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 $P_1, P_2, ..., P_{n-1}$
  - Horizontal growth of T for parameter $P_i$ is to extend each test in T by adding the value of $P_i$.

- **Vertical**
  - After applying horizontal growth
  - Let T be a test set for $p_1, p_2, ..., p_i$
  - Let p be the set of tests not covered by T
  - The vertical growth of T according to p is to construct new tests for pairs in p and add them to T

---

**Horizontal Growth**

**Algorithm** $IPO_{HR}(T, p_i)$

// T is a test set. But T is also treated as a list with elements in arbitrary order.
assume that the domain of $p_i$ contains values $v_1, v_2, ..., v_q$;
let $\pi = \{ \text{pairs between values of } p_i \text{ and values of } p_1, p_2, ..., p_{i-1} \}$;

if ($|T| \leq q$)
    for $1 \leq j \leq |T|$, extend the $j$th 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 $j$th 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 $j$th 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 IPO.$V(T, \pi)$**

1. let $T'$ be an empty set;
2. for each pair in $\pi$
   1. assume that the pair contains value $w$ of $p_k$, $1 \leq k < i$, and value $u$ of $p_i$;
   2. if ($T'$ contains a test with "−" as the value of $p_k$ and $u$ as the value of $p_i$)
      1. modify this test by replacing the "−" with $w$;
   3. else
      1. add a new test to $T'$ that has $w$ as the value of $p_k$, $u$ as the value of $p_i$, and "−" as the value of every other parameter;
3. $T = T \cup T'$;