SWE 637 Software Testing
Chapter 7

Graph Coverage
In-class exercise

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(Dr. B for short)

https://go.gmu.edu/SWE637

Adapted from slides by Jeff Offutt and Bob Kurtz

Graph Coverage Exercise 1

Assume a graph defined as follows:

N = { 1, 2, 3, 4 }

$N0$ = { 1 }

Nf = { 4 }

E = { (1,2), (2,3), (3,2), (2,4) }

1. Draw the graph

2. List *test paths* that satisfy node coverage but NOT edge coverage, or explain why that is not possible

3. List *test paths* that satisfy edge coverage but NOT edge-pair coverage, or explain why that is not possible

4. List *test paths* that satisfy edge-pair coverage

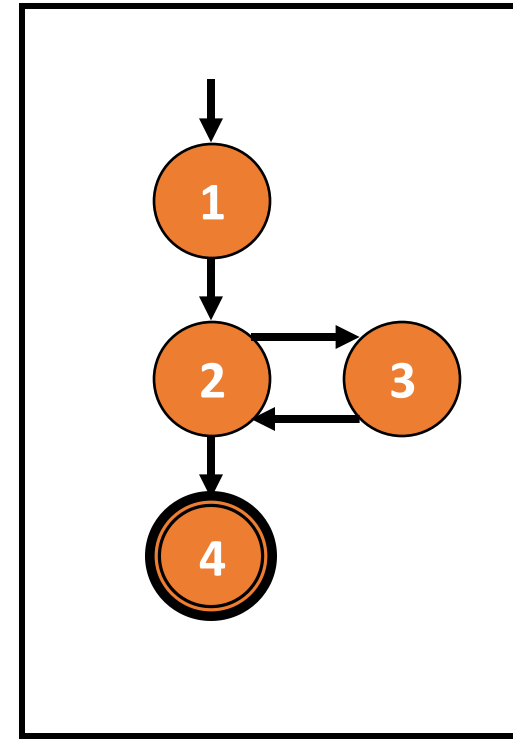# Graph Coverage Exercise 1

Assume a graph defined as follows:

N = { 1, 2, 3, 4 }

$N0$ = { 1 }

Nf = { 4 }
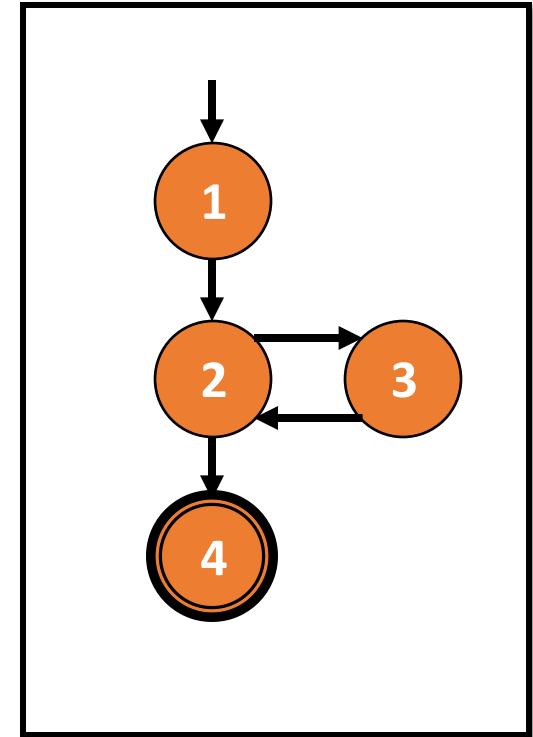
E = { (1,2), (2,3), (3,2), (2,4) }

1. Draw the graph

Node vs. Edge Coverage

2. List test paths that satisfy node coverage but NOT edge coverage, or explain why that is not possible

NOT POSSIBLE – there are no edges that bypass a node, thus it is impossible to miss an edge without also missing a node.

