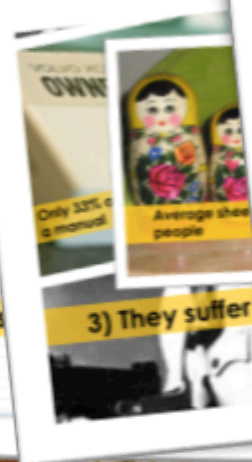
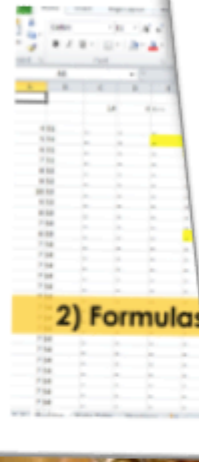
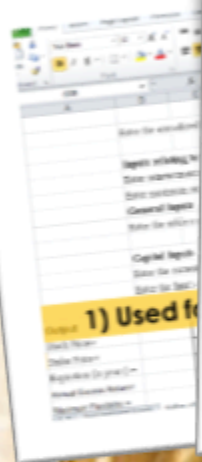
Complex formula in cell E4: `=IF(Index=IndexMin_Swap,IF(Index=IndexSwap,Min,PreviousRow))`

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Swap IndexMin_Swap	Min IndexMin																	
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
5	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
10	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
14	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
10	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
8	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
11	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
10	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
13	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
13	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
14	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

Spreadsheets are code



Spreadsheets are code



	A	B	C	D	E	F	G	H	I	J	K
1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1	1	1

	A	B	C	D	E	F	G	H	I	J	K
1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1	1	1

	A	B	C	D	E	F	G	H	I	J	K
1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1	1	1

So if spreadsheets are
apply software eng

Spreadsheets are code

1) Used for...

2) Formulas

3) They suffer from...

live programming

pure functional

Excel
A Purely functional programming language

Lingua franca of computing

So if spreadsheets can apply software engineering...

`=IF(Index<IndexMin_Swap, Min,PreviousRow)`

`=SUM(D4:D8)<100%, "ERROR", "100%"`

Student	Math	Science	History	Art	Physical Education	Language Arts	Math	Science	History	Art	Physical Education	Language Arts
1	85	78	92	88	75	80	85	78	92	88	75	80
2	78	82	85	79	88	72	78	82	85	79	88	72
3	92	88	80	85	78	82	92	88	80	85	78	82
4	88	75	82	78	85	75	88	75	82	78	85	75
5	75	85	88	82	78	85	75	85	88	82	78	85
6	82	78	85	88	75	82	82	78	85	88	75	82
7	88	82	78	85	88	78	88	82	78	85	88	78
8	78	85	88	75	82	85	78	85	88	75	82	85
9	85	78	82	88	75	85	85	78	82	88	75	85
10	82	88	78	85	82	82	82	88	78	85	82	82
11	88	82	85	78	88	88	88	82	85	78	88	88
12	78	85	88	82	78	85	78	85	88	82	78	85
13	85	78	82	88	75	85	85	78	82	88	75	85
14	82	88	78	85	82	82	82	88	78	85	82	82
15	88	82	85	78	88	88	88	82	85	78	88	88
16	78	85	88	82	78	85	78	85	88	82	78	85
17	85	78	82	88	75	85	85	78	82	88	75	85
18	82	88	78	85	82	82	82	88	78	85	82	82
19	88	82	85	78	88	88	88	82	85	78	88	88
20	78	85	88	82	78	85	78	85	88	82	78	85
21	85	78	82	88	75	85	85	78	82	88	75	85
22	82	88	78	85	82	82	82	88	78	85	82	82
23	88	82	85	78	88	88	88	82	85	78	88	88
24	78	85	88	82	78	85	78	85	88	82	78	85
25	85	78	82	88	75	85	85	78	82	88	75	85
26	82	88	78	85	82	82	82	88	78	85	82	82
27	88	82	85	78	88	88	88	82	85	78	88	88
28	78	85	88	82	78	85	78	85	88	82	78	85
29	85	78	82	88	75	85	85	78	82	88	75	85
30	82	88	78	85	82	82	82	88	78	85	82	82
31	88	82	85	78	88	88	88	82	85	78	88	88
32	78	85	88	82	78	85	78	85	88	82	78	85
33	85	78	82	88	75	8						

