Method Scope Analysis for `computeCost()` – Class `Communication`

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1. Test Design Strategy Used

Strategy: Combinational Function Test

This strategy is chosen because the method `computeCost()`:

- Has **complex conditional logic**
- Depends on **domain constraints**, not on sequence or internal state
- Class classifies as **quasi-modal**

The method is pure (returns a value) and behaves differently based on combinations of:

- `length` or `duration`
- `commtype` (SMS or VOICE)
- `points` of the client
- `#friends` of the client (in specific VOICE conditions)

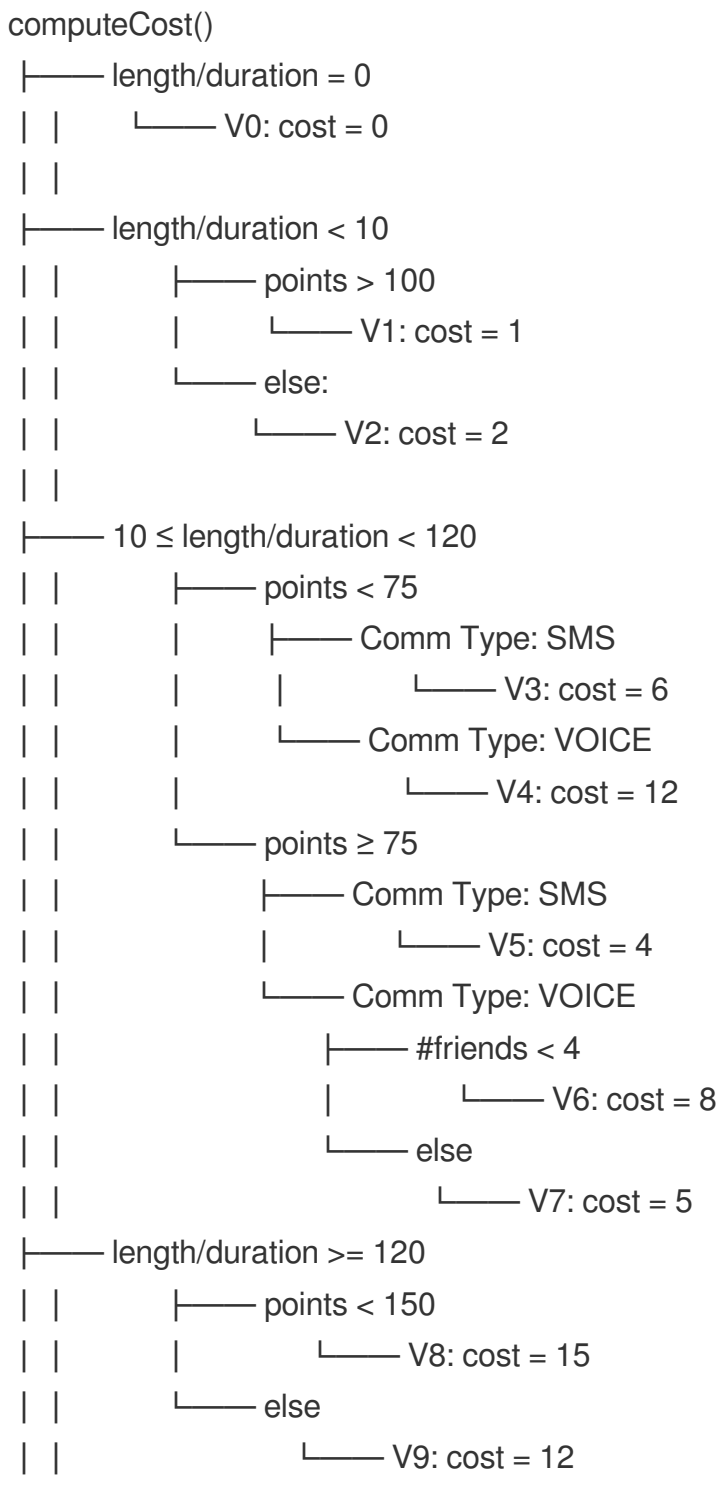
Step by step analysis

Step 1. Identify Input Parameters

- `length/duration` (integer)
- `type` (SMS or VOICE)
- `points` (integer)
- `#friends` (integer)

Step 2: Build the Decision Tree

- Top level: `length` or `duration`
- Nested conditions: `points` and `#friends`
- Final leaves: cost (in cents)



