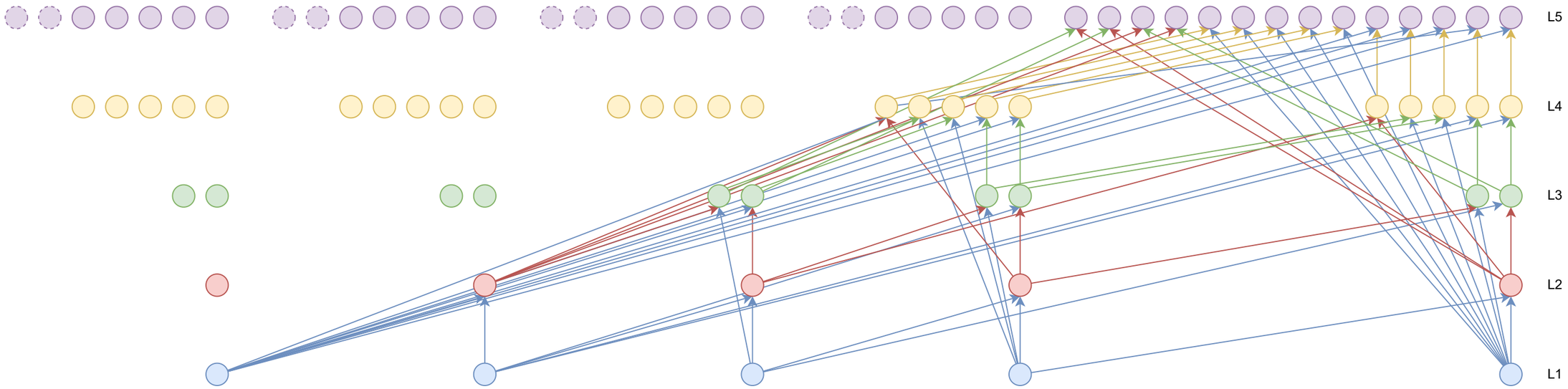
SANI Pregenerated Architecture - 23 Nov 2022 - 13 Dec 2022 [DRAFT]

Structure type #1
(SANI implementation with contiguous wordIndex):



Permutation Count/Measurement

Layer 1: 1 nodes
Layer 2: 1 nodes
Layer 3: 2 nodes (2^(3-1)-3)=1
Layer 4: 5 nodes (2^(4-1)-3)=5
Layer 5: 13 nodes (2^(5-1)-3)=13
Layer 6: 29 nodes? ((2^(6-1)-3)=29

numberOfNodes = 2^(L-1)-3)

- Number of layers (L) = number of words/tokens
- Each node (state) contains q hidden units (hiddenSize ~= embeddingSize, e.g. 512)
- *Optional: each node permutation on a layer (horiz replicas) is stored in same hidden units; ie each hidden unit has multiple pairs of inputs. Required if use same architecture for entire sentence; in which case a single node for each layer is sufficient.

Therefore for 64 word/token sentence, number of nodes = 2^(64-1)-3) = 1*10^19

Conclusion:
- Can only use pregenerated SANI network for lower layers (subsentences)
- Require recursion / mix-and-match for longer sequences

Limitation:
- Need to be able to respond to same semantic input independent of syntactical substructure (exact number of words of subgraph);
    - will require recursion (ie same node / sets of hidden units for every layer)
    - consider recieve recursive input with skipped layers [ie from t time steps earlier] to prevent RNN memorisation/accumulation collapse

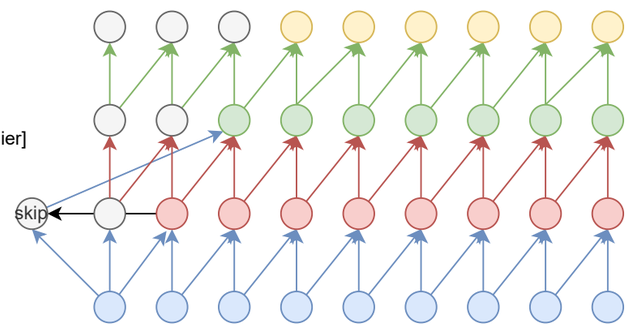
Rule

Rule: every SANI node can only have 2 incoming connections

Structure type #2
(**overloaded SANI implementation with wordIndex overlap**):
[Current implementation]

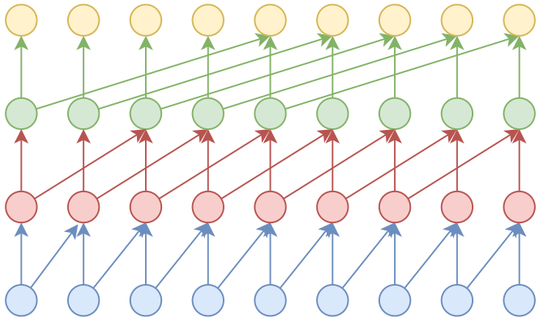
- Each node requires 2 fully satisfied input nodes (*or 1 fully satisfied input node and 1 partially satisfied input node).
- Network should learn to disgard unused/discordant ends of subsequences not connected to subgraph.

- Ideally (as per SANI spec) there should be no overlap between input nodes, however it is difficult to capture all possible syntactical graph structures with this limitation enforced.

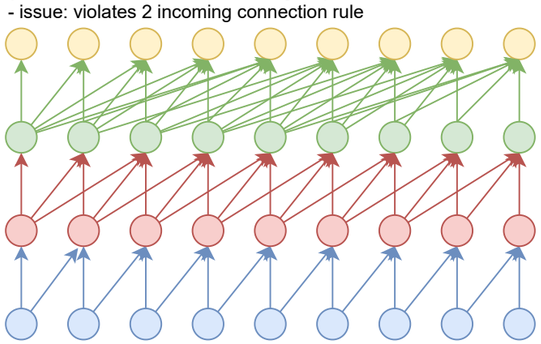


- consider add skip layer connections, with inhibition of intermediary layer

Structure type #4a
(SANIwaveNet recursiveLayers):
- issue: neurons will not have access to slightly offsetted subnet information



Structure type #4b
(SANIwaveNet non-recursiveLayers):
- issue: violates 2 incoming connection rule



Structure type #3
(WaveNet implementation):