FIT1045 Algorithmic Problem Solving – Tutorial 2.

Objectives

The **objectives of this tutorial** are:

- To introduce some fundamental data structures: lists, tables and strings.
- To become familiar with fundamental algorithms involving these structures.

Task 1: Representations of Algorithms

List some ways to represent an algorithm. What are some necessary requirements in any representation of an algorithm?

Note: In one of the remaining tasks, you will have the opportunity to use one or more of these representations.

Task 2: Lists

Suppose you have a shopping list. Describe some operations that you may like to perform on this list. Give an algorithm for checking if an item is on your list.

Task 3: Graphs

Describe three different ways of representing graphs.

Suppose you wanted to find the degree of a vertex in the graph. How would you do this with these structures?

Task 4: Spanning Trees

A *tree* is a connected graph with no cycles. If a graph has several components and has no cycles, then it is called a *forest*. A *spanning tree* of a graph G is a tree subgraph of G consisting of all the vertices and a subset of the edges.

Describe an algorithm to find a spanning tree of a graph.

Task 5: Travelling Salesperson Problem

The *Travelling Salesperson Problem* is the problem of finding the Hamiltonian cycle of least weight in a graph. Give an algorithm for finding this cycle. Is this harder or easier than finding the Eulerian circuit of least weight in a graph?

Task 6: Magic squares

A magic square is a table with n rows and n columns, such that the numbers in each row, and in each column, and the numbers in the main diagonals, all add up to the same number. Write an algorithm to determine if a given table is a magic square.

Puzzle of the week

Handshaking Puzzle: A whole lot of people shook hands and a whole lot refused to shake hands with each other at a recent UN meeting in NYC. As UN handshaking is not just a handshaking but a political statement, all these handshakes were carefully monitored and accounted for by the special math agent Nathan. At the end of the meeting Nathan reported that something fishy is going on as the number of people that shook an odd number of hands is an odd number and this is impossible. He was right. The question is: why