**Lab 5**

1. Let A = { a/20 , b/15 , c/5 , f/15 , e/45 }

List frequencies in ascending order:

* c/5
* b/15
* d/15
* a/20
* e/45

Merge the two lowest frequencies iteratively:

* (c,b) = 20
* (d(c,b)) = 35
* (a,e) = 65
* (d,(c,b)) with (a,e) to get the root = 100

Assign codes:

* e = 0
* a = 10
* d = 110
* c = 1110
* b = 1111

Get average bits per symbol:

* e: 45 occurrences, 1 bit per symbol
* a: 20 occurrences, 2 bit per symbol
* d: 15 occurrences, 3 bit per symbol
* c: 5 occurrences, 4 bit per symbol
* b: 15 occurrences, 4 bit per symbol

total bits = (45 \* 1) + (20 \* 2) + (15 \* 3) + (5 \* 4) + (15 \* 4)

= 45 + 40 + 45 + 20 + 60

= 210

**210 / 100 = 2.1 average bits per symbol**

1. Compress BABAABAAA using LZW

ASCII codes: A = 65 B= 66

Expand out this ‘dictionary’ with new codes to represent the character patterns from what were looking to compress continuing from the max binary value.

A = 65

B = 66

BA = 256

AA = 257

BAA = 258

AAA = 259

Final value (compressed) using this new dictionary:

BABAABAAA = 66, 65, 256, 257, 259

1. Delta compression is a technique to store or transmit data efficiently by recording the differences between the data sent and being sent and only transmitting the data that needs to be updated.

For example, in a movie, 80% of the screen might be the static background and 20% is the protagonist moving around in the scene. Delta compression will determine that 80% of the screen remains the same with each frame and only transmits the data needed to show the protagonist as the background has already been sent and doesn’t need to change.

How it works:

* Compare: Compare the two versions of a file, old and new.
* Identify differences: Determine the change between the old and new data.
* Store the changes: Instead of storing the entire new version of the data, just store the delta (differences) from the old version.
* Reconstruct: Combine the old with the stored version (new changes) to make the updated version.

GitHub is another example of this, sending only the changes made instead of reuploading the project folders and files every time unnecessarily.