

\*\*\*\*\* PROJECT 4 Hardcopy (pdf file) \*\*\*\*\*

\*\*\*\*\* Cover page \*\*\*\*\*

Class: 323 MW

Name: Adewole Adeosun

Project: Project 4

Project name: Huffman Coding (Part 1)

Language: Java

Due date: 10/14/2025, Tuesday before midnight, 11:59pm

Submit date: 10/14/2025

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Top level algorithm steps:

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**Step 0:**

Check the number of arguments.

Open the following files from args [ ]:

- inFile → HuffmanCodingData.txt

- outFile → outFile.txt

- logFile → logFile.txt

**Step 1:**

computeCharCounts(inFile, charCountAry, logFile)

– Reads each character from the input file and computes its frequency.

– Stores the count in charCountAry[ascii].

**Step 2:**

outFile ← "\*\*\*\* Below is the character counts Table \*\*\*\*"

printCountAry(charCountAry, outFile)

- Prints only characters with counts > 0.
- Skips ASCII 10, 13, 23, and 32 (newline, carriage return, etc.)

**Step 3:**

outFile ← "\*\*\* In main, calling constructHuffmanLList \*\*\*"

listHead ← constructHuffmanLList(charCountAry, logFile)

- Creates an ordered linked list of HtreeNodes sorted by frequency

**Step 4:**

outFile ← "\*\*\* In main(): printing list after list is constructed \*\*\*"

printList(listHead, outFile)

- Traverses the list and prints each node's (chStr, count, code, left, right, next)

**Step 5:**

outFile ← "\*\*\* In main before calling constructHuffmanBinTree \*\*\*"

Root ← constructHuffmanBinTree(listHead, logFile)

- Combines the two smallest nodes into one parent node and re-inserts until only one root remains

**Step 6:**

outFile ← "\*\*\* In main(): printing in-Order traversal of the tree \*\*\*"

inOrderTraversal(Root, outFile)

– Prints nodes in sorted order (left → root → right)

**Step 7:**

constructCharCode(Root, "", codeTable)

– Recursively builds Huffman codes for each leaf node.

– Adds '0' for left edges and '1' for right edges

**Step 8:**

outFile ← "\*\*\*\* In main(): printing character code Table \*\*\*\*"

printCodeTable(codeTable, outFile)

– Prints the final Huffman code table for all characters with non-empty codes

**Step 9:**

Close all files (inFile, outFile, logFile).

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**Source code:**

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/\*

Name: Adewole Adeoshun

Course: CSCI 323 (MonWed 3.10pm - 4.25pm)

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Project 4 - Huffman coding (part-1)

\*/

```

import java.io.*;

import java.util.*;

// *****

// HTreeNode CLASS

// *****

class HTreeNode {

    String chStr; // character(s)

    int frequency; // frequency count

    String code; // Huffman code

    HTreeNode next; // pointer to next node

    HTreeNode left; // left child

    HTreeNode right; // right child

    // Constructor

    HTreeNode(String c, int f, String cd, HTreeNode n, HTreeNode l, HTreeNode r) {

        chStr = c;

        frequency = f;

        code = cd;

        next = n;

        left = l;

        right = r;

    }

    // Print a node

    void printNode(PrintWriter outFile) {

        String leftStr = (left != null) ? left.chStr : "null";

```

```

String rightStr = (right != null) ? right.chStr : "null";

String nextStr = (next != null) ? next.chStr : "null";

outFile.printf("(%s, %d, %s, %s, %s, %s)%n",
chStr, frequency, code, leftStr, rightStr, nextStr);

}

}

// *****

// HUFFMAN TOOL CLASS (algorithm + data structure)

// *****

class HuffmanTool {

HTreeNode Root;

HTreeNode listHead;

int[] charCountAry = new int[256];

String[] codeTable = new String[256];

// Constructor

HuffmanTool() {

Root = null;

listHead = new HTreeNode("dummy", 0, "", null, null, null);

Arrays.fill(charCountAry, 0);

Arrays.fill(codeTable, "");

}

// *****

// computeCharCounts

// *****