Step 3: Extract Test Vectors (Leaf Nodes)

V0: length = 0 --> cost = 0
V1: length < 10 & points > 100 --> cost = 1
V2: length < 10 & points <= 100 --> cost = 2
V3: 10 ≤ length/duration < 120 & points < 75 & SMS --> cost = 6
V4: 10 ≤ length/duration < 120 & points < 75 & VOICE --> cost = 12
V5: 10 ≤ length/duration < 120 & points >= 75 & SMS --> cost = 4
V6: 10 ≤ length/duration < 120 & points >= 75 & VOICE & #friends < 4 --> cost = 8
V7: 10 ≤ length/duration < 120 & points >= 75 & VOICE & #friends >= 4 --> cost = 5
V8: length/duration >= 120 & points < 150 --> cost = 15
V9: length/duration >= 120 & points >= 150 --> cost = 12

0 <= #points <= 200
CommType = VOICE | SMS
0 <= #friends <= max_friends ---> max_friends = 5*terminals - 3

V0: length = 0 --> cost = 0

V0			**1**	**-**	**-**	**...**	
length/ duration	= 0	ON	0				
		OFF		1			
		OFF			-1		
	IN					0	
points	>= 0	ON				0	
		OFF					

V0			**1**	**-**	**-**	**...**	
	<= 200	ON					
		OFF					
	IN		11	10	9	8	
CommType	SMS	ON					
		OFF					
	VOICE	ON					
		OFF					
	IN		SMS	SMS	SMS	SMS	
#friends	>= 0	ON					
		OFF					
	<= max_friends	ON					
		OFF					
	IN		max_friends	max_friends	max_friends	max_friends	
Expected Result			V0	V2	x	V0	

Only one test case from this Boundary Table is relevant since if length/duration = 0 then any of the other variables can have any other values and the result will be the same.

V1: length < 10 & points > 100 --> cost = 1

V1			**2**	**-**	**3**	**-**	
length/ duration	< 10	ON	10				
		OFF		9			
	IN				1	2	
points	> 100	ON			100		
		OFF				101	
	IN		101	150			
CommType	SMS	ON					
		OFF					
	VOICE	ON					
		OFF					
	IN		SMS	SMS	SMS	SMS	
#friends	>= 0	ON					
		OFF					
	<= max_friends	ON					
		OFF					
	IN		max_friends	max_friends	max_friends	max_friends	
Expected Result			V5	V1	V2	V1	

V2: length < 10 & points <= 100 --> cost = 2

V2			**4**	**-**	**5**	**-**	
length/ duration	< 10	ON	10				
		OFF		9			
	IN				1	2	
points	<= 100	ON			100		
		OFF				101	
	IN		90	80			
CommType	SMS	ON					
		OFF					
	VOICE	ON					
		OFF					
	IN		SMS	SMS	SMS	SMS	
#friends	>= 0	ON					
		OFF					
	<= max_friends	ON					
		OFF					
	IN		max_friends	max_friends	max_friends	max_friends	
Expected Result			V5	V2	V2	V1	

V3: 10 ≤ length/duration < 120 & points < 75 & SMS --> cost = 6

V3			**6**	**-**	**7**	**-**	
length/ duration	>= 10	ON	10				
		OFF		9			
	< 120	ON			120		
		OFF				119	
	IN						
points	< 75	ON					
		OFF					
	IN		10	20	30	40	
CommType	SMS	ON					
		OFF					
	IN		SMS	SMS	SMS	SMS	
#friends	>= 0	ON					
		OFF					
	<= max_friends	ON					
		OFF					
	IN		max_friends	max_friends	max_friends	max_friends	
Expected Result			V3	V2	V8	V3	

V4: 10 ≤ length/duration < 120 & points < 75 & VOICE --> cost = 12

V4			**10**	**-**	**11**	**-**	
length/ duration	>= 10	ON	10				
		OFF		9			
	< 120	ON			120		
		OFF				119	
	IN						
points	< 75	ON					
		OFF					
	IN		10	20	30	40	
CommType	VOICE	ON					
		OFF					
	IN		VOICE	VOICE	VOICE	VOICE	
#friends	>= 0	ON					
		OFF					
	<= max_friends	ON					
		OFF					
	IN		max_friends	max_friends	max_friends	max_friends	
Expected Result			V4	V2	V8	V4	

