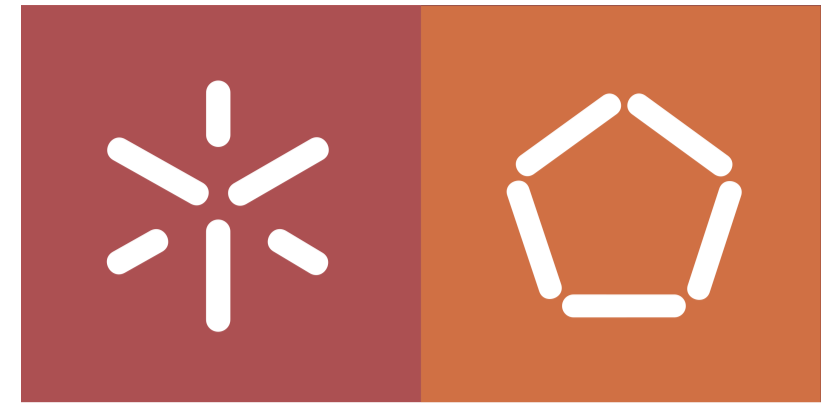


Explaining Spreadsheets with Spreadsheets

§ Jácome Cunha jacome@di.uminho.pt
 † Mihai Dan danm@oregonstate.edu
 † Martin Erwig erwig@oregonstate.edu
 † Danila Fedorin fedorind@oregonstate.edu
 † Alex Grejuc grejuca@oregonstate.edu

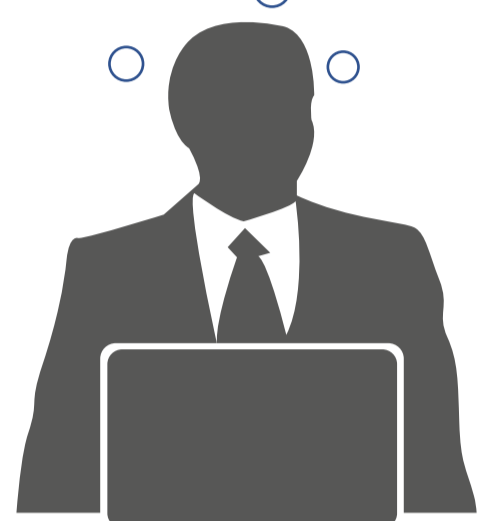
§ University of Minho & NOVA LINCS

† Oregon State University



University of Minho
 School of Engineering
 NOVALINCS
 LABORATORY FOR COMPUTER SCIENCE AND INFORMATICS

What does this spreadsheet do?

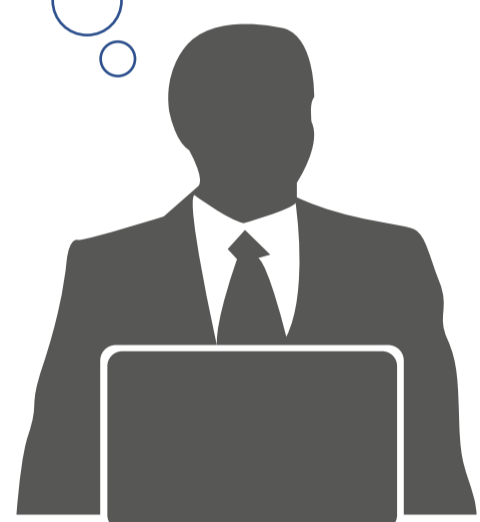


What is it computing is column E?

How is this computed?

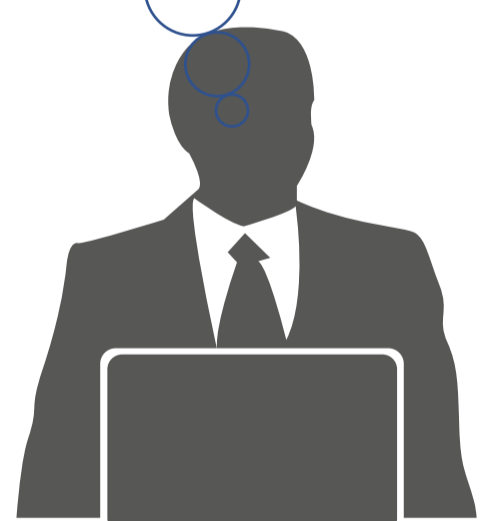
	A	B	C	D	E	F	G
112	Englebert	9,6	40	5	=B112*C112	=B112*1,5*D112	=E112+F112
113	Franklin	11,55	40	3	=B113*C113	=B113*1,5*D113	=E113+F113
114	Griffin	10,8	40	2	=B114*C114	=B114*1,5*D114	=E114+F114
115	Hartford	9,9	40	10	=B115*C115	=B115*1,5*D115	=E115+F115
116	Indio	8,9	40	0	=B116*C116	=B116*1,5*D116	=E116+F116
117	Jackson	21,5	40	1	=B117*C117	=B117*1,5*D117	=E117+F117
118							
119	Totals		=SUM(C4:C117)	=SUM(D4:D117)	=SUM(E4:E117)	=SUM(F4:F117)	=SUM(G4:G117)

Now I understand what the references mean.



