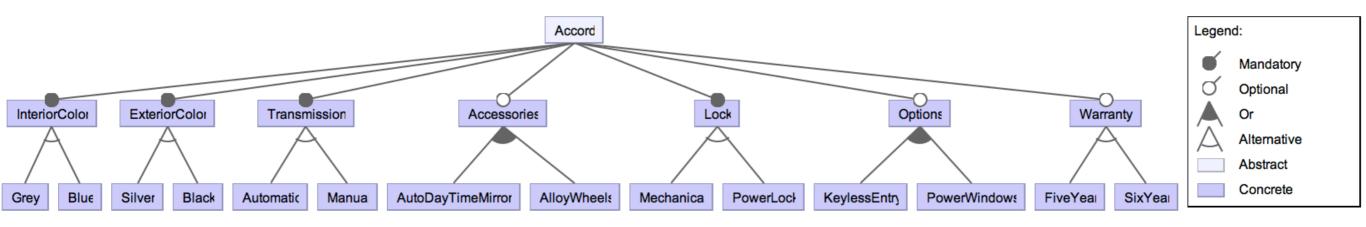
# Feature Modeling Exercise

Reference Solution by Sarah Nadi

Presented by Manuel Weiel



Accord xor Transmission Manual Automatic xor ExteriorColor Silver Black

xor InteriorColor
 Grey

Blue

or Accessories ? AlloyWheels

AutoDayNightMirror

xor Lock
 Mechanical

PowerLock or Options ?

KeylessEntry

PowerWindows

xor Warranty?
 FiveYear

SixYear

## Number of Instances

ClaferConfigurator				Sarah
← → C ☐ 13-necsis.cs.uwaterioo.ca/8093				@☆ =
🔢 Apps 🛛 🖕 GCKey - Log In or Fi 📄 sarah 📄 Lib Make Link	🕒 Linux Kernel Statistic 🗋 facing 🏫 Producing Simple 0	😔 SSH/OpenSSH/Key: 🔣 In brief & Statistics - 📋 ICSE 📋 New folder		Cther Bookmarks
\varTheta 🕀 Input Clafer Mode	el and Options	\varTheta 🕀 Instance Generator 🔹	😑 😁 Output	Clear ?
Choose File No file chosen	Compile S Load into editor	Choco-based (IG + MOO) \$ Kill	ClaferConfigurator> bash claferChocoIG.shfile=file.js	replmaxint=127scope
Or Choose Example	Compile	1000 Get Instances Reload Quit	Clafer Choco Instance Generator and Multi-Objective Optimi	izer
Or enter your model:	Compile Scopes: Fast \$	Scopes	Type 'help' for the list of available REPL commands	t
1 - Accord		All: 1 Inc Default: 1 Set	Clafer Choco Instance Generator and Multi-Objective Optim Type 'help' for the list of available REPL commands	izer
2 - xor Transmission 3 Manual		Custom: Clafer name(s)	o more instances found. Consider increasing scopes.	
4 Automatic		* 1 Inc 1 Set	Generated 768 out of 1000 instances	
5 - xor ExteriorColor		Max Int: 127 Set	ClaferConfigurator> Generating instance	
6 Silver 7 Black		N	to more instances round. Consider increasing scopes.	
8 - xor InteriorColor		c	Could not generate any instance	
0 Grew				
0.00		Feature and Quality Matrix	2 7 🗧	Constraints
Search: search Distinct Reset filters		tisfy the criteria 😨 Show nested quality attributes		
Model \ Variants	1 2 3 4 5 6 7 8 9 10 11 12 1	3 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 3	31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 4	
Accord 1				
Transmission 1				
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ExteriorColor 7				
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InteriorColor 7 Grey ?		000000000000000000000000000000000000000		
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Lock "				
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Options ?			000000000000000000000000000000000000000	
KeylessEntry ?			000000000000000000000000000000000000000	
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Warranty ? ]			000000000000000000	
	<u></u>	000000000000000000000000000000000000000	<b>S S B B B B B B B B B B B B B B B B B B</b>	

Accord
xor Transmission
Manual
Automatic
<pre>xor ExteriorColor</pre>
Silver
Black
<pre>xor InteriorColor</pre>
Grey
Blue
or Accessories ?
AlloyWheels
AutoDayNightMirror
xor Lock
Mechanical
PowerLock
or Options ?
KeylessEntry
PowerWindows
<pre>xor Warranty?</pre>
FiveYear
SixYear

Accord		
xor	Transmission Manual Automatic	 2 possibilities
xor	ExteriorColor Silver Black	
xor	InteriorColor Grey Blue	
or	Accessories ? AlloyWheels AutoDayNightMirror	
xor	Lock Mechanical PowerLock	
or	Options ? KeylessEntry PowerWindows	
xor	Warranty <mark>?</mark> FiveYear SixYear	