Edge vs. Edge-pair coverage

3. List test paths that satisfy edge coverage but NOT edge-pair coverage, or explain why that is not possible

Test path [1,2,3,2,4] satisfies edge coverage but does not satisfy edge-pair coverage because it does not tour edge-pairs [1,2,4] or [3,2,3]
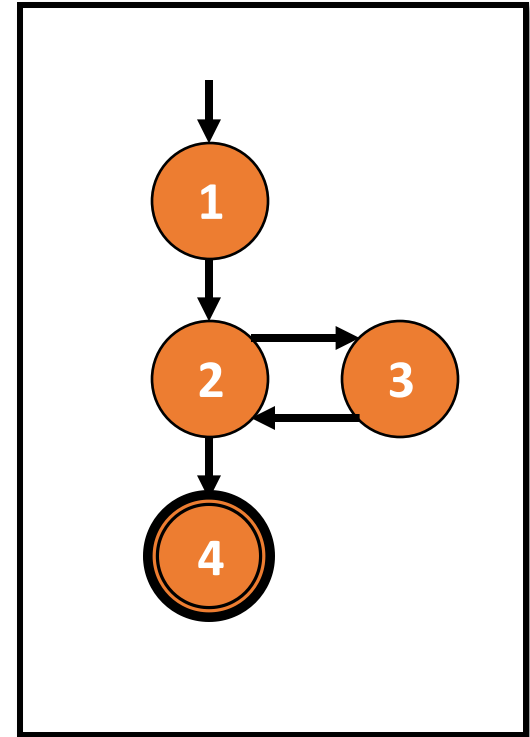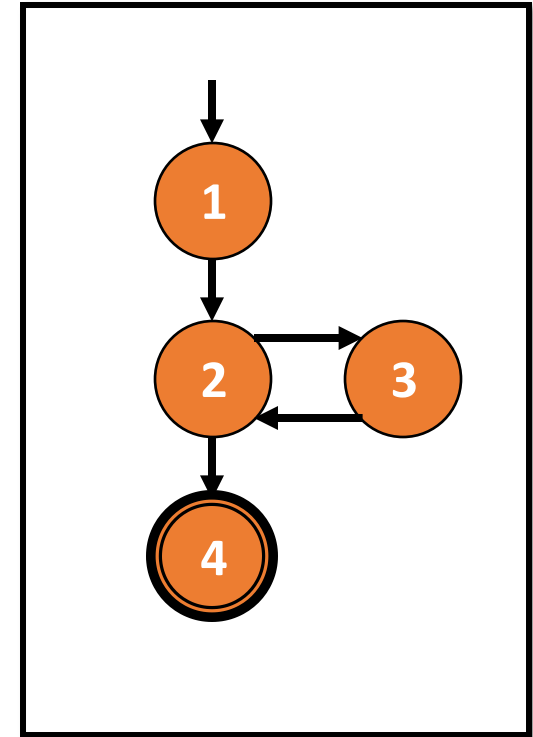
Edge-pair coverage

4. List test paths that satisfy edge-pair coverage

TRs = { [1,2,3], [1,2,4],
           [2,3,2], [3,2,3],
           [3,2,4] }

T = { [1,2,4], [1,2,3,2,3,2,4] }

Graph Coverage Exercise 2

Assume a graph defined as follows:

N = { 1, 2, 3 }

$N0$ = { 1 }

Nf = { 3 }

E = { (1,2), (1,3), (2,1),
(2,3), (3,1) }

1. Draw the graph
2. Which of the following paths are test paths? Why or why not?

p1 = [1,2,3,1]

p2 = [1,3,1,2,3]

p3 = [1,2,3,1,2,1,3]

p4 = [2,3,1,3]

p5 = [1,2,3,2,3]

3. List the requirements for edge-pair coverage
4. Do the previously-identified test paths satisfy edge-pair coverage? Why or why not?
5. Consider the prime path [3,1,3] and test path p6 = [1,3,1,2,1,3]

Does p6 tour the prime path [3,1,3] directly?

Does p6 tour the prime path [3,1,3] with a sidetrip? If so, what is the sidetrip?

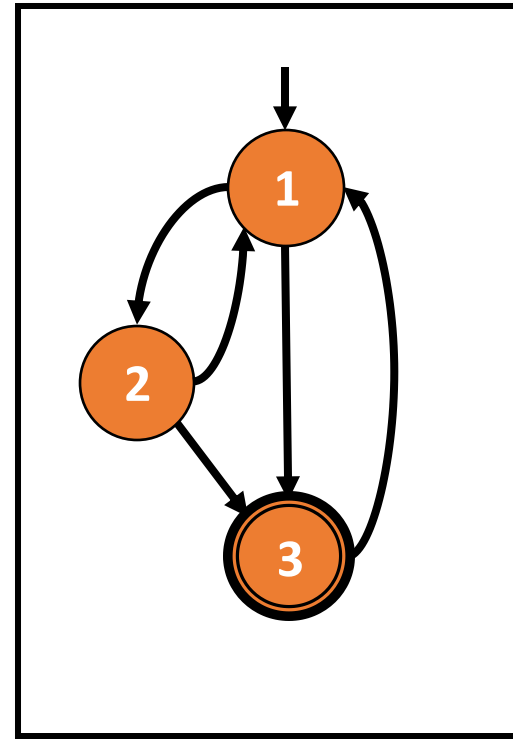# Graph Coverage Exercise 2

Assume a graph defined as follows:

