Software 2: Semester 1- 2025

DSA Assignment 3

Instructions:

1. Implement the structures as outlined below- Part 1 AND Part 2. You are then required to code Part 2 in a language of your choice. **Work in groups of 2**

2. The Assignment is to be presented in a **report** (1 report per group).
   This report is to contain:

   Part 1: Hash Table Application
   - What is a Hash table?
   - Description of application as specified below
   - A table of data of example used
     - Username, ASCII Integer, Index after Hash function applied
   - Diagram of Hash table produced. Highlight any collisions which occurred.

   Part 2: Graph Application
   - Description and diagram of the Graph used.
   - A description (and diagrams) of underlying data structures used to solve the problem (how the graph is stored), and any helper variables
   - pseudocode of the Algorithms used,
   - a copy of the fully documented code,
   - a one line description of all the methods/routines which have been used,
   - Sample execution screenshots showing the outputs generated for each operation using the graph data you provided
   - As part of the report also, produce the minimum spanning tree(MST) of your graph.. no need to code, just a paper version. Indicate which algorithm you used to calculate the MST and show the order of the chosen edges.

3. Report (.pdf format) , Code (.pdf format) and an executable file (.jar format or other) to be uploaded at this link: Upload HERE One of each per group.

   Named as follows: Use first names of both students in file names. For example:
   Report: AineSimonReport.pdf
   Java code: AineSimonCode.pdf
   Executable: AineSimonExe.jar

4. **Due Date: Tuesday Dec 9th 2025 12 noon** (Week 13)

Note: Submissions containing duplicate examples will be fully disregarded and a mark of zero will be awarded. This will also be reported to Office of Academic Affairs and Registrar as a breach of examinations procedures.

Part 1: Hash Table Application

Brief: Develop a Hash table for a Login application containing usernames. Each username (max 6 letters) needs to be converted to a number by adding the ASCII value of each character together. Use a hash table of size 20 and use mod 20 as the hash function. Use the hash table to store 10 names (of your choice) and in case of collision, use linear probing.

Submission: For each of the 10 usernames chosen, show the username, show their integer calculation (adding their ASCII values together) and the index produced after applying the Hash function.
Draw diagram of the completed Hash Table. Highlight any collisions which occurred.

Part 2: Graph Application

Brief: Create a map(graph) of tourist sites (minimum of 7) in your area to be used for a walking tour application.
Each piece of site data stored will contain the name of the site and the co-ordinates of it (expressed as x/y co-ordinates or longitude/latitude co-ordinates).
Each piece of edge data stored will be the distance between the 2 sites connected by the edge.

Design a Data structure to store your map. Draw diagrams of your actual graph, and of the graph stored using your chosen method.

Using the graph storage method you described; Write the algorithms for the following operations:

Search (site): will output full details of the given site

Insert (site1, site2, weight): adds an edge from site1 to site 2 with a given weight

AllCons (site): will output names of all sites connected to the given site

Closest (site): will output names of site which is closest to given site