Software Testing, Quality Assurance and Maintenance Winter 2015

Lecture 8 — January 21, 2015

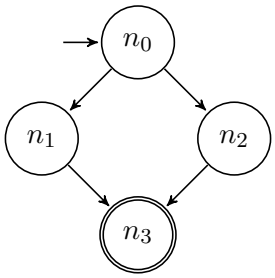
Patrick Lam *version 1*

Another coverage criterion that I've mentioned, but is not in the notes:

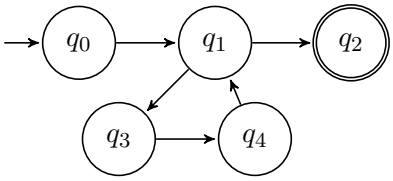
Criterion 1 Specified Path Coverage. *(SPC)* TR *contains a specified set S of paths.*

Specified path coverage might be useful for encoding a set of usage scenarios.

Prime Path Coverage versus Complete Path Coverage.



- Prime paths:
- path(t_1) =
- path(t_2) =
- $T_1 = \{t_1, t_2\}$ satisfies both PPC and CPC.



- Prime paths:
- path(t_3) =
- path(t_4) =
- $T_1 = \{t_3, t_4\}$ satisfies both PPC but not CPC.

Now, we'll see another graph theory-inspired coverage criterion. First, some definitions:

Definition 1 *A graph G is* connected *if every node in G is reachable from the set of initial nodes N_0.*

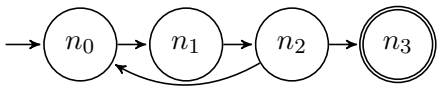
Definition 2 *An edge e is a* bridge *for a graph G if G is connected, but removing e from G results in a disconnected graph.*

(This is similar to an articulation point in a graph, except that articulation points are nodes, not edges.)

Criterion 2 Bridge Coverage. *(BC)* TR *contains all bridges.*

Assume that a graph contains at least two nodes, and all nodes in a graph are reachable from the initial nodes. Does bridge coverage subsume node coverage? Justify your answer, providing a counterexample if appropriate.

Specifying versus meeting test requirements. Consider this graph.



The following simple (and loop-free) path is, in fact, prime:

$$p =$$

PPC includes this path as a test requirement. The *test path*

meets the test requirement induced by p even though it is not prime. Note that a test path may satisfy the prime path test requirement even though it is not prime.

Graph Coverage Exercise. Consider the graph defined by the following sets.

- $N = \{1, 2, 3, 4, 5, 6, 7\}$
- $N_0 = \{1\}$
- $N_f = \{7\}$
- $E = \{[1, 2], [1, 7], [2, 3], [2, 4], [3, 2], [4, 5], [4, 6], [5, 6], [6, 1]\}$

Also consider the following test paths:

- $t_0 = [1, 2, 4, 5, 6, 1, 7]$
- $t_1 = [1, 2, 3, 2, 4, 6, 1, 7]$

Answer the following questions.

(a) Draw the graph.

(b) List the test requirements for EPC. [hint: 12 requirements of length 2]

(c) Does the given set of test paths satisfy EPC? If not, identify what is missing.

(d) Consider the simple path $[3, 2, 4, 5, 6]$ and test path $[1, 2, 3, 2, 4, 6, 1, 2, 4, 5, 6, 1, 7]$. Is the simple path a subpath of the test path?

(e) List the test requirements for NC, EC, and PPC on this graph.

(f) List a test path that achieves NC but not EC on the graph.

(g) List a test path that achieves EC but not PPC on the graph.

(Note: We've talked about test sets meeting criteria in the past. For (f) and (g), we are simply talking about a test set with one test case that induces the given test paths.)