1) Used for

2) Formulas

3) They suffer

live programming

pure functional

Lingua franca
of computing

So if spreadsheets can apply software eng

Spreadsheets are code

1) Used for

2) Formulas

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Lingua franca of computing

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- www.felienne.com
- www.spreadsheetlab.org

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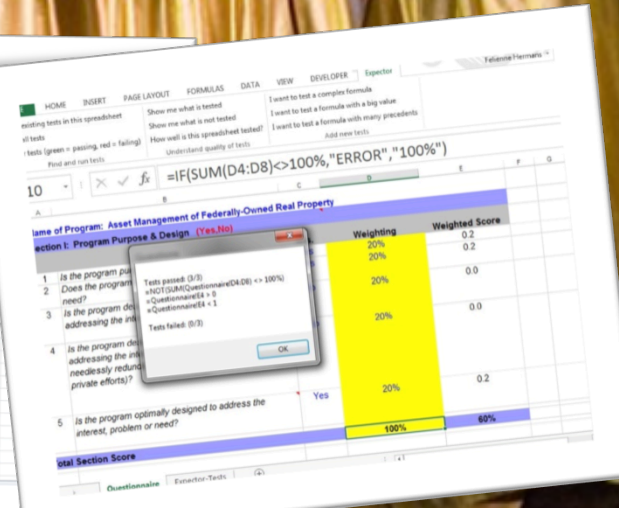
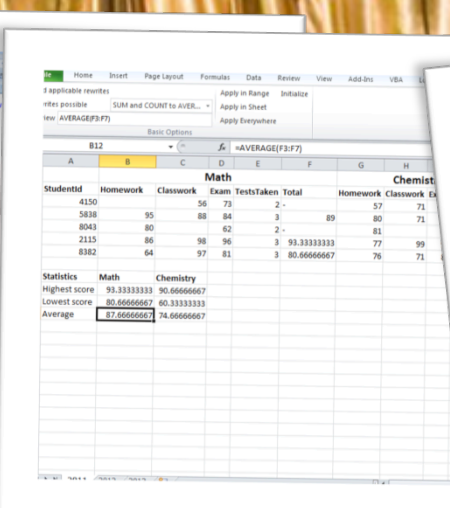
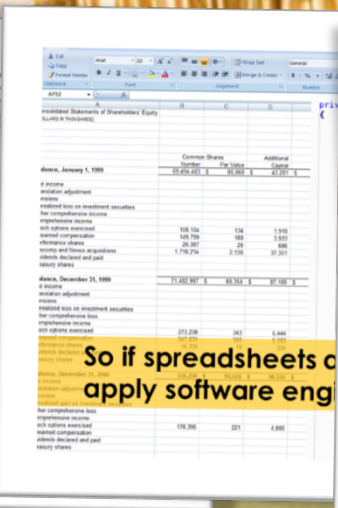
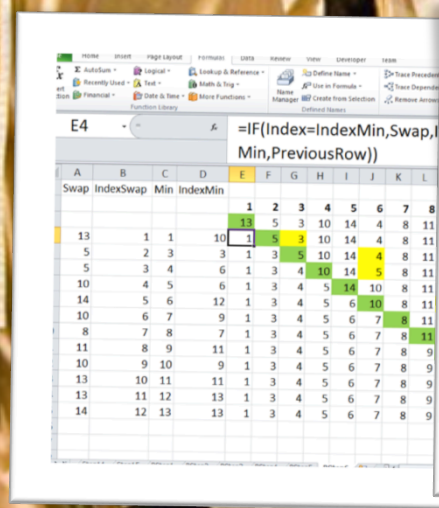
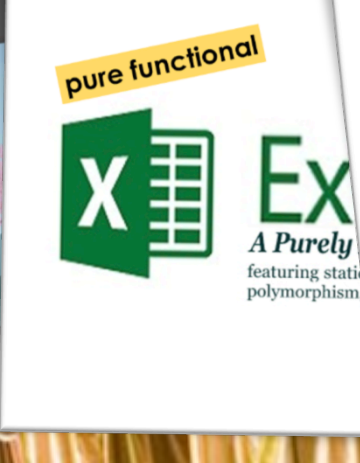
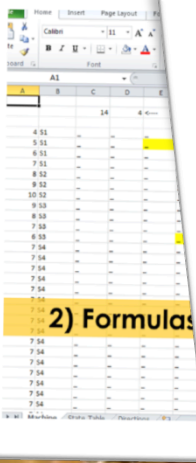


