Introduction:

My program will capture the current height of the water that is filled in a dam. It will then compare the captured height to the maximum height of the dam. The user will then be able to view a specific result regarding their input which will then give them an indication of the status of the chosen dam.

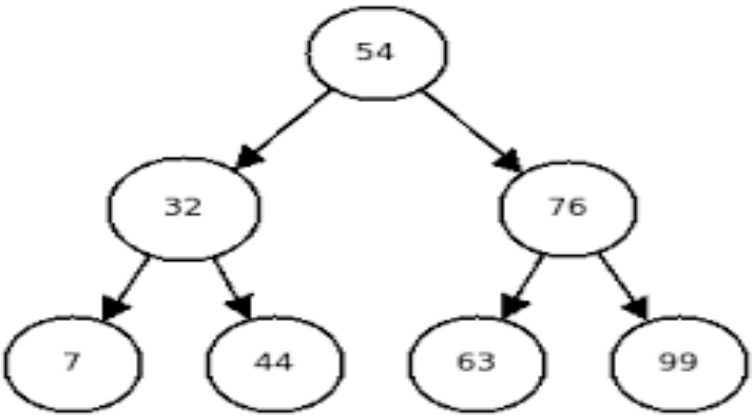
Problem Background:

Due to climate change South Africa has experienced less rainfall, which has resulted in a water crisis (Dentlinger, 2017). Areas and farms around Limpopo suffered a lot because crops died as a result (None, 2015).Major cities around South Africa suffered from water restrictions placed by the department of water and sanitation, therefore a need arose for dam levels to be monitored constantly to distribute water efficiently to meet the needs of the people. just as algorithms are used for load shedding applications, so too can the use of algorithms be applied to Dam monitoring systems.
There are web sites that display data about the dams in south Africa, however there is not much emphasis on what values indicate danger and so forth. Water is essential for life on earth and it is every human's responsibility to use is wisely.
Due to the following constraints, there will be limitations on the system namely, the accuracy in the data. Such as the height of the dam, is not the only variable considered. The shape of the dam for instance whether, its round will affect the surface area and volume (none, 2006). Another factor to consider is that there is no formula to measure drought. Catchment areas, are those areas which collect the water after rainfall and will allow the water to flow to the river then to the dam. At times, even after rainfall, the water cannot flow due to soil moisture leaving the dams at low levels. This natural factor will have an impact on the accuracy of the data.

Model

The first main component of the system is the creation of the dam object. The dam will have a name which will be used as the key in my binary search tree and it will have a value which is the maximum height of a dam which manually will be set by the system. I have used a binary search tree to insert my dam objects.

Structure of Binary tree:



Definition:

A binary search tree is a rooted binary tree, whose internal nodes each store a key (and optionally, an associated value) and each have two distinguished sub-trees, commonly denoted left and right. The tree additionally satisfies the binary search tree property, which states that the key in each node must be greater than or equal to any key stored in the left sub-tree, and less than or equal to any key stored in the right sub-tree. (Cormen, et al., 1990)

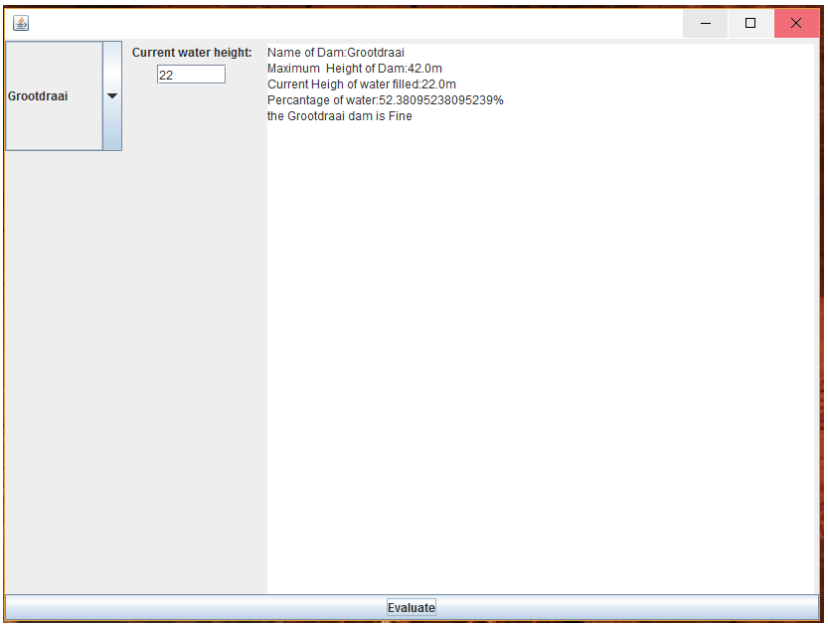
I have used a Binary search tree on my application because my items: which are the dams have a name and a value associated with it. With a binary search tree insert, delete, search run in O (log n) (GOODRICH, 2016). whenever a dam is selected from the list, the data structure should be to search for the selected dam with a fast lookup so that it can be processed. Therefore, I have kept this in mind when creating the program.

