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:

\[ N = \{ 1, 2, 3, 4 \} \]
\[ NO = \{ 1 \} \]
\[ Nf = \{ 4 \} \]
\[ E = \{ (1,2), (2,3), (3,2), (2,4) \} \]

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:

\[ N = \{ 1, 2, 3, 4 \} \]

\[ NO = \{ 1 \} \]

\[ Nf = \{ 4 \} \]

\[ E = \{ (1,2), (2,3), (3,2), (2,4) \} \]

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:

\[ N = \{ 1, 2, 3 \} \]
\[ N_0 = \{ 1 \} \]
\[ N_f = \{ 3 \} \]
\[ E = \{ (1,2), (1,3), (2,1), (2,3), (3,1) \} \]

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] \}
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]
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 \([1,2,1]\).