```

```

void computeCharCounts(BufferedReader inFile, PrintWriter logFile) throws IOException {

logFile.println("**** Entering computeCharCounts ****");

int ch;

while ((ch = inFile.read()) != -1) {

if (ch >= 0 && ch < 256) {

charCountAry[ch]++;

}

}

logFile.println("**** Leaving computeCharCounts ****");

}

// *****

// printCountAry

// *****

void printCountAry(PrintWriter outFile) {

outFile.println("***** Below is the character counts Table *****");

outFile.println("Ascii\tCharacter\tCount");

for (int i = 0; i < 256; i++) {

if (charCountAry[i] > 0 && i != 10 && i != 13 && i != 23 && i != 32) {

outFile.printf("%d\t%c\t%d\n", i, (char) i, charCountAry[i]);

}

}

}

// *****

// findSpot

```

```

// *****

HTreeNode findSpot(HTreeNode listHead, HTreeNode newNode, PrintWriter logFile) {

logFile.println("*** Entering findSpot method ***");

HTreeNode Spot = listHead;

while (Spot.next != null && Spot.next.frequency < newNode.frequency) {

Spot = Spot.next;

}

logFile.printf("in findSpot: Spot.next's frequency is %s and newNode.frequency is %d%n",
(Spot.next != null ? Spot.next.frequency : "null"), newNode.frequency);

logFile.println("*** Leaving findSpot method ***");

return Spot;

}

// *****

// listInsert

// *****

void listInsert(HTreeNode Spot, HTreeNode newNode) {

newNode.next = Spot.next;

Spot.next = newNode;

}

// *****

// printList

// *****

void printList(HTreeNode listHead, PrintWriter outFile) {

HTreeNode spot = listHead;

```

```

while (spot != null) {

spot.printNode(outFile);

spot = spot.next;

}

}

// *****

// constructHuffmanLList

// *****

HTreeNode constructHuffmanLList(HTreeNode listHead, int[] charCountAry, PrintWriter logFile) {

logFile.println("*** Entering constructHuffmanLList method ***");

for (int index = 0; index < 256; index++) {

if (charCountAry[index] > 0) {

char chr = (char) index;

int frequency = charCountAry[index];

HTreeNode newNode = new HTreeNode(String.valueOf(chr), frequency, "", null, null, null);

logFile.println("*** In construct LList, printing newNode ***");

newNode.printNode(logFile);

HTreeNode Spot = findSpot(listHead, newNode, logFile);

listInsert(Spot, newNode);

logFile.println("*** In construct LList, printing list after inserting newNode ***");

printList(listHead, logFile);

}

}

logFile.println("*** Leaving constructHuffmanLList method ***");

```



```

return listHead;

}

// *****

// constructHuffmanBinTree

// *****

HTreeNode constructHuffmanBinTree(HTreeNode listHead, PrintWriter outFile, PrintWriter logFile) {

logFile.println("**** Entering constructHuffmanBinTree() method ****");

while (listHead.next != null && listHead.next.next != null) {

HTreeNode first = listHead.next;

HTreeNode second = first.next;

String combinedCh = first.chStr + second.chStr;

int combinedFreq = first.frequency + second.frequency;

HTreeNode newNode = new HTreeNode(combinedCh, combinedFreq, "", null, first, second);

logFile.println("**** In constructHuffmanBinTree, printing newNode ****");

newNode.printNode(logFile);

HTreeNode Spot = findSpot(listHead, newNode, logFile);

listInsert(Spot, newNode);

// remove first two nodes

listHead.next = second.next;

logFile.println("**** In constructHuffmanBinTree method, printing the list after inserting newNode ****");

printList(listHead, logFile);

}

Root = listHead.next;

logFile.println("**** Leaving constructHuffmanBinTree() ****");

```

```

return Root;

}

// *****

// isLeaf

// *****

boolean isLeaf(HTreeNode node) {

return node.left == null && node.right == null;

}

// *****

// inOrderTraversal

// *****

void inOrderTraversal(HTreeNode T, PrintWriter outFile) {

if (T == null) return;

if (isLeaf(T)) {

T.printNode(outFile);

} else {

inOrderTraversal(T.left, outFile);

T.printNode(outFile);

inOrderTraversal(T.right, outFile);

}

}

// *****

// constructCharCode

// *****