Please

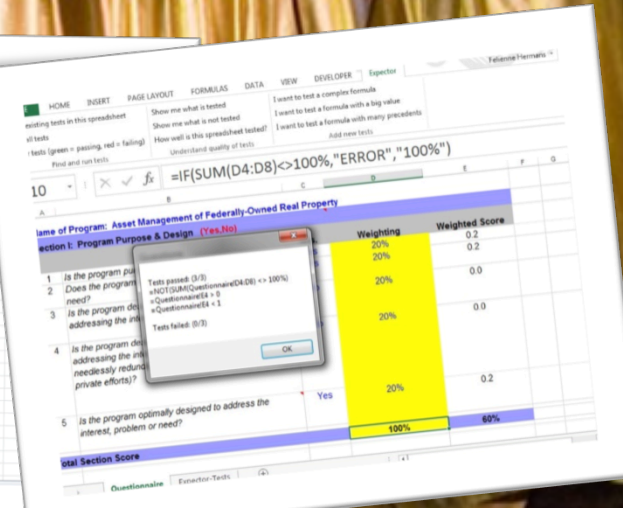
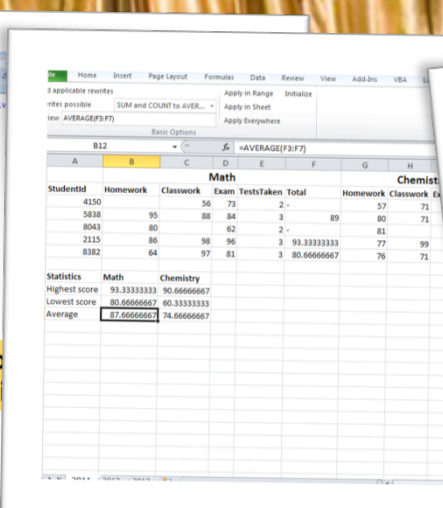
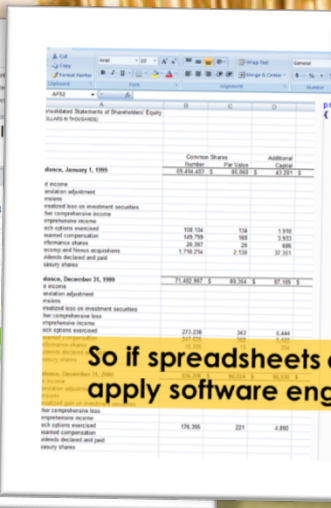
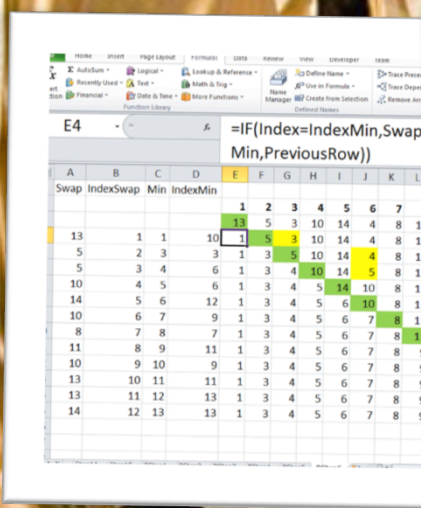
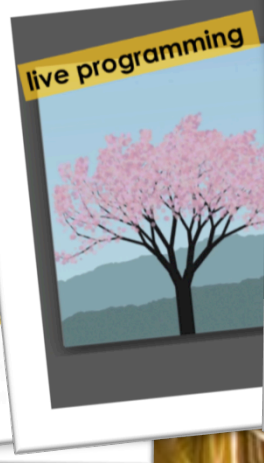
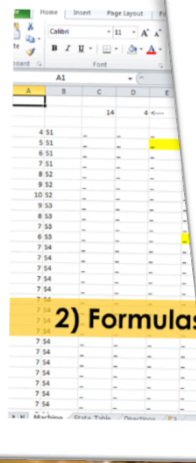
**Remember to
rate session**

