Cause and Effect Graphing

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Why Cause and Effect Graph

- A Major weakness with equivalence class partitioning is that it **does not allow** the tester to **combine conditions.**
- May not disclose inconsistencies in a specification.
- **Example**

  int char a;

  If a given variable is integer as well as character display the value of the variable.

What is cause and effect Graph

- Cause and effect graphing is a technique that can be used to combine conditions and derive an effective set of test cases that may disclose inconsistencies in a specification.
- This is basically a hardware testing technique adapted to software testing. It considers only the desired external behavior of a system.
- This is a testing technique that aids in selecting test cases that logically relate Causes (inputs) to Effects (outputs) to produce test cases.

What is cause? Effect?

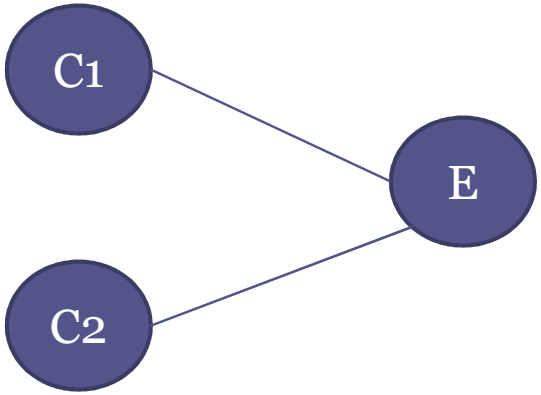
- **Cause**

  A "Cause" represents a distinct input condition that brings about an internal change in the system.

- **Effect**

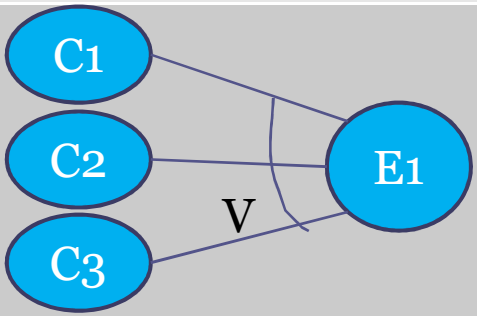
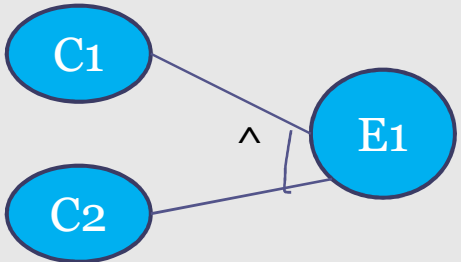
  An "Effect" represents an output condition, a system transformation or a state resulting from a combination of causes.

Example



- Effect E occurs if both causes 1 and 2 are present
- Cause and effects can be represented using oval shape or circle shape.
- Left side-cause
- Right side- Effect

Basic cause effect graph symbols

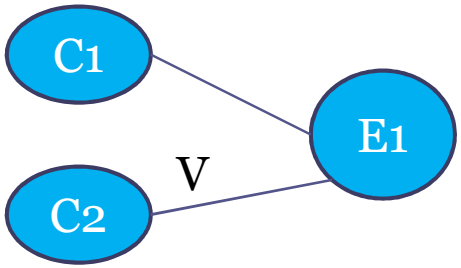
Notations	Meaning	Explanation
	IDENTITY	Effect E1 occurs if cause 1 occurs
	NOT	The NOT function states that if C2 is 1, E2 is 0 and vice-versa.
	OR	Similarly, OR function states that if C1 or C2 or C3 is 1, e1 is 1 else e1 is 0.
	AND	The AND function states that if both C, and C2 are 1, e1 is 1; else e1 is 0. The AND and OR functions are allowed to

Steps to develop test cases

Test technique based on cause effect graph consist in the following step;

1. decompose of the unit to be tested, if it has many functionalities
2. identify the causes (input combinations or classes of input conditions)
3. identify the effects (output conditions, or system transformations)
4. Establish the graph of relations between causes and effects
5. complete the graph by adding the constraints between causes and effects
6. convert the graph to a decision table
7. The columns in the decision table are transformed into test cases.

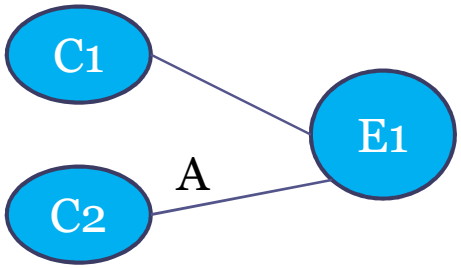
Cause effect graph: optimization rules



Disjunctive case
R1: for X at 1 then
don't take the case A= B=1
R2: for X at 0, enumerates all the situations where A=B=0

A	B
0	0
0	1
1	0
1	-

Cause effect graph: optimization rules



Conjunctive case

R3: for X at 1, enumerate all the situations
Where A=B=C=1
R4: For X at 0
R4.1 include only the case A=B=C=0
R4.2 for all other cases(001, 010, 100, 011,, 101, 110), include only one sample

