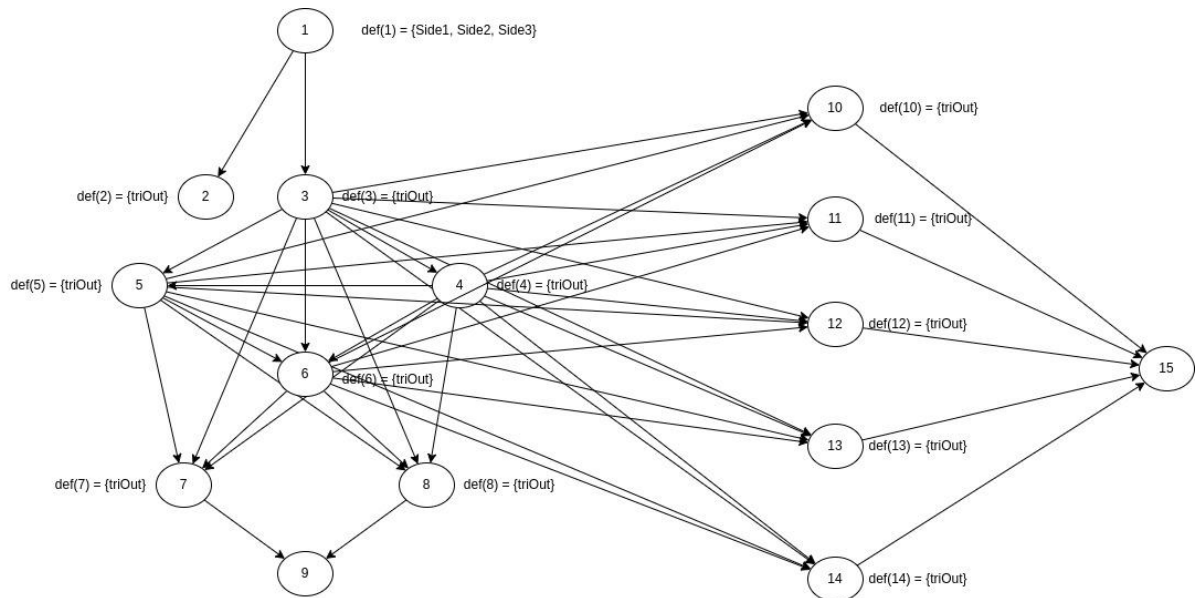


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 Giovanne Lucas Dias Pereira Mariano - 173317  
 Natan Beltrão da Cunha Pevitor Carvalho - 184972

Para o programa do triângulo usado no Exercício da Aula 11:

1. Crie os conjuntos def e uso para as variáveis do programa.



Variável	Definição	C-Uso	P-Uso
Side1	1		1-2, 1-3, 3-4, 3-5, 3-6, 4-5, 4-6, 3-10, 3-11, 3-12, 3-13, 3-14, 4-10, 4-11, 4-12, 4-13, 4-14, 5-10, 5-11, 5-12, 5-13, 5-14, 6-10, 6-11, 6-12, 6-13, 6-14
Side2	1		1-2, 1-3, 3-4, 3-5, 3-6, 4-6, 5-6, 3-10, 3-11, 3-12, 3-13, 3-14, 4-10, 4-11, 4-12, 4-13, 4-14, 5-10, 5-11, 5-12, 5-13, 5-14, 6-10, 6-11, 6-12, 6-13, 6-14
Side3	1		1-2, 1-3, 3-5, 3-6, 4-5, 4-6, 5-6, 3-10,

			3-11, 3-12, 3-13, 3-14, 4-10, 4-11, 4-12, 4-13, 4-14, 5-10, 5-11, 5-12, 5-13, 5-14, 6-10, 6-11, 6-12, 6-13, 6-14
triOut	2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14	2, 4, 5, 6, 9, 15	3-7, 3-8, 4-7, 4-8, 5-7, 5-8, 6-7, 6-8, 3-10, 3-11, 3-12, 3-13, 3-14, 4-10, 4-11, 4-12, 4-13, 4-14, 5-10, 5-11, 5-12, 5-13, 5-14, 6-10, 6-11, 6-12, 6-13, 6-14

Nó	Linha(s)
1	30
2	44-45
3	48
4	50
5	52
6	54
7	61
8	63
9	64
10	71
11	73
12	75
13	77
14	79
15	80

Observação: consideramos diretivas de return como c-uso da variável retornada.