Thank you!

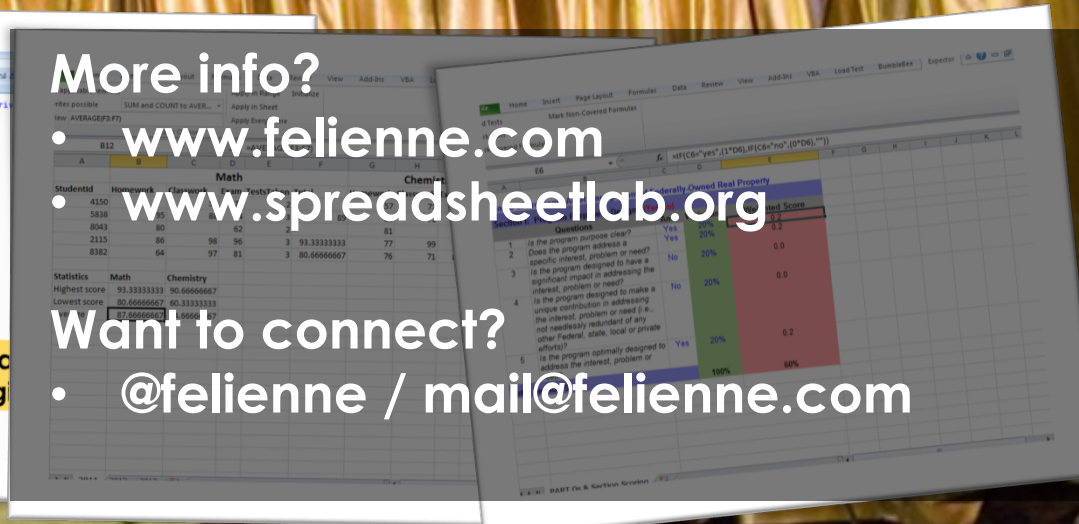
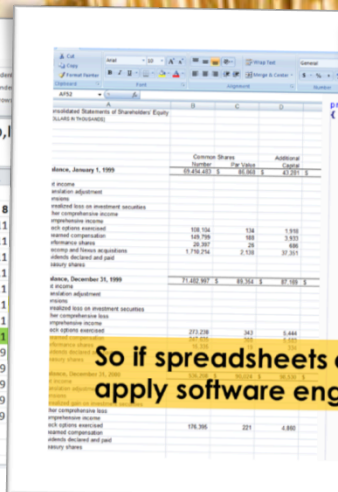
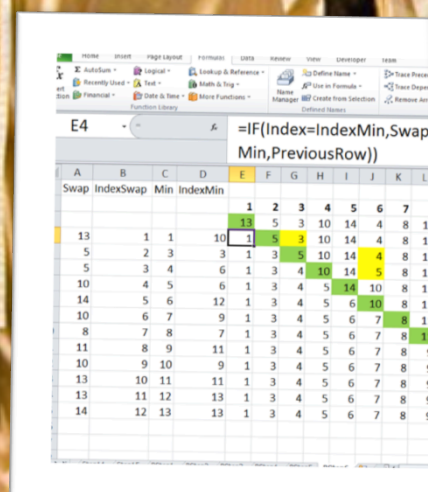
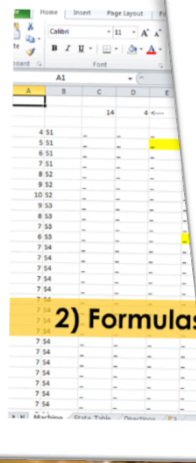
Spreadsheets are code