```

```

void constructCharCode(HTreeNode T, String code, String[] codeTable) {

    if (T == null) return;

    if (isLeaf(T)) {

        T.code = code;

        int index = (int) T.chStr.charAt(0);

        codeTable[index] = code;

    } else {

        constructCharCode(T.left, code + "0", codeTable);

        constructCharCode(T.right, code + "1", codeTable);

    }

}

// *****

// printCodeTable

// *****

void printCodeTable(String[] codeTable, PrintWriter outFile) {

    outFile.println("**** Below is the character code Table ****");

    outFile.println("Ascii\tCharacter\tCode");

    for (int i = 0; i < 256; i++) {

        if (!codeTable[i].equals("")) {

            outFile.printf("%d\t%c\t%s\n", i, (char) i, codeTable[i]);

        }

    }

}

```

```

// *****

// MAIN DRIVER CLASS

// *****

public class AdeoshunA_Project4_Main {

    public static void main(String[] args) throws IOException {

        if (args.length != 3) {

            System.out.println("Usage: java AdeoshunA_Project4_Main inFile outFile logFile");

            return;

        }

        BufferedReader inFile = new BufferedReader(new FileReader(args[0]));

        PrintWriter outFile = new PrintWriter(new FileWriter(args[1]));

        PrintWriter logFile = new PrintWriter(new FileWriter(args[2]));

        HuffmanTool huffman = new HuffmanTool();

        // Step 1: compute character counts

        huffman.computeCharCounts(inFile, logFile);

        inFile.close();

        // Step 2: print character counts

        huffman.printCountAry(outFile);

        // Step 3: construct Huffman linked list

        outFile.println("*** In main, calling constructHuffmanLList ***");

        huffman.listHead = huffman.constructHuffmanLList(huffman.listHead, huffman.charCountAry, logFile);

        // Step 4: print linked list

        outFile.println("*** In main (): printing list after list is constructed ***");

        huffman.printList(huffman.listHead, outFile);
    }
}

```

```

// Step 5: build binary tree

outFile.println("*** In main before calling constructHuffmanBinTree ***");

huffman.Root = huffman.constructHuffmanBinTree(huffman.listHead, outFile, logFile);

// Step 6: in-order traversal

outFile.println("*** In main (): printing in-Order traversal of the tree ***");

huffman.inOrderTraversal(huffman.Root, outFile);

// Step 7: construct char code

huffman.constructCharCode(huffman.Root, "", huffman.codeTable);

// Step 8: print code table

huffman.printCodeTable(huffman.codeTable, outFile);

outFile.close();

logFile.close();

System.out.println("✅ Huffman Coding Part 1 completed successfully.");

}

}

```

---

### **inFile:**

---

The Old Man and the Sea tells the story of a battle between an aging, experienced fisherman, Santiago, and a large marlin. The story opens with Santiago having gone 84 days without catching a fish, and now being seen as *salao*, the worst form of unluckiness. He is so unlucky that his young apprentice, Manolin, has been forbidden by his parents to sail with him and has been told instead to fish with successful fishermen. The boy visits Santiago's shack each night,

