FIT3155: Week 5 tutorial
Covering concepts from Weeks 4-5

Objectives: The tutorials, in general, give practice in problem solving, in analysis of algorithms and data-structures, and in logic useful in the above.

Instructions to the class: Prepare your answers to the questions **before** the tutorial. It will probably not be possible to cover all questions unless the class has prepared them all in advance.

Instructions to Tutors:

i. The purpose of the tutorials is not to solve the practical exercises.

ii. The purpose is to check answers, and to discuss particular sticking points, not to simply make answers available.

1. Consider a disjoint set data structure involving 17 elements labeled $\{0, \ldots, 16\}$. Consider the following sequence of operations:

   - union(1,2)
   - union(3,4)
   - union(3,5)
   - union(1,7)
   - union(3,6)
   - union(8,9)
   - union(1,8)
   - union(3,10)
   - union(3,11)
   - union(3,12)
   - union(3,13)
   - union(14,15)
   - union(16,0)
   - union(14,16)
   - union(1,3)

- union(1,14)

Work out on paper the visual tree representation and its corresponding parent array representation after each union operation when the union is implemented as:

(a) union **by size** without path compression.

(b) union **by height** without path compression.

(c) union by height **with** path compression.

2. Review the Lemma and Corollary given as a part of the analysis of Union-by-size on Slides #29-30 of your lecture slides.

3. Review the Observations, Lemma and Corollary given as a part of the analysis of Union-by-height on Slides #32-34 of your lecture slides.

4. Design a disjoint set data structure that implements *partial* path compression during any `find`(x) operation, where every alternate node on the path from x to the leader/root node points to its grandparent.

5. Clarify any conceptual difficulties you may still have about Ukkonen's algorithm.

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