2. Identifique os pares DU usando a ferramenta [Data Flow Coverage](#).

DU Pairs for all variables are:

Node color: Initial Node, Final Node

Variable	DU Pairs
Side1	[1, (1, 2)] [1, (1, 3)] [1, (3, 4)] [1, (3, 5)] [1, (3, 6)] [1, (4, 5)] [1, (4, 6)] [1, (3, 10)] [1, (3, 11)] [1, (3, 12)] [1, (3, 13)] [1, (3, 14)] [1, (4, 10)] [1, (4, 11)] [1, (4, 12)] [1, (4, 13)] [1, (4, 14)] [1, (5, 10)] [1, (5, 11)] [1, (5, 12)] [1, (5, 13)] [1, (5, 14)] [1, (6, 10)] [1, (6, 11)] [1, (6, 12)] [1, (6, 13)] [1, (6, 14)]

Side2	[1, (1, 2)] [1, (1, 3)] [1, (3, 4)] [1, (3, 5)] [1, (3, 6)] [1, (4, 6)] [1, (5, 6)] [1, (3, 10)] [1, (3, 11)] [1, (3, 12)] [1, (3, 13)] [1, (3, 14)] [1, (4, 10)] [1, (4, 11)] [1, (4, 12)] [1, (4, 13)] [1, (4, 14)] [1, (5, 10)] [1, (5, 11)] [1, (5, 12)] [1, (5, 13)] [1, (5, 14)] [1, (6, 10)] [1, (6, 11)] [1, (6, 12)] [1, (6, 13)] [1, (6, 14)]
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Side3	[1, (1, 2)] [1, (1, 3)] [1, (3, 5)] [1, (3, 6)] [1, (4, 5)] [1, (4, 6)] [1, (5, 6)] [1, (3, 10)] [1, (3, 11)] [1, (3, 12)] [1, (3, 13)] [1, (3, 14)] [1, (4, 10)] [1, (4, 11)] [1, (4, 12)] [1, (4, 13)] [1, (4, 14)] [1, (5, 10)] [1, (5, 11)] [1, (5, 12)] [1, (5, 13)] [1, (5, 14)] [1, (6, 10)] [1, (6, 11)] [1, (6, 12)] [1, (6, 13)] [1, (6, 14)]
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triOut	[2, (3, 7)] [2, (3, 8)] [2, (4, 7)] [2, (4, 8)] [2, (5, 7)] [2, (5, 8)] [2, (6, 7)] [2, (6, 8)] [2, (3, 10)] [2, (3, 11)] [2, (3, 12)] [2, (3, 13)] [2, (3, 14)] [2, (4, 10)] [2, (4, 11)] [2, (4, 12)] [2, (4, 13)] [2, (4, 14)] [2, (5, 10)] [2, (5, 11)] [2, (5, 12)] [2, (5, 13)] [2, (5, 14)] [2, (6, 10)] [2, (6, 11)] [2, (6, 12)] [2, (6, 13)] [2, (6, 14)] [3, (3, 7)] [3, (3, 8)] [3, (4, 7)] [3, (4, 8)] [3, (5, 7)] [3, (5, 8)] [3, (6, 7)] [3, (6, 8)] [3, (3, 10)] [3, (3, 11)] [3, (3, 12)] [3, (3, 13)] [3, (3, 14)] [3, (4, 10)]
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3. Estabeleça os requisitos de testes para o critério todos os usos.

