

Base line	Users	Outcome	Notes
70	80 =Min(A1:A3)	=Min(A1:A3)	• formula wins
70	80 Names	80	• data values have higher priority than text strings
70	80 90	90	• higher value wins
70	Apple Banana	Banana	• both are the same type so longer string wins
apple	80 70	80	• both are same type so higher number wins
apple	banana =Min(A1:A3)	=Min(A1:A3)	• formula wins
apple	banana pear	banana	• longer string wins
apple	tree four	four	• if strings are equal then do it based on the alphabet

Base line	Users	Outcome	Notes
$= \text{Sum}(A1:A3)$	$= \text{Min}(A1:A5)$ $= \text{Max}(A1:A5)$	$= \text{Max}(A1:A5)$	<ul style="list-style-type: none"> <li>max is chosen due to our arbitrarily chosen hierarchy of functions</li> </ul>
$= \text{Sum}(A1:A4)$	$= \text{Sum}(A1:A3)$ $= \text{Sum}(D5:D10)$	$= \text{Sum}(D5:D10)$	<ul style="list-style-type: none"> <li>larger range wins</li> </ul>
$= \text{MIN}(A1:A3)$	$= \text{Min}(A1:A3)/2$ $= \text{Min}(A1:A3)/4$	$= \text{Min}(A1:A3)/4$	<ul style="list-style-type: none"> <li>higher number wins</li> </ul>
$= \text{MIN}(A1:A3)$	$= \text{Min}(A1:A3)/2$ $= \text{Min}(A1:A3)+4$	$= \text{Min}(A1:A3)/4$	<ul style="list-style-type: none"> <li>order of operations and higher number</li> </ul>
$= \text{MIN}(A1:A3)$	$= \text{Min}(A1:A3)/2$ $= \text{Min}(A1:A5)$	$= \text{Min}(A1:A5)/2$	<ul style="list-style-type: none"> <li>larger range wins</li> <li>append wins</li> </ul>
$= \text{MIN}(A1:A3)$	$= \text{Min}(A1:A2)/2$ $= \text{Min}(A1:A3)+4$	$= \text{Min}(A1:A3)/4$	<ul style="list-style-type: none"> <li>larger range wins</li> <li>order of operations and higher number</li> </ul>
$= \text{MIN}(A1:A3)$	$= \text{Min}(A1:A3)/2-1$ $= \text{Min}(A1:A3)+4$	$= \text{Min}(A1:A3)/4-1$	
$= 15 * A5$	$= 15 * A8$ $= 15 * A7$	$= 15 * A8$	<ul style="list-style-type: none"> <li>8 is the higher value</li> </ul>

Base line	Users	Outcome	Notes
$=15 * A5$	$=17 * A5$ $=18 * A5$	$=18 * A5$	<ul style="list-style-type: none"> <li>higher number wins</li> </ul>
$=15 * A5$	$=18 + A5$ $=11 * A5$	$=18 * A5$	<ul style="list-style-type: none"> <li>multiplication wins due to order of operations</li> </ul>
$=15 * A5$	$=\text{Min}(A1:A5)$ $=17 * A5$	$=\text{Min}(A1:A5)$	<ul style="list-style-type: none"> <li>function call has priority</li> </ul>
$=15 * A5$	$=18 * A6$ $=20 + A9$	$\frac{20 * A9}{18 < 20}$ $* 7 +$ $A6 < A9$	<ul style="list-style-type: none"> <li>higher number wins</li> <li>order of operations</li> <li>higher cell reference wins</li> </ul>
$=15 * A5$	$=18 * A6 \div A3$ $=20 + A9 \div 7$	$=20 * A9 \div A3$	<ul style="list-style-type: none"> <li>cell reference beats a number</li> </ul>
$=15 * A5$	$=A6$ $=17 * 3 + 4$	$=17 * 3 + 4$	<ul style="list-style-type: none"> <li>even though these are both formula cells, an actual formula has priority over a cell reference</li> </ul>
$=15 * A5$	$=15 * D7$ $=15 * C14$	$=15 * D7$	<ul style="list-style-type: none"> <li>larger cell reference</li> </ul>