A custom list data structure has been used to add the names of the dams for storing all the keys for usage in the binary tree.

Another custom data structure I used was a custom nodelist to refer to my left and right nodes of the binary search tree.

The graphical user interface consists of : a text area to display the results, a textbox to accept the current height of the dam , a list of dams to choose from and a button for the user to click once done entering the height and selecting a dam.

Graphical user interface:



The user will have to open the combo box which will contain the dam names , thereafter entering a numeric value in the textbox , lastly the evaluate button should be clicked and the results will be displayed on the white text area .

The program contains custom functionality such as the working out of the percenatage using the height of the dam with the current height. Another custom function has also been used to determine the status of a dam based of the percentage,

Results

The data set used for this project was from the list of dams in South Africa from Wikipedia. It also contains information like: which province the dam is in, the nearest locality and the coordinates of the dam. The dams are measured in SI unit (meters). The height which the user will input into the system is also in meters. As stated before these results cannot be used as a means of validation, due to the libations mentioned previously.

The following is actual test data used on the program:

Test data 1:
Name of dam: Vaal
Maximum height of Water :63.0m
Current height of water: 30.0m
Percentage of water:47.61904761904761%
the Vaal dam is Fine

Test data 2

Name of dam: Sterkfontein
Maximum height of Water: 93.0m
Current height of water: 100.0m
Percentage of water:107.5268817204301%
the Sterkfontein dam is overflowing

Test data 3
Name of dam: Beervlei
Maximum height of Water: 31.0m
Current height of water: 12.0m
Percentage of water: 38.70967741935484%
the Beervlei dam water levels are critical

Conclusion

Due to encountering so many limitations In measuring the water percentage of the dam , I experienced difficulty in choosing the most accurate form of measurement .Furthermore , speaking to people at rand water was a challenge as well .My skill set in GUI is moderate .I found it interesting how factors in geography can impact computer science for instance , if this application was more realistic an algorithm would be needed to take into consideration catchment areas .Also , there is no formula for drought.

My application does not necessarily solve the problem due to the type of data I used. If I had the opportunity to take this further is, I would store all areas near a dam in another data structure and display it with the affected dam. I would use a more valid and realistic formula to calculate the percentage of water available in the dam.
Lastly, I would add more features like the Eskom load shedding app which would display all the times when water restrictions would take place.

References

Cormen, T. H., Leiserson, C. E., Rivest, R. L. & Stein, C., 1990. *Introduction to Algorithms.* 3rd ed. MIT: Press and McGraw-Hil.

Dentlinger, L., 2017. *IOL.* [Online]
Available at: http://www.iol.co.za/weekend-argus/news/dam-levels-near-critical-7440933
[Accessed 1 May 2017].

GOODRICH, T. G., 2016. Binary search treees. In: *DATA STRUCTURES AND ALGROTHIMS IN JAVA* . s.l.:WILEY, pp. 434-435.

none, 2006. *AgricultureVictoria.* [Online]
Available at: http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/water/farm-water-solutions/how-much-water-is-available/how-much-water-is-in-my-dam
[Accessed 29 May 2017].

None, 2015. *bbc.* [Online]
Available at: http://www.bbc.com/news/world-africa-34884135
[Accessed 30 May 2017].