**All Use Coverage for all variables are:**

<b>Variable</b>	<b>All Use Coverage</b>
Side1 (27)	[1,2] [1,3,7,9] [1,3,4,7,9] [1,3,5,7,9] [1,3,6,7,9] [1,3,4,5,7,9] [1,3,4,6,7,9] [1,3,10,15] [1,3,11,15] [1,3,12,15] [1,3,13,15] [1,3,14,15] [1,3,4,10,15] [1,3,4,11,15] [1,3,4,12,15] [1,3,4,13,15] [1,3,4,14,15] [1,3,5,10,15] [1,3,5,11,15] [1,3,5,12,15] [1,3,5,13,15] [1,3,5,14,15] [1,3,6,10,15] [1,3,6,11,15] [1,3,6,12,15] [1,3,6,13,15] [1,3,6,14,15]



Side2 (27)	[1,2] [1,3,7,9] [1,3,4,7,9] [1,3,5,7,9] [1,3,6,7,9] [1,3,4,6,7,9] [1,3,5,6,7,9] [1,3,10,15] [1,3,11,15] [1,3,12,15] [1,3,13,15] [1,3,14,15] [1,3,4,10,15] [1,3,4,11,15] [1,3,4,12,15] [1,3,4,13,15] [1,3,4,14,15] [1,3,5,10,15] [1,3,5,11,15] [1,3,5,12,15] [1,3,5,13,15] [1,3,5,14,15] [1,3,6,10,15] [1,3,6,11,15] [1,3,6,12,15] [1,3,6,13,15] [1,3,6,14,15]
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Side3 (27)	[1,2] [1,3,7,9] [1,3,5,7,9] [1,3,6,7,9] [1,3,4,5,7,9] [1,3,4,6,7,9] [1,3,5,6,7,9] [1,3,10,15] [1,3,11,15] [1,3,12,15] [1,3,13,15] [1,3,14,15] [1,3,4,10,15] [1,3,4,11,15] [1,3,4,12,15] [1,3,4,13,15] [1,3,4,14,15] [1,3,5,10,15] [1,3,5,11,15] [1,3,5,12,15] [1,3,5,13,15] [1,3,5,14,15] [1,3,6,10,15] [1,3,6,11,15] [1,3,6,12,15] [1,3,6,13,15] [1,3,6,14,15]
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triOut (28 paths)	[1,3,7,9] [1,3,8,9] [1,3,10,15] [1,3,11,15] [1,3,12,15] [1,3,13,15] [1,3,14,15] [1,3,4,7,9] [1,3,4,8,9] [1,3,4,10,15] [1,3,4,11,15] [1,3,4,12,15] [1,3,4,13,15] [1,3,4,14,15] [1,3,5,7,9] [1,3,5,8,9] [1,3,5,10,15] [1,3,5,11,15] [1,3,5,12,15] [1,3,5,13,15] [1,3,5,14,15] [1,3,6,7,9] [1,3,6,8,9] [1,3,6,10,15] [1,3,6,11,15] [1,3,6,12,15] [1,3,6,13,15] [1,3,6,14,15]
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Gerando, os 32 caminhos únicos:

[[1, 2], [1, 3, 7, 9], [1, 3, 4, 7, 9], [1, 3, 5, 7, 9], [1, 3, 6, 7, 9], [1, 3, 4, 5, 7, 9], [1, 3, 4, 6, 7, 9], [1, 3, 10, 15], [1, 3, 11, 15], [1, 3, 12, 15], [1, 3, 13, 15], [1, 3, 14, 15], [1, 3, 4, 10, 15], [1, 3, 4, 11, 15], [1, 3, 4, 12, 15], [1, 3, 4, 13, 15], [1, 3, 4, 14, 15], [1, 3, 5, 10, 15], [1, 3, 5, 11, 15], [1, 3, 5, 12, 15], [1, 3, 5, 13, 15], [1, 3, 5, 14, 15], [1, 3, 6, 10, 15], [1, 3, 6, 11, 15], [1, 3, 6, 12, 15], [1, 3, 6, 13, 15], [1, 3, 6, 14, 15], [1, 3, 5, 6, 7, 9], [1, 3, 8, 9], [1, 3, 4, 8, 9], [1, 3, 5, 8, 9], [1, 3, 6, 8, 9]]

4. Compare com os requisitos de teste gerados para os critérios decisão/condições: o número de requisitos é o mesmo? Quais as diferenças?

