

INPUT DATA (HUMAN READABLE)

Log,
Trace Payload { location = "LN", patient= "001A" }
Referral{ CA15-3 = 69 }
Mastectomy{ CA15-3 = 69, biopsy = true }
FollowUp{ CA15-3 = 10 }
Trace Payload { location = "NE", patient = "002A" }
Referral{ CA15-3 = 20 }
Trace Payload { loc_po = "YO", patientId = "003A" }
Referral{ CA15-3 = 61 }
Lumpectomy { CA15-3 = 61, biopsy = true }
FollowUp{ CA15-3 = 55 }

Data Loading + Indexing

(§4.1)

COLUMN-BASE Knowledge Base

CountingTable		
ActivityId	Trace Count	
__trace__payload	1	1
__trace__payload	2	1
__trace__payload	3	1
Referral	1	1
Referral	2	1
Referral	3	1
FollowUp	1	1
FollowUp	2	0
FollowUp	3	1
Mastectomy	1	1
Mastectomy	2	0
Mastectomy	3	0
Lumpectomy	1	0
Lumpectomy	2	0
Lumpectomy	3	1

ActivityTable					
ID	ActivityId	Trace	Event	Prev	Next
#1	__trace__payload	1	1	NULL	#4
#2	__trace__payload	2	1	NULL	#5
#3	__trace__payload	3	1	NULL	#6
#4	Referral	1	2	#1	#7
#5	Referral	2	2	#2	NULL
#6	Referral	3	2	#3	#8
#7	Mastectomy	1	2	#4	#9
#8	Lumpectomy	3	3	#6	#10
#9	FollowUp	1	4	#7	NULL
#10	FollowUp	3	4	#8	NULL

AttributeTable <i>patient</i>		
ActivityId	Value	Offset
__trace__payload	"001A"	#0
__trace__payload	"002A"	#1
__trace__payload	"003A"	#2

AttributeTable <i>location</i>		
ActivityId	Value	Offset
__trace__payload	"LN"	#0
__trace__payload	"NE"	#1
__trace__payload	"YO"	#2

AttributeTable <i>biopsy</i>		
ActivityId	Value	Off.
Mastectomy	1.0	#7
Lumpectomy	1.0	#8

AttributeTable <i>CA15-3</i>		
ActivityId	Value	Off.
Referral	20	#5
Referral	61	#6
Referral	69	#4
Mastectomy	69	#7
Lumpectomy	61	#8
FollowUp	10	#9
FollowUp	55	#10

Max-SAT Query

Declare Model (\mathcal{M})

- Ⓐ **Response**(*Referrall*, $CA15-3 \geq 23.5$, *FollowUp*, $CA15-3 < 23.5$) where $Referral.CA15-3 > FollowUp.CA15-3$
- Ⓑ **Succession**(*FollowUp*, $CA15-3 < 23.5$, *Referral*, $CA15-3 \geq 23.5$) where $Referral.CA15-3 > FollowUp.CA15-3$
- Ⓒ **Choice**(*Mastectomy*, $CA15-3 \geq 50 \ \&\& \ biopsy = true$, *Lumpectomy*, $CA15-3 \geq 50 \ \&\& \ biopsy = true$)

Atomization Pipeline

MODEL ATOMIZATION (§4.2 i)

Atoms	
Atom	Predicates (A, p)
\mathcal{P}_1	<i>Referral</i> , $-\infty < CA15-3 < 23.5$
\mathcal{P}_2	<i>Referral</i> , $23.5 \leq CA15-3 < +\infty$
\mathcal{P}_3	<i>FollowUp</i> , $-\infty < CA15-3 < 23.5$
\mathcal{P}_4	<i>FollowUp</i> , $23.5 \leq CA15-3 < +\infty$
\mathcal{P}_5	<i>Mastectomy</i> , $(-\infty < CA15-3 < 50 \wedge biopsy = \text{false})$
\mathcal{P}_6	<i>Mastectomy</i> , $(-\infty < CA15-3 < 50 \wedge biopsy = \text{true})$
\mathcal{P}_7	<i>Mastectomy</i> , $(50 \leq CA15-3 < +\infty \wedge biopsy = \text{false})$
\mathcal{P}_8	<i>Mastectomy</i> , $(50 \leq CA15-3 < +\infty \wedge biopsy = \text{true})$
\mathcal{P}_9	<i>Lumpectomy</i> , $(-\infty < CA15-3 < 50 \wedge biopsy = \text{false})$
\mathcal{P}_{10}	<i>Lumpectomy</i> , $(-\infty < CA15-3 < 50 \wedge biopsy = \text{true})$
\mathcal{P}_{11}	<i>Lumpectomy</i> , $(50 \leq CA15-3 < +\infty \wedge biopsy = \text{false})$
\mathcal{P}_{12}	<i>Lumpectomy</i> , $(50 \leq CA15-3 < +\infty \wedge biopsy = \text{true})$

Atomized Model (\mathcal{M})

- Ⓐ **Response**($\mathcal{P}_2, \mathcal{P}_3$) where $Referral.CA15-3 > FollowUp.CA15-3$
- Ⓑ **Succession**($\mathcal{P}_2, \mathcal{P}_3$) where $Referral.CA15-3 > FollowUp.CA15-3$
- Ⓒ **Choice**($\mathcal{P}_8, \mathcal{P}_{12}$)

(§4.2 ii)
xTLTL_r Compiler

QUERY PLAN (§4.2 iii)