Accord			
xor	Transmission Manual Automatic		2 possibilities
xor	ExteriorColor Silver Black	>	2 possibilities
xor	InteriorColor Grey Blue		
or	Accessories <mark>?</mark> AlloyWheels AutoDayNightMi	rror	
xor	Lock Mechanical PowerLock		
or	Options <b>?</b> KeylessEntry PowerWindows		
xor	Warranty? FiveYear SixYear		

Accord			
	Transmission Manual Automatic		2 possibilities
xor	ExteriorColor Silver Black		2 possibilities
xor	InteriorColor Grey Blue		2 possibilities
xor or C	Accessories ? AlloyWheels AutoDayNightMi Lock Mechanical PowerLock Options ? KeylessEntry PowerWindows Warranty? FiveYear SixYear	rror	

Accord	
<pre>xor Transmission     Manual     Automatic</pre>	2 possibilities
<pre>xor ExteriorColor     Silver     Black</pre>	2 possibilities
xor InteriorColor Grey Blue	2 possibilities
or Accessories ? AlloyWheels AutoDayNightMirror xor Lock	2 <sup>2</sup> possibilities
Mechanical PowerLock or Options ?	
KeylessEntry PowerWindows xor Warranty? FiveYear	
SixYear	

Accord			
Ma	ansmission nual tomatic	>	2 possibilities
Si	teriorColor lver ack	>	2 possibilities
Gr	teriorColor ey ue		2 possibilities
Al Au	essories ? loyWheels toDayNightMir	ror	2 <sup>2</sup> possibilities
Po	echanical werLock	>	2 possibilities
Ke Po	ions ? eylessEntry owerWindows		
Fi	rranty? .veYear .xYear		

Accord	
<pre>xor Transmission     Manual     Automatic</pre>	2 possibilities
<pre>xor ExteriorColor    Silver    Black</pre>	2 possibilities
xor InteriorColor Grey Blue	2 possibilities
or Accessories ? AlloyWheels AutoDayNightMirror	2 <sup>2</sup> possibilities
xor Lock Mechanical PowerLock	2 possibilities
or Options ? KeylessEntry PowerWindows xor Warranty? FiveYear	2 <sup>2</sup> possibilities
SixYear	

Accord	
<pre>xor Transmission     Manual     Automatic</pre>	2 possibilities
<pre>xor ExteriorColor     Silver     Black</pre>	2 possibilities
<pre>xor InteriorColor    Grey    Blue</pre>	2 possibilities
or Accessories ? AlloyWheels AutoDayNightMirror	2 <sup>2</sup> possibilities
xor Lock Mechanical PowerLock	2 possibilities
or Options ? KeylessEntry PowerWindows	2 <sup>2</sup> possibilities
xor Warranty? FiveYear SixYear	3 possibilities

Accord			
<pre>xor Transmission     Manual     Automatic</pre>	2 possibilities		
<pre>xor ExteriorColor     Silver</pre>	2 possibilities		
Black xor InteriorColor Grey Blue	2 possibilities	=	768
AutoDayNightMirror	2 <sup>2</sup> possibilities		instances
PowerLock	2 possibilities		
or Options ? KeylessEntry PowerWindows xor Warranty?	2 <sup>2</sup> possibilities		
	3 possibilities		

Accord <mark>xor</mark>	Transmission	ding Cross-tree
vor	Manual Automatic ExteriorColor	Constraints
	Silver Black	
xor	InteriorColor Grey	
or A	Blue Accessories ? AlloyWheels	
xor	AutoDayNightMirror Lock	
or (	Mechanical PowerLock Options ?	
	KeylessEntry PowerWindows	
xor	Warranty? FiveYear SixYear	