hauling his fishing gear, preparing food,  
talking about American baseball and his favorite player,  
Joe DiMaggio. Santiago tells Manolin that on the next day,  
he will venture far out into the Gulf Stream,  
north of Cuba in the Straits of Florida to fish,  
confident that his unlucky streak is near its end.  
On the eighty-fifth day of his unlucky streak,  
Santiago takes his skiff into the Gulf Stream,  
sets his lines and by noon, has his bait taken by a big fish  
that he is sure is a marlin. Unable to haul in the great marlin,  
Santiago is instead pulled by the marlin,  
and two days and nights pass with Santiago holding onto the line.  
Though wounded by the struggle and in pain,  
Santiago expresses a compassionate appreciation for his adversary,  
often referring to him as a brother.  
He also determines that, because of the fish's great dignity,  
no one shall deserve to eat the marlin.  
On the third day, the fish begins to circle the skiff.  
Santiago, worn out and almost delirious,  
uses all his remaining strength to pull the fish onto its side  
and stab the marlin with a harpoon.  
Santiago straps the marlin to the side of his skiff and heads home,  
thinking about the high price the fish will bring him at the market  
and how many people he will feed.  
On his way in to shore, sharks are attracted to the marlin's blood.  
Santiago kills a great mako shark with his harpoon,  
but he loses the weapon.  
He makes a new harpoon by strapping his knife  
to the end of an oar to help ward off the next line of sharks;  
five sharks are slain and many others are driven away.  
But the sharks keep coming, and by nightfall  
the sharks have almost devoured the marlin's entire carcass,  
leaving a skeleton consisting mostly of its backbone, its tail,  
and its head. Santiago knows that he is destroyed and  
tells the sharks of how they have killed his dreams.  
Upon reaching the shore before dawn on the next day,  
Santiago struggles to his shack, carrying the heavy mast on his shoulder,  
leaving the fish head and the bones on the shore.  
Once home, he slumps onto his bed and falls into a deep sleep.  
A group of fishermen gather the next day around the boat  
where the fish's skeleton is still attached.  
One of the fishermen measures it to be 18 feet (5.5 m) from nose to tail.  
Pedrico is given the head of the fish,  
and the other fishermen tell Manolin to tell the old man how sorry they are.

Tourists at the nearby cafe mistakenly take it for a shark.

Manolin, worried about the old man, cries upon finding him safe asleep and at his injured hands, and brings him newspapers and coffee.

When the old man wakes, they promise to fish together once again.

Upon his return to sleep, Santiago dreams of his youth of lions on an African beach.

The Gettysburg Address is a speech by U.S. President Abraham Lincoln, one of the best known in American history.

It was delivered by Lincoln during the American Civil War, on the afternoon of Thursday, November 19, 1863, at the dedication of the Soldiers National Cemetery in Gettysburg, Pennsylvania, four and a half months after the Union armies defeated those of the Confederacy at the Battle of Gettysburg.

Four score and seven years ago our fathers brought forth on this continent a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live.

It is altogether fitting and proper that we should do this.

But, in a larger sense, we can not dedicate, we can not consecrate, we can not hallow this ground. The brave men, living and dead, who struggled here, have consecrated it, far above our poor power to add or detract. The world will little note, nor long remember what we say here, but it can never forget what they did here.

It is for us the living, rather, to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced.

It is rather for us to be here dedicated to the great task remaining before us that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion that we here highly resolve that these dead shall not have died in vain that this nation, under God, shall have a new birth of freedom and that government of the people, by the people, for the people, shall not perish from the earth.

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and dedicated to the proposition that all men are created equal.  
Now we are engaged in a great civil war, testing whether that nation,

or any nation so conceived and so dedicated, can long endure.  
We are met on a great battlefield of that war. We have come to dedicate  
a portion of that field, as a final resting place for those  
who here gave their lives that that nation might live.  
It is altogether fitting and proper that we should do this.  
But, in a larger sense, we can not dedicate, we can not consecrate,  
we can not hallow this ground. The brave men, living and dead,  
who struggled here, have consecrated it,  
far above our poor power to add or detract. The world will little note,  
nor long remember what we say here, but it can never forget what they did here.  
It is for us the living, rather,  
to be dedicated here to the unfinished work which they  
who fought here have thus far so nobly advanced.  
It is rather for us to be here dedicated to the great task remaining  
before us that from these honored dead we take increased devotion to  
that cause for which they gave the last full measure of devotion that  
we here highly resolve that these dead shall not have died in vain  
that this nation, under God, shall have a new birth of freedom  
and that government of the people, by the people, for the people,  
shall not perish from the earth.

The Gettysburg Address is a speech by U.S. President Abraham Lincoln,  
one of the best known in American history.

It was delivered by Lincoln during the American Civil War,  
on the afternoon of Thursday, November 19, 1863, at the dedication of the Soldiers'  
National Cemetery in Gettysburg, Pennsylvania,  
four and a half months after the Union armies defeated those of the Confederacy  
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It is rather for us to be here dedicated to the great task remaining before us that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion that we here highly resolve that these dead shall not have died in vain that this nation, under God, shall have a new birth of freedom and that government of the people, by the people, for the people, shall not perish from the earth.

