Heuristic Approach to TCG

- Heuristic
  - Webster dictionary
    - involving or serving as an aid to learning, discovery, or problem-solving by experimental and especially trial-and-error methods
- Examples
  - Discussion

Search Examples

- Looking for a solution in a search space
- Known techniques
  - Depth-first
  - Breadth-first
  - Binary search for certain structures
- Others?
  - Large branching factor
  - Very deep
Do we need a Heuristic?

- To generate test cases that achieve maximal branch coverage

**Example Flow-chart**

![Flow-chart](image)
Observations

- 1T, 1F, 2T, 2F have been covered
- 3T has been covered
- To cover 3F, can we tweak the test case for 3T?
- Also, what do we do when multiple test cases are available for tweaking?
  - Need a way to compare

“Best Test Case”

- If (Exp) THEN ___ ELSE ___;
- Exp can be (LHS <op> RHS)
- The “goodness” of a test case t1
  \[ \frac{|LHS(t1) - RHS(t1)|}{(2*\text{MAX}(|LHS(t1)|,|RHS(t1)|))} \]
- Should we rely on only local information?
  - What are the risks?
Better "Best Test Case"

\[ G(t,D) = w \times L(t,D) + (1-w) \times P(t,D) \]  \hspace{1cm} (2)

where:
- \( G(t,D) \) : Goodness of test case \( t \) at condition \( D \).
- \( L(t,D) \) : Freedom space of \( t \) at \( D \).
- \( P(t,D) \) : Sum of freedom space reciprocals of \( t \) along the path toward \( D \).
- \( w \) : Weighting factor between \( L(t,D) \) and \( P(t,D) \), \( 0 < w < 1 \).

\( L(t,D) \) is defined as in formula (1), and \( P(t,D) \) is defined as:

\[ P(t,D) = \sum_{\text{all } D_i} \frac{1}{(n \times L(t,D))} \]  \hspace{1cm} (3)

• Smallest value indicates the best test case