#### //additional cross-tree constraints

### New Number of Instances

• • • ClaterConfigurator ×															Sarah
← → C □ t3-necsis.cs.uwaterloo.ca:8093															@☆ =
👯 Apps 🛭 👙 GCKey - Log In or Fi 📄 sarah 📄 Lib Make Link 📄 Linux K	ernel Statistic	E facing	Producing Simple	. 🛞 SSH/OpenSSł	- Keys 🔣 In brief & Stati	Nics - 🔛 ICBE	New folder							Cth	er Bookmarks
😑 😁 Input Clafer Model and Op	tions		?	0	Instance Gen	erator	?	00			Out			Clear	
Choose File No file chosen	Compile	✓ Load in	nto editor	Choco-based	(IG + MOO) 💠 Kill			ClaferConfi	gurator> hash	claferCho	coIG, sh	files	file isre	plmaxint=12	7 scope
Or Choose Example \$	Compile			1000 Get Inst	ances Reload Qu	t		Clafer Choc	o Instance Ge	nerator an	nd Multi-	Objecti	ve Optimizer		. acope
Dr enter your model:	Compile	Scopes:	Fast \$	Scopes		-		Type 'help'	for the list	of availa	able REPL	comman	ds		
20 - xor Warranty?					Inc Default	: 1	Set		TOP the List						
21 FiveYear				Custom: Cla	fer name(s)			No more ins	tances found.	Consider	incrusi	ing scop	les.		
22 SixYear				* 1	Inc	1 Set	- (	Generated 2	88 out of 100	0 instance	is l				
23 24 //additional cross-tree constraints				Atom 2010 (107				ClaferConfi	gurator> Gene enerate 1000	instant instant	stane.s.				
25 [ExteriorColor.Black =>   InteriorColor	or.Grey]	//assumed	color const	Max Int: 127	Set			No more ins	tances found.	Consider	increasi	ing scop	es.		
26 [ExteriorColor.Silver -> ! InteriorCol	or.Blue]	//assume	d color cons	t				Could not g	enerate any i	nstance					
27 [KeylessEntry => PowerLock] //KeylessE	ntry wou	ld not wo	rk with manu	a				_							
00				Feature and Q	uality Matrix							2		Constraints	2
	ariants 28	8 out of 28	38 variant(s) s		ia 🗷 Show nester	d quality attr	ibutes					<u> </u>		Consciantes	
					18 19 20 21 22			0 31 32 33 34	35 36 37 38	39 40 41 4	2 43 44	45 46 47	7 4		
Accord 1															
Transmission 7															
					000000										
Automatic ?	000	000	0000	<u> </u>	00000	0000	0000	00000	0000	0000	000	000	06		
ExteriorColor 7															
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InteriorColor 7															
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Lock 7. Mechanical ?	000	000	0000		00000	0000	0000		0000		000	000			
Options ?	000	000			00000	0000	0000		0000						
KeylessEntry ?	999	000			99999		9999		0000						
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				00000	99999		9999		0000						
	000	000					0000		0000						

Accord

**xor** Transmission Manual Automatic **xor** ExteriorColor Silver Black **xor** InteriorColor Grey Blue or Accessories ? AlloyWheels AutoDayNightMirror xor Lock Mechanical PowerLock or Options ? KeylessEntry PowerWindows xor Warranty? FiveYear SixYear

#### //additional cross-tree constraints

Accord

xor Transmission Manual Automatic xor ExteriorColor Silver

Black

xor InteriorColor

Grey Blue

or Accessories ? AlloyWheels

AutoDayNightMirror

xor Lock

Mechanical PowerLock

or Options ?

KeylessEntry

PowerWindows

xor Warranty?
 FiveYear

SixYear

#### //additional cross-tree constraints

[ExteriorColor.Black => ! InteriorColor.Grey] //assumed color constraints
[ExteriorColor.Silver => ! InteriorColor.Blue] //assumed color constraints
[KeylessEntry => PowerLock] //KeylessEntry would not work with manual locks

→ 2 possibilities

Accord

xor Transmission
 Manual
 Automatic
xor ExteriorColor

Silver

- Black
- xor InteriorColor
   Grey
  - Blue
- or Accessories ? AlloyWheels
  - AutoDayNightMirror

#### xor Lock

Mechanical PowerLock

or Options ?

KeylessEntry PowerWindows

xor Warranty?

FiveYear SixYear

#### //additional cross-tree constraints

[ExteriorColor.Black => ! InteriorColor.Grey] //assumed color constraints
[ExteriorColor.Silver => ! InteriorColor.Blue] //assumed color constraints
[KeylessEntry => PowerLock] //KeylessEntry would not work with manual locks