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**outFile:**

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\*\*\*\* Below is the character counts Table \*\*\*\*

Ascii	Character	Count
39	'	15
40	(	1
41	)	1
44	,	373
45	-	1
46	.	181
49	1	23
51	3	11
52	4	1
53	5	2
54	6	11
56	8	13
57	9	11
59	;	1
65	A	47
66	B	23
67	C	34
68	D	1
70	F	12
71	G	46
72	H	3
73	I	44
74	J	1
76	L	22
77	M	6
78	N	33
79	O	6
80	P	23
83	S	40
84	T	49
85	U	25
87	W	34
97	a	1627
98	b	271
99	c	456
100	d	876
101	e	2547
102	f	478
103	g	406
104	h	1240
105	i	1131

106	j	1
107	k	81
108	l	662
109	m	269
110	n	1321
111	o	1436
112	p	216
113	q	11
114	r	1226
115	s	862
116	t	1914
117	u	343
118	v	323
119	w	338
120	x	6
121	y	260

\*\*\* In main, calling constructHuffmanLList \*\*\*

\*\*\* In main (): printing list after list is constructed \*\*\*

(dummy, 0, , null, null, j)

(j, 1, , null, null, J)

(J, 1, , null, null, D)

(D, 1, , null, null, ;)

(;, 1, , null, null, 4)

(4, 1, , null, null, -)

(-, 1, , null, null, ))

(, 1, , null, null, ()

((, 1, , null, null, 5)

(5, 2, , null, null, H)

(H, 3, , null, null, x)

(x, 6, , null, null, O)

(O, 6, , null, null, M)

(M, 6, , null, null, q)

(q, 11, , null, null, 9)

(9, 11, , null, null, 6)

(6, 11, , null, null, 3)

(3, 11, , null, null, F)

(F, 12, , null, null, 8)

(8, 13, , null, null, ')

(', 15, , null, null, L)

(L, 22, , null, null, P)

(P, 23, , null, null, B)

(B, 23, , null, null, 1)

(1, 23, , null, null, U)

(U, 25, , null, null, N)



```

(N, 33, , null, null, W)
(W, 34, , null, null, C)
(C, 34, , null, null, S)
(S, 40, , null, null, I)
(I, 44, , null, null, G)
(G, 46, , null, null, A)
(A, 47, , null, null, T)
(T, 49, , null, null, k)
(k, 81, , null, null, .)
(., 181, , null, null, p)
(p, 216, , null, null, y)
(y, 260, , null, null, m)
(m, 269, , null, null, b)
(b, 271, , null, null, v)
(v, 323, , null, null, w)
(w, 338, , null, null, u)
(u, 343, , null, null, .)
(., 373, , null, null,
)
(
, 398, , null, null, g)
(g, 406, , null, null, c)
(c, 456, , null, null, f)
(f, 478, , null, null, l)
(l, 662, , null, null, s)
(s, 862, , null, null, d)
(d, 876, , null, null, i)
(i, 1131, , null, null, r)
(r, 1226, , null, null, h)
(h, 1240, , null, null, n)
(n, 1321, , null, null, o)
(o, 1436, , null, null, a)
(a, 1627, , null, null, t)
(t, 1914, , null, null, e)
(e, 2547, , null, null, )
( , 4253, , null, null, null)
*** In main before calling constructHuffmanBinTree ***
*** In main (): printing in-Order traversal of the tree ***
(y, 260, , null, null, m)
(ym, 529, , y, m, bU8'NWCSk)
(m, 269, , null, null, b)
(ymbU8'NWCSk, 1075, , ym, bU8'NWCSk, i)
(b, 271, , null, null, U8'NWCSk)
(bU8'NWCSk, 546, , b, U8'NWCSk, vw)

