

Dealing with car complexity



Roman 8U bYf
GcYfYb † WYbUW
Simon GWbi ffYf

DYfgcbU]n]b[VWFgfc H.Y fYei]fYa YbHg UbX hUghY cZH.Y]bX]j]Xi U`ck bYf\Ug`cb[VYYb`
UXf]j]b[ZcfW`]b h.Y Ui hca chj Y]bXi ghf m'6i h h Uh[cU`UddYUfgfc \Uj Y`gd]fUYX`ci hcZ
V`bhf c`"5g`UfYgi `hZVWf V`ta d`YI]hm\ Ug`fYUW`YX`h.Y`dc]bhk \YfY h.YfY`UfY`gc`a Ubmicd]cbg`
fc`W`ccgY Zfca`h.Uh]hg[chYb`c] Yfk \Y`a]b[`mW` hYfYX` `bch`f ghZcf`cf][]bU`Yei]da Ybh
a Ubi ZUW` fYfg`fc 9A gZgi dd`]YfgzUbX XYU`YfgzVi hZcf`Vi nYfgz`hc"

A cfYcj Yfzh]b[gUFY UVci htc`[YhYj Yb`a cfY`W` hYfYX.`6m&\$&) zh.Y`bi a VYf`cZVU`hYf`m
Y`YVW`]Wj Y\]Wg`f69J gZ`YI]gh]b[`k]h`"Y[UVW]bhYfbU`V`ta Vi gh]cb`Yb[]bY`f79E`d`UhZ`fa g`k`]"
dfcVUV`mVccghh.Y`bi a VYf`cZj Uf]Ubhg`dYf`W`fa U`Yf`Vm) \$` `%\$`i` k`cf`Xk]XY"

H`]g`V`ta d`YI]hmU` YVW`g`bchcb`mYbX`W`ghca Yfg`Vi hU`gc`C`9A`g`UbX`gi`dd`]Yfgz`k`\]W`a`i`gh
ghc`W`Yj Yfmdcgg]V`Y`cdh]cb`f`f`Uh`YUgha`U`Y`h`Ya`YUg]`mUj`Uj`UV`YE`"5`"h`]g`V`g`h`a`cb`Ym
UbX`fYgc`fW`g`"7i`fYb`h`n`z`f`ci`[`\`m`\$` `(\$i`c`ZU`"C`9A`Ya`d`cm`Yg`XYU`k`]h`j`Uf]Ubhg`UbX`
Uggc`V]U`hYX`V`ta d`YI]hm]ggi`Yg`z`UbX`a`cfY`k`]"`VY`bY`Y`X`Y`g`c`cb`"H`]g`]a`]hg`W`d]hU`Uj`Uj`UV`Y`
Zcf`V`ta`d`Ubmi`f`Ub`g`Z`fa`Uh]cb`z`b`Yk`h`V`W`bc`c`[]Yg`z`UbX`b`Yk`Vi`g]b`Ygg`a`c`X`Y`g`"6`m`di`f`gi`]b[`
ghf`U`h`[]Yg`fc`W`U`W`h`Y`V`ta`d`YI]hmV`e`X`Y`z`Ui`hca`chj`Y`d`Un`Y`fg`V`e`i`X`cdh]a`]nY`h`Y`d`fc`W`ggz`
]b`W`Y`U`g`Y`d`fc`hg`V`Y`k`Y`Y`b`)`\$`\$`UbX`+)\$`d`Yf`W`fz]a`d`fc`j`Y`h`Y`]f`gi`dd`m`W`U]b`z`UbX`W`Y`U`h`U`
V`Y`h`Y`f`W`ghca`Yf`YI`d`Yf]Y`b`W`"B`ck`\`Y`f`Y`]g`h`Y`V`ta`d`YI]hmW`U`Y`b[]Y`a`cf`Y`gh`_]b[`h`Ub`]b`h`Y`
V`b`hf`U`gh`V`Y`k`Y`Y`b`];`Y`fa`Ub`mg`a`Uf`_`Y`h`UbX`h`U`h`c`Z`7`\]bU`"K`\]Y`Ui`hca`U`_`Y`fg`]b`7`\]bU`c`Yf`
]a`]h`X`W`c`]W`g`z`;`Y`fa`Ub`V`e`b`gi`a`Y`f`g`c`Z`h`Y`b`c`f`X`Y`f`UbX`g`d`Y`V`Z`m`h`Y`]f`W`f`g`h`Y`a`g`Y`Y`g`"b`f`Y`h`f`b`z`
;`Y`fa`Ub`W`f`Vi`n`Y`fg`U`f`Y`k`]"`]b[`h`c`k`U]h`a`cb`h`g`h`c`[]Y`h`YI`UV`m`k`\`U`h`h`Y`m`k`Ub`h`]b`h`Y`]f`j`Y`\]W`"
<`ck`Yj`Yf`zh`h`Y`]b`X]j]Xi U`d`f`Y`Z`Y`f`b`W`g`c`Z`g`c`a`Ub`m`W`f`Vi`n`Y`fg`g`Y`Y`f`Y`m`h`U`Y`g`C`9A`gi`dd`m`
W`U]b`UbX`"c`[]gh]V`g`g`n`gh`Y`a`g`z`Y`g`d`Y`W`U`"m`Xi`f]b[`d`Yf]c`X`g`c`Z`gh`f`Y`gg`z`gi`W`U`g`h`f`U`X`Y`k`U`f`g`c`f`h`Y`
7CJ`-8!%`d`Ub`X`Y`a`]W`

