Pairwise Testing

• Necessary condition
  - For each pair of input parameters, every combination of valid values of these two parameters be covered

• Example
  - Parameter A has values A1 and A2
  - Parameter B has values B1 and B2
  - Parameter C has values C1 and C2

• Discussion

Some Test Cases

• {\{(A1, B1, C1), (A1, B2, C2), (A2, B1, C3), (A2, B2, C1), (A2, B1, C2), (A1, B2, C3)}\}

• {\{(A1, B1, C1), (A1, B2, C1), (A2, B1, C2), (A2, B2, C3), (A2, B1, C1), (A1, B2, C2), (A1, B1, C3)}\}

• {\{(A1, B1, C1), (A1, B2, C1), (A2, B1, C2), (A2, B2, C2), (A2, B1, C1), (A1, B1, C2), (A1, B1, C3), (A2, B2, C3)}\}

Growth Terms

• Horizontal
  - Let T be a pairwise test set for parameters P1, P2, ..., Pn-1
  - Horizontal growth of T for parameter Pi is to extend each test in T by adding the value of Pi

• Vertical
  - After applying horizontal growth
  - Let T be a test set for P1, P2, ..., Pi
  - Let π be the set of tests not covered by T
  - The vertical growth of T according to π is to construct new tests for pairs in π and add them to T

Horizontal Growth

Algorithm IPG(\pi, p_i)

// T is a test set. But T is also treated as a list with elements in arbitrary order
// assume that the domain of pi contains values v1, v2, ..., and \nu_i
\pi = \{ \text{pairs between values of } p_i \text{ and values of } p_1, p_2, \ldots, p_{i-1} \};

if \(|T| \leq q\)
  \{ for \(1 \leq j \leq |T|\), extend the jth test in T by adding value v_j and remove from \(\pi\) pairs covered by the extended test; \}
else
  \{ for \(1 \leq j \leq q\), extend the jth test in T by adding value v_j and remove from \(\pi\) pairs covered by the extended test; for \(q < j \leq |T|\), extend the jth test in T by adding one value of \(p_i\) such that the resulting test covers the most number of pairs in \(\pi\), and remove from \(\pi\) pairs covered by the extended test; \}

Vertical Growth

Algorithm $IP_O.V(T, x)$

1. let $T'$ be an empty set;
2. for each pair in $\pi$
3. \{
4. assume that the pair contains value $w$ of $p_k$, $1 \leq k < i$, and value $u$ of $p_i$;
5. if $T'$ contains a test with "-" as the value of $p_k$ and $u$ as the value of $p_i$,
6. modify this test by replacing the "-" with $w$;
7. else
8. add a new test to $T'$ that has $w$ as the value of $p_k$, $u$ as the value of $p_i$,
9. and "-" as the value of every other parameter;
10. \}
11. $T = T \cup T'$;