Spreadsheets are code



Spreadsheets are code



More info?

• www.felienne.com

• www.spreadsheetlab.org

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L17 =Index

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17				IndexRange	1	2	3	4	5	6	7	8	9	10	11	12	13	

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4

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Name Manager Define Name Use in Formula Create from Selection Defined Names

Trace Precedents Trace Dependents Remove Arrows Show Formulas Error Checking Evaluate Formula Formula Auditing

Watch Window Calculation Options Calculation

SUM x ✓ fx =Index

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Swap	IndexSwap	Min	IndexMin														
2					1	2	3	4	5	6	7	8	9	10	11	12	13	
3					13	5	3	10	14	4	8	11	7	1	9	6	12	
4	13	1	1	10	1	5	3	10	14	4	8	11	7	13	9	6	12	
5	5	2	3	3	1	3	5	10	14	4	8	11	7	13	9	6	12	
6	5	3	4	6	1	3	4	10	14	5	8	11	7	13	9	6	12	
7	10	4	5	6	1	3	4	5	14	10	8	11	7	13	9	6	12	
8	14	5	6	12	1	3	4	5	6	10	8	11	7	13	9	14	12	
9	10	6	7	9	1	3	4	5	6	7	8	11	10	13	9	14	12	
10	8	7	8	7	1	3	4	5	6	7	8	11	10	13	9	14	12	
11	11	8	9	11	1	3	4	5	6	7	8	9	10	13	11	14	12	
12	10	9	10	9	1	3	4	5	6	7	8	9	10	13	11	14	12	
13	13	10	11	11	1	3	4	5	6	7	8	9	10	11	13	14	12	
14	13	11	12	13	1	3	4	5	6	7	8	9	10	11	12	14	13	
15	14	12	13	13	1	3	4	5	6	7	8	9	10	11	12	13	14	
16																		
17				IndexRange	1	2	3	4	5	6	7	=Index	9	10	11	12	13	

Step11 Step12 Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4

Edit 140%



Whitney
Houston

my love is
your love

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Financial Date & Time More Functions Create from Selection Remove Arrows Evaluate Formula Calculation Options

Function Library Defined Names Formula Auditing Calculation

C3

Love

New Name

Name: MyLove
Scope: Workbook
Comment:
Refers to: =YourLove

OK Cancel

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

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C3 =MyLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love	#NAME?								
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

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Recently Used Text Math & Trig Use in Formula Trace Dependents Error Checking Watch Window
Financial Date & Time More Functions Create from Selection Remove Arrows Evaluate Formula Calculation Options
Function Library Defined Names Formula Auditing Calculation

C4

Love

New Name

Name: YourLove

Scope: Workbook

Comment:

Refers to: =15

OK Cancel

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Enter 140%

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Recently Used Text Math & Trig Use in Formula Trace Dependents Error Checking Watch Window
Financial Date & Time More Functions Create from Selection Remove Arrows Evaluate Formula Calculation Options

Function Library Defined Names Formula Auditing Calculation

C3 =MyLove

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		Love	15								
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

Step13 Step14 Step15 BStep1 BStep2 BStep3 BStep4 BStep5 BStep6

Ready 140%