H`Y`"Y`gg`c`bg`"Y`U`f`b`Y`X`]b`];`Y`fa`Ub`m`W`b`\`Y`d`C`9A`g`]b`c`h`Y`f`a`Uf`_`Y`hg`b`X`h`Y`c`d`h]a`i`a`V`U`Ub`W`
V`Y`k`Y`Y`b`V`Y`b`Y`V]U`V`ta`d`YI]hmUbX`h`Y`j`U`i`Y`]h`W`b`[]Y`b`Y`f`U`h`z`UbX`h`c`c`a`i`W`c`ZU`[`cc`X`h`]b[`"
H`c`d`fc`j`XY`U`V`ta`d`f`Y`\`Y`b`g]j`Y`d`]W`h`f`Y`c`Z`h`Y`W`U`g`Y`Z`c`f`cdh]a`]n]b[`V`ta`d`YI]hm`h`]g`d`c]b`h`c`Z]]Yk`
YI`Ua`]b`Y`g`h`Y`]ggj`Y`Z`f`ca`h`Y`d`Y`f`g`d`Y`W`h]j`Y`g`c`Z`h`Y`C`9A`zh`Y`gi`dd`]Y`f`z`UbX`h`Y`V`e`b`gi`a`Y`f`"

BcbY'cZH\]g\Va d`Yl]hm]g`hU_]b[`d`UW`]b`Uj UW i a .`A i W`cZ]hgYfj Yg`U`di fdcgYzfYgi `h]b[`

“Streamlining Complexity”

CbYUi tca U_Yfi gYX'hY'a cXY'hc'a U_Y'Ub YUf'mXYWg]cb'hc'X]gVt'bh]bi Y'U'dck YfHfU]b' j Uf]UbhhUhgUj YX'hY'Vta dUbmfcI [\`m %`a `]`cb]b Vta d'YI]hmVt'ghg'cj Yf'hY']ZYh]a Y'cZ'hY'j Y\]WV''h\Y'Vta dUbm'g'gUj]b[g'k ci `X`Uj Y'VYb Yj Yb`Uf[Yf`UX]h' X]gVt'bh]bi YX'hY'dck YfHfU]b Ybh]fY'mfU'h Yf'h'Ub'cb`mcb'cbY'WVf'']bY' `U'ghYd]h]g' WffYbh'mVt'bg]XYf]b[``=b`Ubch'Yf'WgYz'Ub`C9A`i gYX'hY'a cXY'hc'cdh]a]nY'hY'Vi]X' Vta d'YI]hmcZ'Ub Ybhf'm'Yj Y'j Y\]WV'UbX'fYXi WX'Vt'ghg'VmUddfcl]a Uh'mi &\$`a `]`cb` cj Yf'hY'dfcXi Vh']ZYVWVW''=b'h]g'VWgYz'hY'gUj]b[g'Wla Y'Zca `UV'cgg'hY'j U'i Y'WU]b''

