Handwriting

1. (15%) In a binary tree, what is the maximum number of nodes that can be found in level 3? In level 4? In level 12?
(The root node is at level 0)

2. (15%) Show the depth-first traversals (preorder, inorder, and postorder) of the binary tree in Figure 6-26.

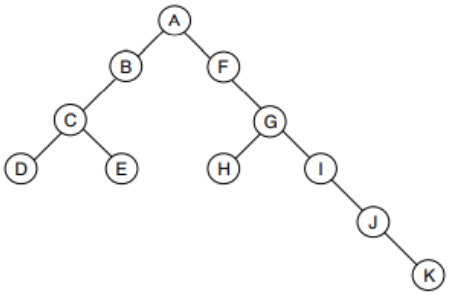


FIGURE 6-26 Binary Tree for Exercises 11, 14, 15, and 30

3. (10%) A binary tree has eight nodes. The postorder and inorder traversals of the tree are given below. Draw the tree.

Postorder: FECHGDBA

Inorder: FCEABHDG

4. (10%) A nearly complete binary tree has nine nodes. The breadth traversal of the tree is given below. Draw the tree.

Breadth: JCBADEFIG

5. (10%) Draw the corresponding binary tree of Figure 6-21

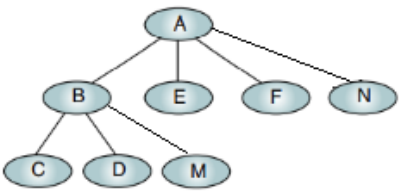


FIGURE 6-21 General Trees

6. (15%) Draw the expression tree and find the infix and postfix expressions for the following prefix expression:

```
× - A B + × C D / E F
```

7. (10%) Write an algorithm that counts the number of nodes in a binary tree.

- Write pseudo code or c-style code.

8. (15%) Rewrite the binary tree preorder traversal algorithm using a stack instead of recursion.

- Write pseudo code or c-style code.

Programming

9. (100%)

Write the C implementation for the Huffman algorithm developed in Project 47. After it has been built, print the code. Then write a C program to read characters from the keyboard and convert them to your Huffman code. Include a function in your program that converts Huffman code back to text. Use it to verify that the code entered from the keyboard was converted correctly.

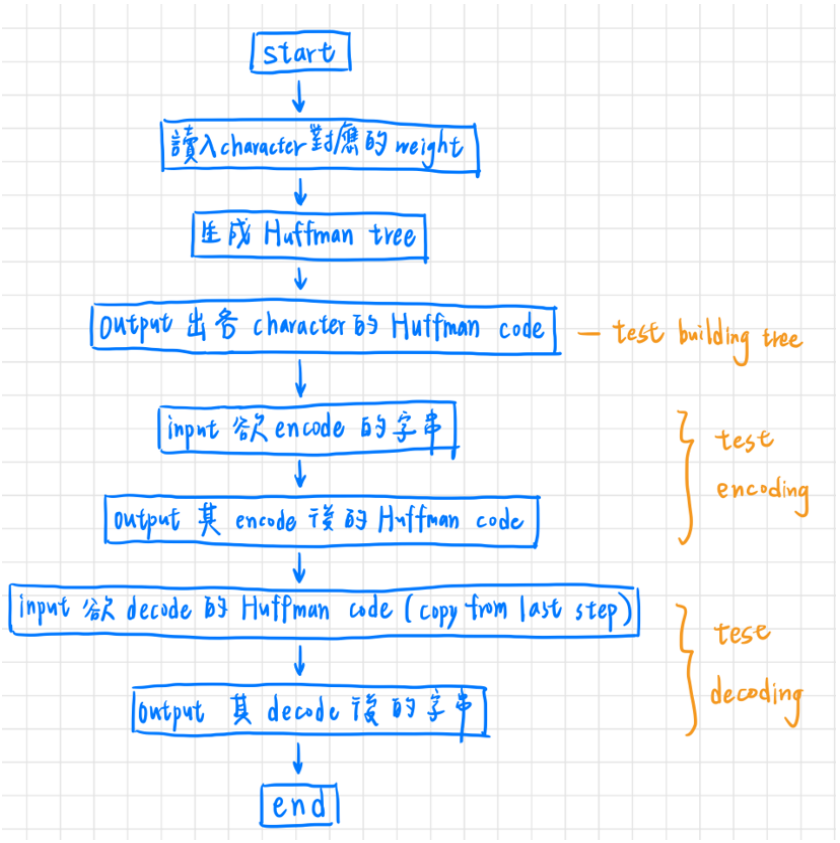
47. Write a pseudocode algorithm to build a Huffman tree. Use the alphabet as shown in Table 6-3.

Character	Weight	Character	Weight	Character	Weight
A	7	J	1	S	6
B	2	K	1	T	8
C	2	L	4	U	4
D	3	M	3	V	1
E	11	N	7	W	2
F	2	O	9	X	1
G	2	P	2	Y	2
H	6	Q	1	Z	1
I	6	R	6		

TABLE 6-3 Huffman Character Weights for Project 47

程式流程圖如下:

- 對照Table6-3，將各character的weight寫在code中，不須讀檔。
- 請如實將Huffman tree建好，如發現偷吃步，以零分計算。
- 輸出請Print至Terminal上，並對照下面的運行結果，因為Huffman tree並非唯一，所以各character的Huffman code與運行結果不一致是正常的，
  只要確定Huffman tree的建立與encoding, decoding function正確運行即可。



程式運行結果如下:

```
demo@DS-HW:~/Downloads$ ./a.out
A = 1010
B = 110110
C = 110010
D = 10001
E = 010
F = 110000
G = 110011
H = 0011
I = 0110
J = 1111001
K = 1100010
L = 0010
M = 10000
N = 1011
O = 000
P = 110111
Q = 1111000
R = 1001
S = 0111
T = 1110
U = 11010
V = 1100011
W = 111111
X = 1111010
Y = 111110
Z = 1111011
Encode: HELLOWORLD
Encode result: 00110100010001000011111100010010010100 01

Decode: 00110100010001000011111100010010010100 01
Decode result: HELLOWORLD
```

Submission - Deadline: 2022/12/2 13:20

題目形式:

- 手寫題可以用手寫拍照、打字的方式完成，但最後要統一轉成.pdf檔繳交
  檔名為HW6_學號.pdf。例如:HW6_0123456.pdf
- 程式題則繳交程式原始碼(.c檔/.cpp檔/.h檔 if needed)
  檔名為HW6_題號_學號.c / .cpp。例如:HW6_9_0123456.c / .cpp / .h

繳交方式:

- 將上述共兩個檔案及h檔(if needed)(手寫題pdf檔*1+程式題c/cpp檔*1)直接上傳至e3
- 檔名 / 格式錯誤者扣該次作業總分10分。
- 程式部分輸出格式請照作業說明，若不同會酌量扣分。

收作業規則:

- 遲交一個禮拜內分數打七折，超過一個禮拜即不接受補交。
- 遲交期限內僅接受原本沒交作業的同學補交，不接受先前交過作業的同學再次補交，若要修改答案請在繳交期限內修改完畢。
- 請務必重新整理，確認檔案已成功上傳至e3。

如有任何問題，麻煩從e3來信給所有助教。