```

(U, 25, , null, null, 8')  
 (U8', 53, , U, 8', NW)  
 (8, 13, , null, null, ')  
 (8', 28, , 8, ', N)  
 (' , 15, , null, null, D;jJ)(4-5Hx)  
 (U8'NW, 120, , U8', NW, CSk)  
 (N, 33, , null, null, W)  
 (NW, 67, , N, W, CS)  
 (W, 34, , null, null, C)  
 (U8'NWCSk, 275, , U8'NW, CSk, v)  
 (C, 34, , null, null, S)  
 (CS, 74, , C, S, k)  
 (S, 40, , null, null, D;jJ)(4-5Hx63)  
 (CSk, 155, , CS, k, D;jJ)(4-5Hx63q9LIPB)  
 (k, 81, , null, null, D;jJ)(4-5Hx63q9L)  
 (ymbU8'NWCSki, 2206, , ymbU8'NWCSk, i, rh)  
 (i, 1131, , null, null, r)  
 (ymbU8'NWCSkirh, 4672, , ymbU8'NWCSki, rh, envwl)  
 (r, 1226, , null, null, h)  
 (rh, 2466, , r, h, e)  
 (h, 1240, , null, null, n)  
 (ymbU8'NWCSkirhenvwl, 9863, , ymbU8'NWCSkirh, envwl, ouD;jJ)(4-5Hx63q9LIPB.,  
 aG1OMFATpgsdcft )  
 (e, 2547, , null, null, nvwl)  
 (envwl, 5191, , e, nvwl, ouD;jJ)(4-5Hx63q9LIPB.,  
 aG1OMFATpgs)  
 (n, 1321, , null, null, vwl)  
 (nvwl, 2644, , n, vwl, ouD;jJ)(4-5Hx63q9LIPB.,  
 )  
 (v, 323, , null, null, w)  
 (vw, 661, , v, w, l)  
 (w, 338, , null, null, u)  
 (vwl, 1323, , vw, l, o)  
 (l, 662, , null, null, uD;jJ)(4-5Hx63q9LIPB.)  
 (ymbU8'NWCSkirhenvvlouD;jJ)(4-5Hx63q9LIPB.,  
 aG1OMFATpgsdcft , 24046, , ymbU8'NWCSkirhenvwl, ouD;jJ)(4-5Hx63q9LIPB.,  
 aG1OMFATpgsdcft , null)  
 (o, 1436, , null, null, uD;jJ)(4-5Hx63q9LIPB.,  
 )  
 (ouD;jJ)(4-5Hx63q9LIPB.,  
 , 2906, , o, uD;jJ)(4-5Hx63q9LIPB.,  
 , aG1OMFATpgs)  
 (u, 343, , null, null, D;jJ)(4-5Hx63q9LIPB.)  
 (uD;jJ)(4-5Hx63q9LIPB., 699, , u, D;jJ)(4-5Hx63q9LIPB., ,

)  
 (D, 1, , null, null, ;)  
 (D;, 2, , D, ;, jJ)  
 (;, 1, , null, null, 4)  
 (D;jJ, 4, , D;, jJ, )(4-)  
 (j, 1, , null, null, J)  
 (jJ, 2, , j, J, 5)  
 (J, 1, , null, null, D)  
 (D;jJ)(4-, 8, , D;jJ, )(4-, 5Hx)  
 (), 1, , null, null, ()  
 ()(, 2, , ), (, 4-)  
 ((, 1, , null, null, )()  
 ()(4-, 4, , )(, 4-, 5H)  
 (4, 1, , null, null, -)  
 (4-, 2, , 4, -, D;)  
 (-, 1, , null, null, ))  
 (D;jJ)(4-5Hx, 19, , D;jJ)(4-, 5Hx, 63)  
 (5, 2, , null, null, H)  
 (5H, 5, , 5, H, x)  
 (H, 3, , null, null, D;jJ)  
 (5Hx, 11, , 5H, x, q)  
 (x, 6, , null, null, O)  
 (D;jJ)(4-5Hx63, 41, , D;jJ)(4-5Hx, 63, q9L)  
 (6, 11, , null, null, 3)  
 (63, 22, , 6, 3, q9)  
 (3, 11, , null, null, OM)  
 (D;jJ)(4-5Hx63q9L, 85, , D;jJ)(4-5Hx63, q9L, IPB)  
 (q, 11, , null, null, 9)  
 (q9, 22, , q, 9, L)  
 (9, 11, , null, null, 6)  
 (q9L, 44, , q9, L, I)  
 (L, 22, , null, null, P)  
 (D;jJ)(4-5Hx63q9LIPB, 175, , D;jJ)(4-5Hx63q9L, IPB, .)  
 (I, 44, , null, null, PB)  
 (IPB, 90, , I, PB, G1OMF)  
 (P, 23, , null, null, B)  
 (PB, 46, , P, B, G)  
 (B, 23, , null, null, 1)  
 (D;jJ)(4-5Hx63q9LIPB., 356, , D;jJ)(4-5Hx63q9LIPB, ., .)  
 (., 181, , null, null, G1OMFAT)  
 (uD;jJ)(4-5Hx63q9LIPB.,  
 , 1470, , uD;jJ)(4-5Hx63q9LIPB., ,  
 , a)  
 (., 373, , null, null,

