INPUT DATA (HUMAN READABLE)

Log, $\mathcal{L}$

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*	2	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 *patient*

ActivityId	Value	Offset
__trace_payload	"001A"	#0
__trace_payload	"002A"	#1
__trace_payload	"003A"	#2

AttributeTable *location*

ActivityId	Value	Offset
__trace_payload	"LN"	#0
__trace_payload	"NE"	#1
__trace_payload	"YO"	#2

AttributeTable *biopsy*

ActivityId	Value	Off.
Mastectomy	1.0	#7
Lumpectomy	1.0	#8

AttributeTable *CA15-3*

ActivityId	Value	Off.
Referral	69	#4
Referral	20	#5
Referral	61	#6
Mastectomy	69	#7
Lumpectomy	61	#8
FollowUp	10	#9
FollowUp	55	#10

Max-SAT Query

Declare Model ($\mathcal{M}$)

Response(*Referrall*, CA15-3 >= 23.5, *FollowUp*, CA15-3 < 23.5) where *Referral*.CA15-3 > *FollowUp*.CA15-3

Succession(*Referral*, CA15-3 >= 23.5, *FollowUp*, CA_15 < 23.5) where *Referral*.CA15-3 > *FollowUp*.CA15-3

Choice(*Mastectomy*, CA15-3 >= 50 && biopsy = true, *Lumpectomy*, CA15-3 >= 50 && biopsy = true)

Atomization Pipeline

DECOMPOSED MODEL (§4.2 *i*)

Atoms

Atom	Predicates
$\mathcal{P}_1$	∞ ≤ Referral.CA15-3 < 23.5
$\mathcal{P}_2$	23.5 ≤ Referral.CA15-3 ≤ + ∞
$\mathcal{P}_3$	-∞ ≤ FollowUp.CA15-3 < 23.5
$\mathcal{P}_4$	23.5 ≤ FollowUp.CA15-3 ≤ + ∞
$\mathcal{P}_5$	-∞ ≤ Mastectomy.CA15-3 < 50 Mastectomy.biopsy = false
$\mathcal{P}_6$	-∞ ≤Mastectomy.CA15-3 < 50 Mastectomy.biopsy = true
$\mathcal{P}_7$	50 ≤ Mastectomy.CA15-3 ≤ + ∞ Mastectomy.biopsy = false
$\mathcal{P}_8$	50 ≤ Mastectomy.CA15-3 ≤ + ∞ Mastectomy.biopsy = true
$\mathcal{P}_9$	-∞ ≤ Lumpectomy.CA15-3 < 50 Lumpectomy.biopsy = false
$\mathcal{P}_{10}$	-∞ ≤ Lumpectomy.CA15-3 < 50 Lumpectomy.biopsy = true
$\mathcal{P}_{11}$	50 ≤ Lumpectomy.CA15-3 ≤ + ∞ Lumpectomy.biopsy = false
$\mathcal{P}_{12}$	50 ≤ Lumpectomy.CA15-3 ≤ + ∞ Lumpectomy.biopsy = true

Atomized Model ($\mathcal{M}$)

Response($\mathcal{P}_2$,$\mathcal{P}_4$) where *Referral*.CA15-3 > *FollowUp*.CA15-3

Succession($\mathcal{P}_2$,$\mathcal{P}_4$) where *Referral*.CA15-3 > *FollowUp*.CA15-3

Choice($\mathcal{P}_8$,$\mathcal{P}_{12}$)

(§4.2 *ii*) xtLTL$_f$ Compiler

QUERY PLAN (§4.2 *iii*)