5'dfcj Yb'k Umhc'fYXi W'Vta d'YI]hm]bj'c'j Yg'Yj U'i Uh]b['fY'Yj Ubh]bZcfa Uh]cb'cb'Ub YbX! hc!YbX'VUg]g'UbX]bW X]b[`Vch' `U'W'ghca Yf'UbX'U'Vt'ghdYfgdYVW] Y''Hc'i bXYfgh'UbX'hY']_Y'mV'ghca Yf'fYgdcbgY'hc'fYa cj]b[`U'WVf'cdh]cbzVta d'YI]hm'fYXi W]cb'hY'Ua'g'a cXY'hY' dYfV'bhU] Yg'cZ'W'ghca Yfg'hY'C9A'Vti `X'i dgY''`hc'U'VYHf'f'Yei]ddYX'j Y\]WVz'h'cgY'h'Uh' k ci `X'g]a d'mXc'k]h'ci h'hY'cdh]cb'Vi hghUmk]h'h'Y'gUa Y'j Y\]WVz'UbX'h'Y'cbYg'h'Uhk ci `X' UVUbX'cb'hY'Vf'UbX'UbX'gYY_'U'Vta dYh]h'f'dfcXi W'h'Y'hY'Ua' h'Yb'cj Yf'Um'g'h'YgY' bX]b[g' k]h' Vt'ghX'Uh'Z'fca `]bX]j]Xi U'XYd'Uf'ha Ybh'g'U'cb[`h'Y'j U'i Y'WU]b'hc'XYH'fa]bY'hY'W'Ub[Y'g' hc'U'Vt'gh]a dUV'h'cj Yf'hY'']ZYVWVW'cZ'hY'j Y\]WV''fGY'7UgY'Gh' Xn%'@Ygg'gA cFY'z

K \]Y'Y' cfhg'hc'fYXi W'Vta d'YI]hmci hf][\h' `W'h]b['UggYa V'mi]bYgzd'fcXi W'gZ'ZYUhi fYgZ' cf'Yei]da Ybh' `Uj Y'hY'V][[Ygh]a dUV'Vt'ch'Yf'Uddf'c'UW'YgZ'gi W'Ug'\Ufa'cb]n]b[` gh'UbX'UfX]nUh]cbz'Vi bX']b[`cdh]cbgZ'UbX'a cX]Zn]b[`Vi]X'fi `Yg'U'gc'[YbYf'UH'fYgi `hg'' <Ufa'cb]n]b['gh'UbX'UfX'g'UV'cgg'a Uf_YhgZ'a cXY'gZ'UbX'Vti bh'f'mj Uf]Ubhg'W'Ub'd'Um'U'fc'Y''

HUhgi dd]Yfgi bXYfghUbX hY YbX Wghca Yf Ugk Y Ugz]ZbchVYHYf hU b hY U i hca U_Yfg
hYa gYj Yg" HUhVtghg'a cbYnzUbX g]bW' bchU"]bbcj Uh]cbgk]" VY'cZ]bHYfYghc hY]f' C 9A
Wghca YfgzhYgY Y cfhgWb' W' HYf Ugi dd]Yfg'dcfhZc']c'cZc Yf]b[gk]h'ci hWYU]b[j U i Y"

CdYfUh]cbU" nzi dd]Yfg'a UFW']b" cW_ghYd' k]h' hY]f' C 9A Wghca Yfgz[YUF]b[' i d' h' d' f' c' j]X Y'
hY ZYU h fYg'UbX' cdh]cbgXYa UbXYX]b' hY' ei Ubh]h]Yg'gdYVY' YX" =Z hY' C 9A [i YggYgk fcb[]b'
]hg'Zc'fYUWghgzhY' gi dd]Yf' Y]h' Yf' bYXg' h' f' ch' Y' VUW' d' f' c' X i W']cb' c' f' g' d' Y Y X]h' i d' X f' Ua Uh]W' m'
H' X U m g]b' W Y U g]b[" Y j Y' g' c' Z V t a d' Y i]h' m' W b' V t a d']W H Y h']g' d' f' c' W g g' U b X h' Y' g' i d d']Y f' g'
f' Y' U h] c b g \]d' k]h' h' Y' W f a U_Y f"

;]j Yb hY]f' bYX' h' c' i bXYfghUbX hY YbX Wghca Yfzi dd]Yfg' fYei]fY' f' U b g d U f Y b W h]b' h' c' h' Y'
YbX Wghca Yf g' X Y g]f' Y' Z' f' X] Y f y b h] U h Y' d' f' c' X i W' h' c' Y f]b[g' U b X' k \ U h' h' Y m' U f Y' k]"]b[' h' c' d' U m' Z' c' f'
h' Y a " 5 h' h' Y' g' U a Y' h] a Y' z]b' W a V Y b h] g' i d d']Y f' g' a i g h g' f' Y U a]b' Y' h' Y]f']b' h' f' b' U' d' f' c' W g g' Y g' U W' c' g g'
h' Y]f' c' k b j U i Y W U]b' g' z' d' i g' \]b[' Z' c' f' Y U b Y f' d' f' c' W g g' Y g' U b X W W U b Y f' c' f [U b]n U h] c b U' g' f' i W' h' f' Y g"
H' Y m' U' g' c' b' Y Y X' h' c' _ Y d' U b Y m' ' c' b' U' h' Y' b' Y k' d' U m' Y f g' W f' W]b[' h' Y]b' X i g' h' f' n' z' f' c' a' g' h' U' f' h' i d' g' h' c' h' Y W'
[] U b h g z' Y U W' h' f' n]b[' h' c' i h' W t a d' Y H Y' U b X' c' i h]b b c j U h' h' Y a' h' c' [U]b' U' d' U W' U h' h' Y' C 9A g' H U V' Y"