V4			**10**	**-**	**11**	**-**

V5: 10 ≤ length/duration < 120 & points >= 75 & SMS --> cost = 4

V5			**14**	**-**	**15**	**-**
length/ duration	>= 10	ON	10			
		OFF		9		
	< 120	ON			120	
		OFF				119
	IN					
points	>= 75	ON				
		OFF				
	IN		75	76/101	77/150	78
CommType	SMS	ON				
		OFF				
	IN		SMS	SMS	SMS	SMS
#friends	>= 0	ON				
		OFF				
	<= max_friends	ON				

V5			**14**	**-**	**15**	**-**	
		OFF					
	IN		max_friends	max_friends	max_friends	max_friends	
Expected Result			V5	V2 or V1 (depending on the input of number of points >= 75 & > 100)	V8 or V9 (depending on the input number of points >= 75 & >= 150)	V5	

V6: 10 ≤ length/duration < 120 & points >= 75 & VOICE & #friends < 4 --> cost = 8

V6			**18**	**-**	**19**	**-**	**20**	**-**
length/ duration	>= 10	ON	10					
		OFF		9				
	< 120	ON			120			
		OFF				119		
	IN						10	11
points	>= 75	ON					75	
		OFF						74
	IN		75	76 /101	77/150	78		
CommType	VOICE	ON						

V6			**18**	**-**	**19**	**-**	**20**	**-**
		OFF						
	IN		VOICE	VOICE	VOICE	VOICE	VOICE	VOICE
#friends	< 4	ON						
		OFF						
	IN		1	2	3	1	2	3
Expected Result			V6	V2 or V1 (depending on the number of points >= 75 & > 100)	V8 or V9 (depending on the number of points >= 75 && >= 150)	V6	V6	V4

V7: 10 ≤ length/duration < 120 & points >= 75 & VOICE & #friends >= 4 --> cost = 5

V7			**23**	**-**	**24**	**-**	**25**	**-**
length/ duration	>= 10	ON	10					
		OFF		9				
	< 120	ON			120			
		OFF				119		
	IN						10	11
points	>= 75	ON					75	
		OFF						74

V7			**23**	**-**	**24**	**-**	**25**	**-**
	IN		75	76/101	77/150	78		
CommType	VOICE	ON						
		OFF						
	IN		VOICE	VOICE	VOICE	VOICE	VOICE	VOICE
#friends	>= 4	ON						
		OFF						
	IN		4	5	6	7	8	9
Expected Result			V7	V2 or V1 (depending on the input of number of points >= 75 & > 100)	V8 or V9 (depending on the input of number of points >= 75 && >= 150)	V7	V7	V4

V8: length/duration >= 120 & points < 150 --> cost = 15

V8			**28**	**-**	**29**	**-**
length/ duration	>= 120	ON	120			
		OFF		119		
	IN				120	121
points	< 150	ON			150	

V8			**28**	**-**	**29**	**-**
		OFF				149
	IN		149	148	132	147
CommType	SMS	ON				
		OFF				
	VOICE	ON				
		OFF				
	IN		SMS	SMS	SMS	SMS
#friends	>= 0	ON				
		OFF				
	<= max_friends	ON				
		OFF				
	IN		max_friends	max_friends	max_friends	max_friends
Expected Result			V8	V3 or V4 or V5 or V6 or V7 (depends on the input of number of points: points < 100 & points < 75 & points >= 75; on the input of type of communication SMS & VOICE; and on the input of the	V9	V8

V8			**28**	**-**	**29**	**-**
				number of friends)		

V9: length/duration >= 120 & points >= 150 --> cost = 12

V9			**30**	**-**	**31**	**-**
length/ duration	>= 120	ON	120			
		OFF		119		
	IN				120	121
points	>= 150	ON			150	
		OFF				149
	IN		151	152	153	154
CommType	SMS	ON				
		OFF				
	VOICE	ON				
		OFF				
	IN		SMS	SMS	SMS	SMS
#friends	>= 0	ON				
		OFF				
	<= max_friends	ON				

V9			**30**	**-**	**31**	**-**
		OFF				
	IN		max_friends	max_friends	max_friends	max_friends
Expected Result			V9	V5 or V6 or V7 (depends on the input of type of communication SMS & VOICE and on the input of number of friends)	V9	V8