FIT2004: Tutorial 4 (held in Week 9)
# Covering concepts from Weeks 7,& 8

Objectives: The tutorials, in general, give practice in problem solving, in analysis of algorithms and data-structures, and in mathematics and 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 in advance. There is 0.5 mark worth for this Tute towards active participation. 0.25 marks is towards answering the starred questions (*) indicated below, before attending your assigned tutorial. You will have to hand in your work on these starred questions to your tutor at the very start of the tutorial. Remaining 0.25 mark is for participating during the rest of the tutorial.

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. ***** Work out by hand the Burrows-Wheeler Transform (BWT) of the following reference string: "**woolloomooloo\$**".

2. Using the BWT of "**woolloomooloo\$**", work out step-by step the search for the following patterns:

   (a) "**olo**"
   (b) "**oll**"
   (c) "**oo**"
   (d) "**wol**"

3. ***** Work out on paper, using Dijkstra's algorithm, the shortest distance from the source vertex z to every other vertex in the given graph:
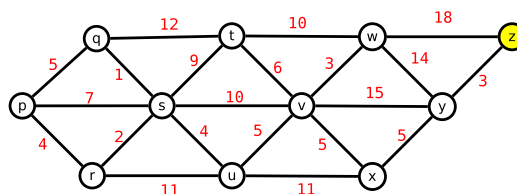
4. Graphs are often used as preferred representations to understand the relationships between various objects/entities/concepts. In this exercise we will try to capture as a graph the various concepts we have learnt so far – it would be pretty informative for all of us to understand the relationships between various things we have studied.

We are in Week 9 of this unit, and have covered 9 lectures coming into this week: **L1 ... L9**. Additionally, we have also had three tutorials in week 3, 5 and 7 (denoted as **T3, T5, T7** and 2 *assignments* for weeks 4, and 6; denote these as **A4, A6**.

Draw an (undirected) graph with $9(lectures)+3(tutorials)+2(assignments) = 14$ vertices. Any two vertices are said to be adjacent[1] if there is (some) conceptual relationship/link between the two corresponding lectures/assignments. For example, BWT can be efficiently constructed using an algorithm very similar to efficient suffix array construction. Hence there is an edge between vertices **L6** and **L7**. Also, the assessed lab for week 4 require radix sort covered in **L3**. Therefore, there should be a link between **A4**−**L3**.

Your task in this exercise is to make these conceptual connections between the 13 vertices and represent this (FIT2004 concepts) graph as an **adjacency list**.

As we enter into the last quarter of this unit, this exercise will help you contextualize the *web of interactions* between various things we have covered over the past 9 weeks. Note, there is no one correct answer, as the (subjective) criteria one uses defines how the vertices end up being connected. However, this is a **must do** exercise as it will help you explore the '**Big Picture**' of what we learnt (or did not) in this unit so far.

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[1]Two vertices are adjacent when they have an edge between them