N = { 1, 2, 3 }

$N0$ = { 1 }

Nf = { 3 }

E = { (1,2), (1,3), (2,1), (2,3), (3,1) }

1. Draw the graph

Test Paths

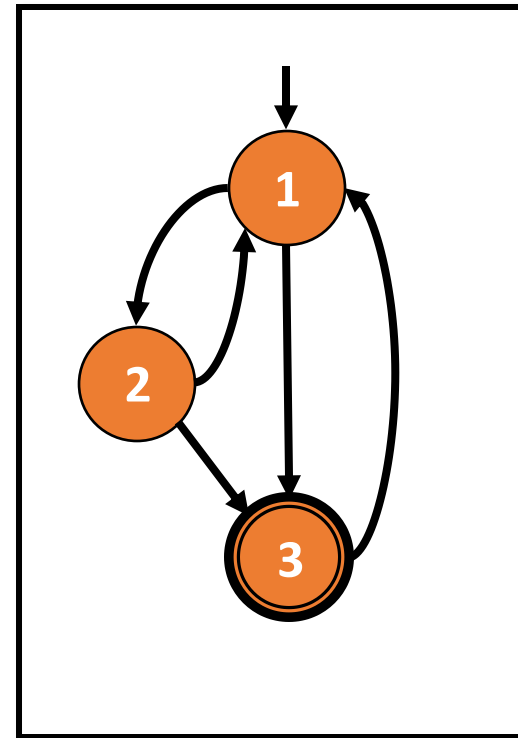Which of the following paths are test paths? Why or why not?

p1 = [1,2,3,1]   No, doesn't end at a terminal node

p2 = [1,3,1,2,3]   Yes

p3 = [1,2,3,1,2,1,3]   Yes
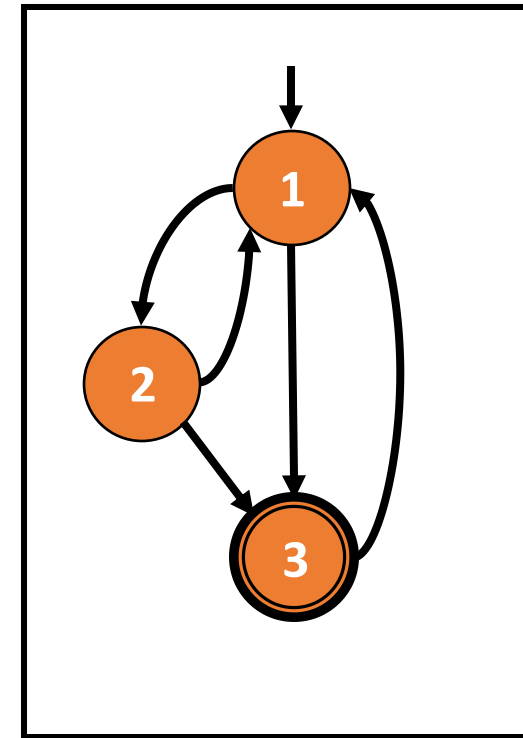
p4 = [2,3,1,3]   No, doesn't start at an initial node

p5 = [1,2,3,2,3]   No, edge (3,2) is not part of the graph

Edge-Pair Coverage

List the requirements for edge-pair coverage

Edge-pair TRs:
{ [1,2,1], [1,2,3],
  [1,3,1], [2,1,2],
  [2,1,3], [2,3,1],
  [3,1,2], [3,1,3] }

Edge-Pair Coverage

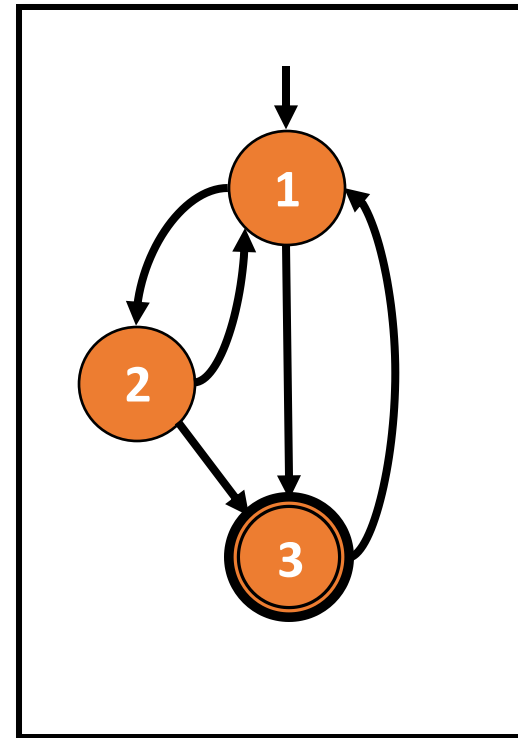Do the previously-identified test paths satisfy edge-pair coverage? Why or why not?

Test paths:
{ [1,3,1,2,3], [1,2,3,1,2,1,3] }

Edge-pairs:
{ [1,2,1], [1,2,3], [1,3,1], [2,1,2],
  [2,1,3], [2,3,1], [3,1,2], [3,1,3] }

No, the test paths do not
tour edge-pairs [2,1,2] or
[3,1,3]

Prime Paths and Touring

Consider the prime path [3,1,3] and test path p6 = [1,3,1,2,1,3]

Does p6 tour the prime path [3,1,3] directly?

No, because [3,1,3] is not a subpath of p6.

Does p6 tour the prime path [3,1,3] with a sidetrip?

Yes, p6 tours [3,1,3] with the sidetrip [1,2,1].