)  
 (  
 , 771, , ,  
 , G1OMFATpg)  
 (  
 , 398, , null, null, G1OMFATp)  
 (ouD;jJ)(4-5Hx63q9LIPB.,  
 aG1OMFATpgs, 6206, , ouD;jJ)(4-5Hx63q9LIPB.,  
 , aG1OMFATpgs, dcft )  
 (a, 1627, , null, null, G1OMFATpgs)  
 (aG1OMFATpgs, 3300, , a, G1OMFATpgs, dcft)  
 (G, 46, , null, null, 1OMF)  
 (G1OMF, 93, , G, 1OMF, AT)  
 (1, 23, , null, null, OMF)  
 (1OMF, 47, , 1, OMF, A)  
 (O, 6, , null, null, M)  
 (OM, 12, , O, M, F)  
 (M, 6, , null, null, D;jJ)(4-  
 (OMF, 24, , OM, F, U)  
 (F, 12, , null, null, 8)  
 (G1OMFAT, 189, , G1OMF, AT, p)  
 (A, 47, , null, null, T)  
 (AT, 96, , A, T, U8'NW)  
 (T, 49, , null, null, U8')  
 (G1OMFATp, 405, , G1OMFAT, p, g)  
 (p, 216, , null, null, y)  
 (G1OMFATpg, 811, , G1OMFATp, g, s)  
 (g, 406, , null, null, c)  
 (G1OMFATpgs, 1673, , G1OMFATpg, s, dcf)  
 (s, 862, , null, null, d)  
 (ouD;jJ)(4-5Hx63q9LIPB.,  
 aG1OMFATpgsdcft , 14183, , ouD;jJ)(4-5Hx63q9LIPB.,  
 aG1OMFATpgs, dcft , ymbU8'NWCSkirhenvwlouD;jJ)(4-5Hx63q9LIPB.,  
 aG1OMFATpgsdcft )  
 (d, 876, , null, null, cf)  
 (dcf, 1810, , d, cf, t)  
 (c, 456, , null, null, f)  
 (cf, 934, , c, f, ymbU8'NWCSk)  
 (f, 478, , null, null, ym)  
 (dcft, 3724, , dcf, t, )  
 (t, 1914, , null, null, ymbU8'NWCSki)  
 (dcft , 7977, , dcft , , ymbU8'NWCSkirhenvwI)  
 ( , 4253, , null, null, ymbU8'NWCSkirh)  
 \*\*\*\* Below is the character code Table \*\*\*\*

Ascii	Character	Code
10		100111
32		111
39	'	0000110011
40	(	10010100000101
41	)	10010100000100
44	,	100110
45	-	10010100000111
46	.	1001011
49	1	1011000010
51	3	10010100011
52	4	10010100000110
53	5	1001010000100
54	6	10010100010
56	8	0000110010
57	9	10010100101
59	;	10010100000001
65	A	101100010
66	B	1001010111
67	C	000011100
68	D	10010100000000
70	F	10110000111
71	G	101100000
72	H	1001010000101
73	I	100101010
74	J	10010100000011
76	L	1001010011
77	M	101100001101
78	N	000011010
79	O	101100001100
80	P	1001010110
83	S	000011101
84	T	101100011
85	U	000011000
87	W	000011011
97	a	1010
98	b	000010
99	c	110010
100	d	11000
101	e	010
102	f	110011
103	g	101101
104	h	0011