	A	B	C	D	E	F	G
1							
2					Payroll Spreadsheet		
3		Pay Rate	Regular Hours	Overtime Hours	Regular Pay	Overtime Pay	Total
4	Adams	8,9	40	0	Pay Rate*Regular Hours	Pay Rate*1.5*Overtime Hours	Regular Pay+Overtime Pay
5	Baker	12,55	35	0	Pay Rate*Regular Hours	Pay Rate*1.5*Overtime Hours	Regular Pay+Overtime Pay
					⋮		
112	Englebert	9,6	40	5	Pay Rate*Regular Hours	Pay Rate*1.5*Overtime Hours	Regular Pay+Overtime Pay
113	Franklin	11,55	40	3	Pay Rate*Regular Hours	Pay Rate*1.5*Overtime Hours	Regular Pay+Overtime Pay
114	Griffin	10,8	40	2	Pay Rate*Regular Hours	Pay Rate*1.5*Overtime Hours	Regular Pay+Overtime Pay
115	Hartford	9,9	40	10	Pay Rate*Regular Hours	Pay Rate*1.5*Overtime Hours	Regular Pay+Overtime Pay
116	Indio	8,9	40	0	Pay Rate*Regular Hours	Pay Rate*1.5*Overtime Hours	Regular Pay+Overtime Pay
117	Jackson	21,5	40	1	Pay Rate*Regular Hours	Pay Rate*1.5*Overtime Hours	Regular Pay+Overtime Pay
118							
119	Totals		SUM(Regular Hours)	SUM(Overtime Hours)	SUM(Regular Pay)	SUM(Overtime Pay)	SUM(Total)

I don't need all entries to understand a spreadsheet.



	A	B	C	D	E	F	G
3					Payroll Spreadsheet		
4		Pay Rate	Regular Hours	Overtime Hours	Regular Pay	Overtime Pay	Total
5	[Adams...Jackson]	[8...12.55]	[35...40]	[0...10]	Pay Rate*Regular Hours	Pay Rate*1.5*Overtime Hours	Regular Pay+Overtime Pay
6							
7	Totals		SUM(Regular Hours)	SUM(Overtime Hours)	SUM(Regular Pay)	SUM(Overtime Pay)	SUM(Total)

Explanation Language

VALUE $v \triangleleft v$	VALUE RANGE $v_1 \leq v \leq v_2$ $(v_1, v_2) \triangleleft v$	ADDRESS RANGE $a_1 \leq a \leq a_2$ $(a_1, a_2) \triangleleft a$
FORMULA $x_1 \triangleleft f_1 \quad \dots \quad x_n \triangleleft f_n$ $\omega(x_1, \dots, x_n) \triangleleft \omega(f_1, \dots, f_n)$	LABEL $L(a) = \ell$ $\ell \triangleleft a$	
EMPTY VALUE $(v_1, v_2) \triangleleft \perp$	EMPTY FORMULA $\omega(x_1, \dots, x_n) \triangleleft \perp$	UNEXPLAINED $\perp \triangleleft f$

Semantics

$\llbracket v \rrbracket_X = (v, v)$	$\llbracket \bar{v} \rrbracket_X = \bar{v}$	$\llbracket a \rrbracket_X = \llbracket X(a) \rrbracket_X$
$\llbracket \bar{a} \rrbracket_X = \uparrow\{\llbracket X(a) \rrbracket_X \mid a \in \rho(\bar{a})\}$	$\llbracket \ell \rrbracket_X = \uparrow L^{-1}(\ell)$	
$\llbracket x_i \rrbracket_X = (v_i^1, v_i^2)$	$v_i^1 \leq v_i \leq v_i^2$	$\llbracket \perp \rrbracket_X = \perp$
$\llbracket \omega(x_1, \dots, x_n) \rrbracket_X = \uparrow\{\llbracket \omega(v_1, \dots, v_n) \rrbracket_X\}$		