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"""
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Class:BE-4 Computer Engineering
Batch : R4
Lab Assignment No: 2
Title: Write a program to implement Huffman Encoding using a greedy
strategy.
"""

# A Huffman Tree Node
import heapq

class node:
      def __init__(self, freq, symbol, left=None, right=None):
            # frequency of symbol
            self.freq = freq

            # symbol name (character)
            self.symbol = symbol

            # node left of current node
            self.left = left

            # node right of current node
            self.right = right

            # tree direction (0/1)
            self.huff = ''

      def __lt__(self, nxt):
            return self.freq < nxt.freq


# utility function to print huffman
# codes for all symbols in the newly
# created Huffman tree
def printNodes(node, val=''):

      # huffman code for current node
      newVal = val + str(node.huff)

      # if node is not an edge node
      # then traverse inside it
      if(node.left):
            printNodes(node.left, newVal)
      if(node.right):
            printNodes(node.right, newVal)

            # if node is edge node then
            # display its huffman code
      if(not node.left and not node.right):
            print(f"{node.symbol} -> {newVal}")


# characters for huffman tree
chars = []

# frequency of characters
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freq = []

# list containing unused nodes
nodes = []

n=int(input("Enter number of chars you want"))

for i in range(n):
    print("Enter character and frequency")
    c=input()
    f=int(input())
    chars.append(c)
    freq.append(f)
# converting characters and frequencies
# into huffman tree nodes
for x in range(len(chars)):
      heapq.heappush(nodes, node(freq[x], chars[x]))

while len(nodes) > 1:

      # sort all the nodes in ascending order
      # based on their frequency
      left = heapq.heappop(nodes)
      right = heapq.heappop(nodes)

      # assign directional value to these nodes
      left.huff = 0
      right.huff = 1

      # combine the 2 smallest nodes to create
      # new node as their parent
      newNode = node(left.freq+right.freq, left.symbol+right.symbol,
left, right)

      heapq.heappush(nodes, newNode)

# Huffman Tree is ready!
printNodes(nodes[0])

''' OUTPUT
Enter number of chars you want6
Enter character and frequency
a
5
Enter character and frequency
b
9
Enter character and frequency
c
12
Enter character and frequency
d
13
Enter character and frequency
e
16
Enter character and frequency
f
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45
f -> 0
c -> 100
d -> 101
a -> 1100
b -> 1101
e -> 111
'''
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