105	i	0001
106	j	10010100000010
107	k	00001111
108	l	01111
109	m	000001
110	n	0110
111	o	1000
112	p	1011001
113	q	10010100100
114	r	0010
115	s	10111
116	t	1101
117	u	100100
118	v	011100
119	w	011101
120	x	100101000011
121	y	000000

---

### logFile:

---

```
*** Entering computeCharCounts ***
*** Leaving computeCharCounts ***
*** Entering constructHuffmanLList method ***
*** In construct LList, printing newNode ***
(
, 398, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is null and newNode.frequency is 398
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null,
)
(
, 398, , null, null, null)
*** In construct LList, printing newNode ***
( , 4253, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is null and newNode.frequency is 4253
*** Leaving findSpot method ***
```

```

*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null,
)
(
, 398, , null, null, )
( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
(', 15, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 398 and newNode.frequency is 15
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null, ')
(', 15, , null, null,
)
(
, 398, , null, null, )
( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
((, 1, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 15 and newNode.frequency is 1
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null, ())
((, 1, , null, null, ')
(', 15, , null, null,
)
(
, 398, , null, null, )
( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
(), 1, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 1 and newNode.frequency is 1
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null, ))
(), 1, , null, null, ()
((, 1, , null, null, ')
(', 15, , null, null,
)
(
, 398, , null, null, )

```

```

( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
(, 373, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 398 and newNode.frequency is 373
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null, )
(), 1, , null, null, ()
((, 1, , null, null, ')
(', 15, , null, null, ,)
(, 373, , null, null,
)
(
, 398, , null, null, )
( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
(-, 1, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 1 and newNode.frequency is 1
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null, -)
(-, 1, , null, null, ))
(), 1, , null, null, ()
((, 1, , null, null, ')
(', 15, , null, null, ,)
(, 373, , null, null,
)
(
, 398, , null, null, )
( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
(., 181, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 373 and newNode.frequency is 181
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null, -)
(-, 1, , null, null, ))
(), 1, , null, null, ()
((, 1, , null, null, ')
(', 15, , null, null, .)
(., 181, , null, null, ,)

```



```

(, 373, , null, null,
)
(
, 398, , null, null, )
( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
(1, 23, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 181 and newNode.frequency is 23
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null, -)
(-, 1, , null, null, ))
(), 1, , null, null, ()
((, 1, , null, null, ')
(', 15, , null, null, 1)
(1, 23, , null, null, .)
(., 181, , null, null, ,)
(, 373, , null, null,
)
(
, 398, , null, null, )
( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
(3, 11, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 15 and newNode.frequency is 11
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null, -)
(-, 1, , null, null, ))
(), 1, , null, null, ()
((, 1, , null, null, 3)
(3, 11, , null, null, ')
(', 15, , null, null, 1)
(1, 23, , null, null, .)
(., 181, , null, null, ,)
(, 373, , null, null,
)
(
, 398, , null, null, )
( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
(4, 1, , null, null, null)

```

```

*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 1 and newNode.frequency is 1
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null, 4)
(4, 1, , null, null, -)
(-, 1, , null, null, )
(), 1, , null, null, ()
((, 1, , null, null, 3)
(3, 11, , null, null, ')
(', 15, , null, null, 1)
(1, 23, , null, null, .)
(., 181, , null, null, ,)
(., 373, , null, null,
)
(
, 398, , null, null, )
( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
(5, 2, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 11 and newNode.frequency is 2
*** Leaving findSpot method ***
*** In construct LList, printing list after inserting newNode ***
(dummy, 0, , null, null, 4)
(4, 1, , null, null, -)
(-, 1, , null, null, )
(), 1, , null, null, ()
((, 1, , null, null, 5)
(5, 2, , null, null, 3)
(3, 11, , null, null, ')
(', 15, , null, null, 1)
(1, 23, , null, null, .)
(., 181, , null, null, ,)
(., 373, , null, null,
)
(
, 398, , null, null, )
( , 4253, , null, null, null)
*** In construct LList, printing newNode ***
(6, 11, , null, null, null)
*** Entering findSpot method ***
in findSpot: Spot.next's frequency is 11 and newNode.frequency is 11
*** Leaving findSpot method ***

```

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