2 possibilities

2 combinations

→ 2 possibilities

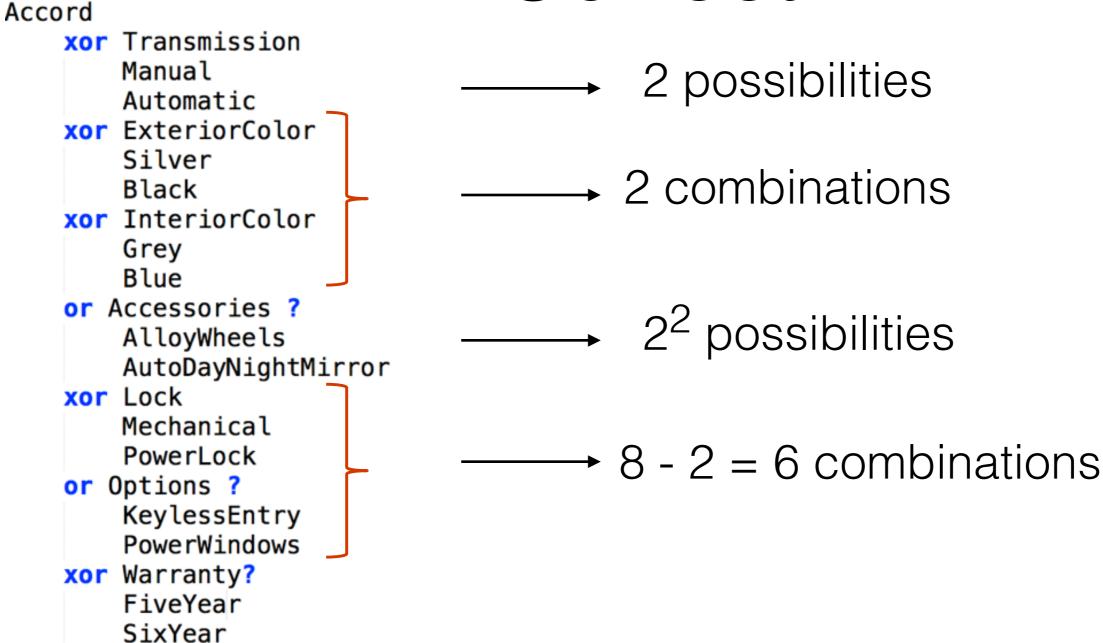
2 combinations

 $\rightarrow$  2<sup>2</sup> possibilities

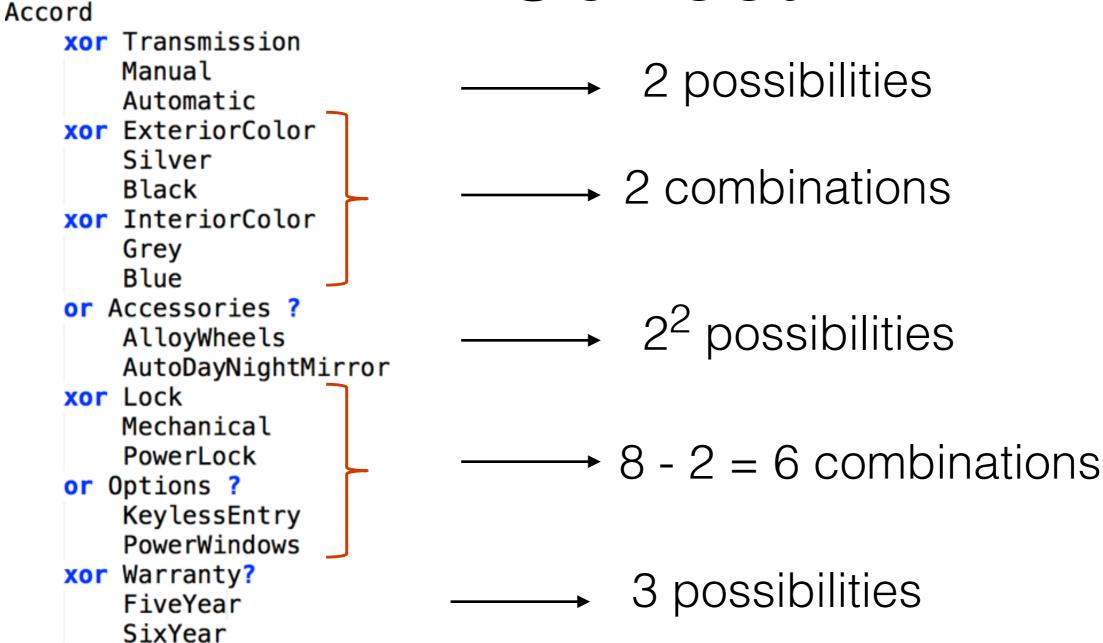
Accord **xor** Transmission Manual Automatic xor ExteriorColor Silver Black xor InteriorColor Grey Blue or Accessories ? AlloyWheels AutoDayNightMirror xor Lock Mechanical PowerLock or Options ? KeylessEntry PowerWindows xor Warranty? FiveYear SixYear

#### XTEaT

#### //additional cross-tree constraints



#### //additional cross-tree constraints



#### //additional cross-tree constraints

#### New Number of Instances Correct? Accord **xor** Transmission Manual → 2 possibilities Automatic xor ExteriorColor Silver 2 combinations Black xor InteriorColor Grey Blue or Accessories ? → 2<sup>2</sup> possibilities AlloyWheels 288 **AutoDayNightMirror** instances xor Lock Mechanical 8 - 2 = 6 combinations PowerLock or Options ? KeylessEntry PowerWindows xor Warranty? 3 possibilities FiveYear SixYear

#### //additional cross-tree constraints