No Exercício 11, obtivemos os seguintes requisitos de teste para os critérios decisão/condições:

[1,2a], [2a,2b], [2a,3], [2b,3], [2b,2c], [2c,3], [2c,4], [4,5], [5,6], [5,7], [6,7], [7,8], [7,9], [8,9], [9,10], [9,11], [10,11], [11,16], [11,12a], [12a,13], [12a,12b], [13,15], [12b,13], [12b,12c], [12c,15], [12c,14], [14,15], [16,18a], [16,17], [17,25], [18a,18b], [18a,20a], [18b,20a], [18b,19], [19,25], [20a,22a], [20a,20b], [20b,21], [20b,22a], [21,25], [22a,22b], [22a,24], [24,25], [22b,24], [22b,23], [23,25]

No total, são 46 requisitos de teste.

Já os caminhos de teste para cobertura de arestas (sem validação de impossibilidade lógica) gerados seguem a seguinte distribuição:

- Com o Algoritmo 1 do GraphCoverage, obtemos os seguintes casos de teste

**18** test paths are needed for Edge Coverage

[1,2a,3],  
[1,2a,2b,3],  
[1,2a,2b,2c,3],  
[1,2a,2b,2c,4,5,7,9,11,12a,12b,12c,15],  
[1,2a,2b,2c,4,5,7,9,11,12a,13,15],  
[1,2a,2b,2c,4,5,7,9,11,16,17,25],  
[1,2a,2b,2c,4,5,7,9,11,12a,12b,12c,14,15],  
[1,2a,2b,2c,4,5,7,9,11,16,18a,18b,19,25],  
[1,2a,2b,2c,4,5,7,9,11,16,18a,20a,20b,21,25],  
[1,2a,2b,2c,4,5,7,9,11,16,18a,20a,22a,24,25],  
[1,2a,2b,2c,4,5,7,9,11,16,18a,20a,22a,22b,23,25],  
[1,2a,2b,2c,4,5,6,7,9,11,12a,12b,12c,15],  
[1,2a,2b,2c,4,5,7,8,9,11,12a,12b,12c,15],  
[1,2a,2b,2c,4,5,7,9,10,11,12a,12b,12c,15],  
[1,2a,2b,2c,4,5,7,9,11,12a,12b,13,15],  
[1,2a,2b,2c,4,5,7,9,11,16,18a,18b,20a,20b,21,25],  
[1,2a,2b,2c,4,5,7,9,11,16,18a,20a,20b,22a,24,25],  
[1,2a,2b,2c,4,5,7,9,11,16,18a,20a,22a,22b,24,25]

- Com o Algoritmo 2, obtivemos os casos a seguir:

**13** test paths are needed for Edge Coverage

[1,2a,2b,2c,4,5,7,9,11,16,18a,20a,22a,22b,23,25],  
[1,2a,2b,2c,4,5,7,9,11,16,18a,20a,20b,22a,24,25],  
[1,2a,2b,2c,4,5,7,9,11,16,18a,18b,19,25],  
[1,2a,2b,2c,4,5,7,9,11,16,18a,20a,22a,22b,24,25],  
[1,2a,2b,2c,4,5,7,9,11,16,17,25],  
[1,2a,2b,2c,4,5,7,9,11,12a,12b,12c,14,15],  
[1,2a,2b,2c,4,5,7,9,11,12a,12b,12c,15],  
[1,2a,2b,2c,4,5,7,9,11,12a,12b,13,15],  
[1,2a,2b,2c,4,5,7,8,9,11,16,18a,18b,20a,20b,21,25],  
[1,2a,2b,2c,4,5,6,7,9,10,11,12a,13,15],  
[1,2a,2b,2c,3],  
[1,2a,2b,3],

[1,2a,3]

Comparando com os 32 requisitos de teste encontrados para todos os usos, a cobertura para decisões e condições tem um número muito menor de caminhos. Uma das principais diferenças é que os caminhos de teste na análise de fluxo de controle costumam ser maiores e cobrem múltiplos requisitos ao mesmo tempo, enquanto os caminhos de teste para fluxo de dados cobrem poucos requisitos de teste, exigindo mais caminhos para cobrir todos os usos.