A	B
1	0
1	1
0	0
	-

Cause effect graph, an example

- The character of the first column should be “A” or “B”. The second column should be a number. In this case the file is considered up dated.
- If the first character is erroneous, we should print then the message X12.
- If in the second column we don’t have a number, we print the message X13.

contd…

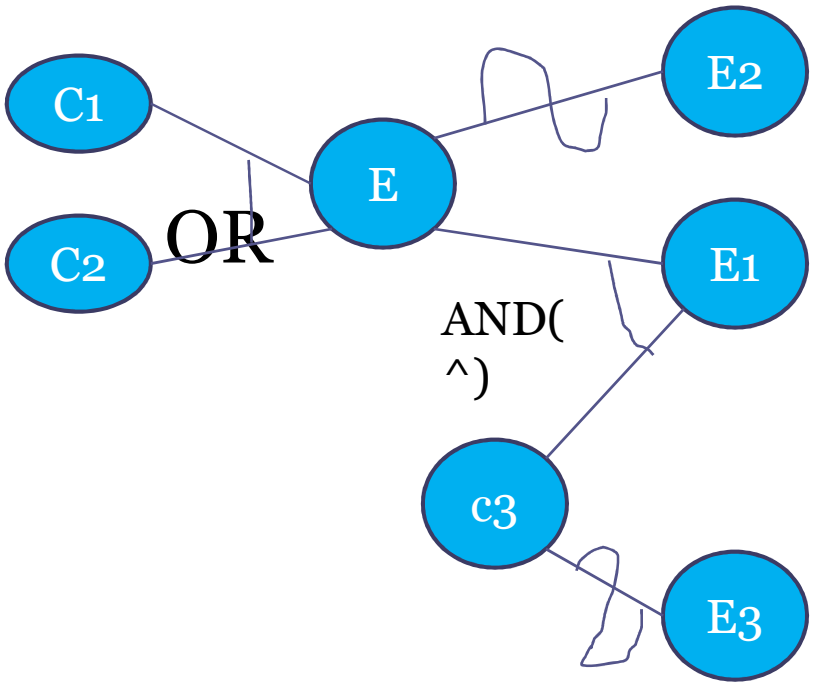
Identify Causes(input)

- C1: first char is “A”
- C2:the first char is :B”
- C3: the second is a number

Identify Effects(output)

- E1: update the file
- E2: message X12
- E3: the message X13

Cause and effect graph



Cause effect graph: decision table

- Start with Effect E1. For E1 to be true, the condition is: (C1 C2) and C3 .
- Here we are representing True as **1** and False as **0**

Cause effect graph: decision table

- Start with Effect E1. For E1 to be true, the condition is: (C1 v C2) ^ C3 .
- Here we are representing True as **1** and False as **0**
- Now for E1 to be "1" (true), we have the below two conditions –

C1 AND C3 will be true
C2 AND C3 will be true

Cause effect graph: decision table

TEST DATA(RULES)	CAUSE			EFFECT		
	C1	C2	C3	E1	E2	E3
1	1	0	1	1		
2	0	1	1	1		
3						
4						
5						
6						

Cause effect graph: decision table

- For E2 to be True, either C1 or C2 has to be false shown as

Cause effect graph: decision table

TEST DATA(RULES)	CAUSE			EFFECT		
	C1	C2	C3	E1	E2	E3
1	1	0	1	1	0	0
2	0	1	1	1	0	0
3	0	1	1	0	1	0
4	1	0	1	0	1	0
5						

Cause effect graph: decision table

- For E3 to be true, C3 should be false.

Cause effect graph: decision table

TEST DATA(RULES)	CAUSE			EFFECT		
	C1	C2	C3	E1	E2	E3
1	1	0	1	1	0	0
2	0	1	1	1	0	0
3	0	0	1	0	1	0
4	1	0	1	0	1	0
5	1	1	0	0	0	1
6	1	0	0	0	0	1

Cause effect graph: decision table

TEST DATA(RULES)	CAUSE			EFFECT		
	C1	C2	C3	E1	E2	E3
1	0	0	0	0	1	1
2	0	1	0	0	0	1
3	1	0	0	0	0	1
	1	1	0	-		
4	0	0	1	0	1	0
5	1	0	1	1	0	0
	1	1	1			
	0	0	0			
6	0	1	1	1	0	0

Test case design

Since there are 6 rules, we get following 6 test cases

Test case #	Input data	Expected result
1	Ss	Print messages E2, E3
2	Bs	Print Message E3
3	As	Print Message E3
4	C2	Print message E2
5	A2	File updated(E1)
6	B3	File updated(E1)

Assignment

- Determine if three numbers make a valid triangle; if not, print message NOT A TRIANGLE.

  If it is a triangle, classify it according to the length of the sides as scalene(no sides equal), isosceles (two sides equal), or equilateral (all sides equal