Base line	Users	Outcome	Notes
$= \text{sum}(A1:A5)$	$= \text{Min}(A1:A3)$ $= \text{Product}(A:A5)$ (yields an error)	$= (A1:A3)$	• error cells always lose
$= A1 + A2$	$= \text{IF}(A1 > A2, A1 - A2, A2 - A1)$ $= 5$	$= \text{IF}(A1 > A2, A1 - A2, A2 - A1)$	• Formula wins
$= A1 + A2$	$= \text{Sum}(A1:A2)$ $= \text{Mean}(A1:A2)$	$= \text{Sum}(A1:A2)$	• Sum has higher priority than mean
$= \text{Sum}(A1:A3)$	$= \text{top} + \text{max}(\text{error})$ $= 5$	$= 5$	• the "error" loses
$= 17 * A5$	$= A5 * A7$ $= 17 * 10$	$= A5 * A7$	• because in the Ast we are comparing A5 to 17 and A7 to 10
$= \text{dog}$	$= A5$ $= 3$	$= A5$	• formula call has priority
$= 23$	$= \text{cat}$ $= A5$	$= A5$	• Formula call has priority
$= \text{true}$	$= \text{true}$ $= \text{true}$	$= \text{true}$	

Base line	Users	Outcome	Notes
= 28	= false = false	= false	
= apple	= false = true	= true	• if either is true then pick true
= 17	= C5:C10 = A1:B17	= C5:C10	• larger range wins - is calculated in the merge function
= pear	= true = cat	= true	• booleans beat strings
= 17	= false = 15	= 15	• numbers beat booleans, as in the context of formulas they are more important
= twist	= A7 = true	= A7	• cell references beat booleans
= A1*A7	= false = A1:A3	= A1:A3	• cell ranges beat booleans
= 17+5*7	= MIN(A1:A3) = true	= min(A1:A3)	• function calls beat booleans

[illegible]

# Language:

merge :  $f \times f \rightarrow f$

$f ::= n \mid c \mid r \mid f \text{ op } f \mid -f \mid s \mid f_{\text{unc}} \mid b$

$n = \text{number}$

$c = \text{cell reference}$

$r = \text{range}$

$f \text{ op } f = \text{binary operation}$

$-f =$

$s = \text{string}$

$f_{\text{unc}} = \text{function call}$

$b = \text{boolean}$

$$\text{merge } (f, \text{error}) = f,$$

$$\text{merge } (f, \langle \text{nothing} \rangle) = f,$$

$$\text{merge } (n_1, n_2) = \max(n_1, n_2)$$

$$\text{merge } (n, c) = c$$

$$\begin{aligned} \text{merge } (c_1, c_2) = & \text{ if } x_1 \neq x_2 \Rightarrow \max(x_1, x_2) \\ & \text{ if } x_1 = x_2 \Rightarrow \max(y_1, y_2) \end{aligned}$$

$$\text{merge } (n, \text{func}) = \text{func}$$

$$\text{merge } (s, n) = n$$

$$\text{merge } (s_1, s_2) = \max + \text{alphabetically } (s_1, s_2)$$

$$\text{merge } (s, \text{func}) = \text{func}$$

$$\text{merge } (\text{func}_1, \text{func}_2) = \text{based on pre-coded hier archy}$$

$$\text{merge } (c, \text{func}) = \text{func}$$

$$\text{merge } (f \text{ op } f, \text{func}) = \text{func}$$

$$\text{merge } (f \text{ op } f, c) = c$$

$$\text{merge } (f \text{ op } f, n) = f \text{ op } f$$



$$\text{merge}(f \text{ op } f, s) = f \text{ op } f$$

$$\text{merge}(f_{11} \text{ op } f_{12}, f_{21} \text{ op } f_{22}) =$$

$$\text{merge}(f_{11}, f_{21}) \text{ op } \text{merge}(f_{12}, f_{22})$$

$$\text{merge}(n, r) = r$$

$$\text{merge}(c, r) = r$$

$$\text{merge}(r, s) = c$$

$$\text{merge}(r, f \text{ op } f) = f \text{ op } f$$

$$\text{merge}(r, s) = r$$

$$\text{merge}(r, \text{func}) = \text{func}$$

$$\text{merge}(f \text{ op } f, s) = f \text{ op } f$$