5hk \ Uhdc]b h X c Y g h Y' g' Y Y f' U f f' U m c' Z c d h] c b g' U b X' Z Y U h' f Y g' g' a d' m c j Y f k \ Y' a' W f'
V i m Y f g 3 7 c b g i a Y f g' U f Y' c' Z h' c' a']b' X' g' c' b' h']g' e i Y g h] c b " :]f' g' h' z' h' Y m k U b h' h' Y' g' U a Y' Y' j Y' g' c' Z
]b' X]j]X i U']n U h] c b' U j U] U V' Y' c' b' g' c' V U' a' Y X]U' d' U h' Z' f' a' g' U b X' c' h' Y f' X] []h' j' Y b i Y g' z' k \]W' f' Y' m' c' b'
g' c' Z h' U f Y ! X f]j Y b j]f' h' U']n U h] c b' h' c' d' Y f' g' c' b' U']n Y' c' Y f g' ' U b' U j' Y b i Y' c' b' m' d' U f' h] U' m' U j U] U V' Y' h' c'
U i h' c a' c h] j Y]b' X i g' h' f' m' X i Y' h' c' h' Y' U W' c' Z U' g' h' U b X U f X]n Y X' X] []h' U' U f W]h' Y W' f Y " G Y V t b X z a U b m f Y U]n Y'
h' c' a' i W' j U f]Y h' m' W b' a U_Y W' c' c g]b[' X] W' h' ' U b X Y i d Y b g]j Y"

5bch Yf Vt b W f b' U a c b [V t b g i a Y f g' U X X g' U b Y k " U n Y f' c' Z a Y U b]b [' h' c' h' Y V t a d' Y i]h' m' e i Y g h] c b :
g i g h U]b U V]"]h' m' i ; f c k]b [' g Y [a Y b h g' c' Z V i m Y f g' k U b h' c' _ b c k' h' Y' d' f' c' X i W g' h' Y m' V i m k]" V Y'
Y b j]f' c' b a Y b h U' m' z]Y b X' m' c' f' b' Y i f' U' ' W' h] b [V t a d' Y i]h' m' W b' U d d' Y U' h' c' h' Y g' Y' g' c' d d' Y f g' V i h'
X c]b [' g' c' k]" f Y e i]f' Y' C 9A g' U b X' g' i d d']Y f' g' h' c' a' c j Y' h' c' k U f X' g' i g h U]b U V' Y' U b X' V t b b Y V W X' d' f' c' X i W g'

HAY]bXi ghfmk]" bYj Yf fYh' fb' h' c' h' Y' X U m g' c' Z c b Y ! g h Y ! h g] U " i h]] h z k \] W ' a Y U b g' X Y U]b [' k] h '
V t a d' Y i]h' m' k]" f Y a U]b' U' Z W' i c' Z'] Z Y " < c k Y j Y f z a U]b' h U]b]b [' U' V t b g] g h Y' b h V U' U b W' V Y h' k Y Y b '
b Y W' g g' U f m' V t a d' Y i]h' m' U b X' d' f' c' H U V' Y [f c k h' W b' Y b U V' Y' C 9A g' U b X' g' i d d']Y f' g' h' c' V t a d' Y H Y']b' h' Y'
f U d] X' m' W' U b []b [a U f _ Y h'

7ca dUb]YgbYXX' h' c' W Y U H Y' U' g' i g H U]b U V' Y V t b Y A U b c H U " \ ' g h d d' b U i Y Y]f]

C`j Yf`K ma Ub]gU[`cVU`YUXYf]b'a UbU[Ya YbhVtbgj `h]b[`h UhVt`a V]bYgXYd]bXi ghfm_bck `YX[Y`k]h`
gdYV]U`nYX`YI dYfh]gY`]b`ghfUHY[n`cdYfU]cbgz`f]g_`a UbU[Ya YbhzUbX`cf[Ub]nU]cb hfUbgZcfa Uh]cb"
: cf`a cfY`]bZcfa Uh]cbzd`YUgY`Vt`bhUWih`Y`a Uf_Y]b[`XYdUfha YbhVmd\cbY UhcbY`cZh`Y Zc``ck]b[`cW]h]cbg.

5a Yf]W]g