Quiz 3 (ch10, 12, 15, 16)

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CMPT231
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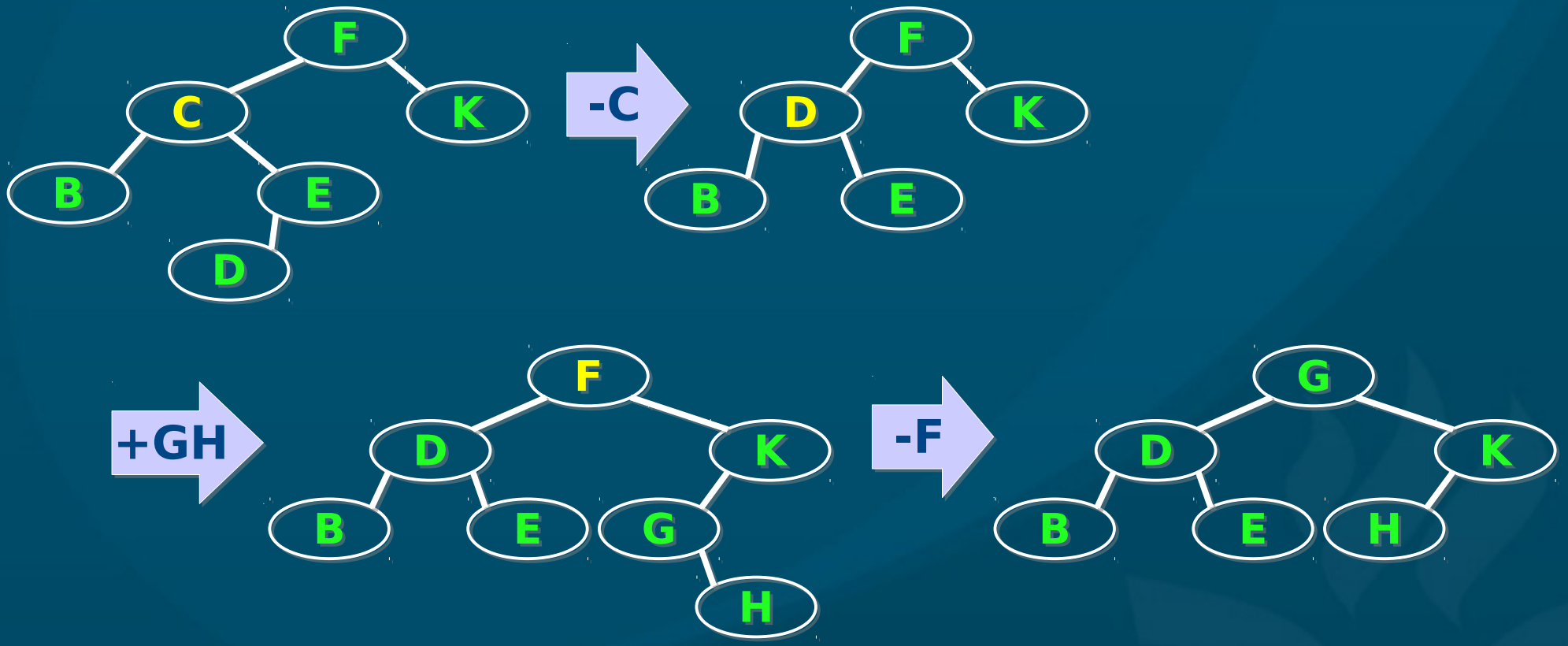
Quiz 3: 30pts

- Let "+X" = Insert(X) and "-X" = Delete(X) in a BST.
  - [6] Demonstrate the following sequence of operations:
    +F +C +B +E +D +K -C +G +H -F
  - [3] Print a preorder traversal of the resulting BST
- [5] In your own words, what is dynamic programming? Why is it cool? What does optimal substructure mean?
- Given the following symbols and frequencies:
  A:16, B:4, C:6, D:8, E:26, F:4, G:5, H:14, I:14, J:1, K:2
  - [8] Build the Huffman binary encoding tree
  - [2] Encode the string HEADACHE
  - [2] Decode: 1000 1011 1111 0100 0111 0010 01
  - [4] On a 1000-symbol text with symbols/freqs as above, what is the compression ratio of the Huffman coding versus a fixed-length binary encoding?

Quiz 3: solutions #1

- [6] Demonstrate the following sequence of operations:
  +F +C +B +E +D +K -C +G +H -F



- [3] Print a preorder traversal: G D B E K H

Quiz 3: solutions #2

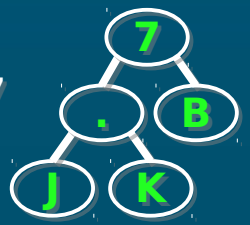
- [5] In your own words, what is dynamic programming? Why is it cool? What does optimal substructure mean?
  - Dynamic programming:
    - Typically used for optimisation (min/max)
    - Task divided into similar-looking subtasks
    - Each task requires making a choice over subtasks
    - Optimal solution for a task uses optimal solutions on subtasks (optimal substructure)
    - Solve smaller subtasks first and save in table, then build up to larger tasks bottom-up
    - The same subtasks are referenced multiple times, so saving results in table achieves speed-up (coolness)

Quiz 3: solutions #3

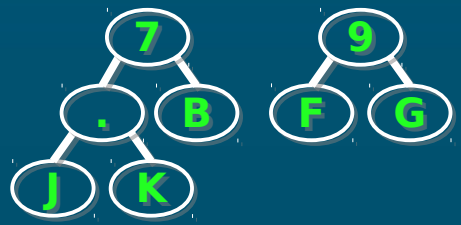
- [8] Build the Huffman binary encoding tree:
  A:16, B:4, C:6, D:8, E:26, F:4, G:5, H:14, I:14, J:1, K:2

JK: 3
B: 4
F: 4
G: 5
C: 6
D: 8
H: 14
I: 14
A: 16
E: 26

F: 4
G: 5
C: 6
JKB: 7
D: 8
H: 14
I: 14
A: 16
E: 26

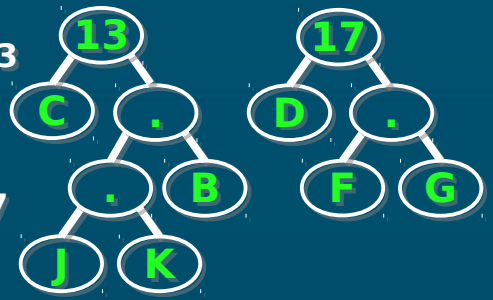


C: 6
JKB: 7
D: 8
FG: 9
H: 14
I: 14
A: 16
E: 26

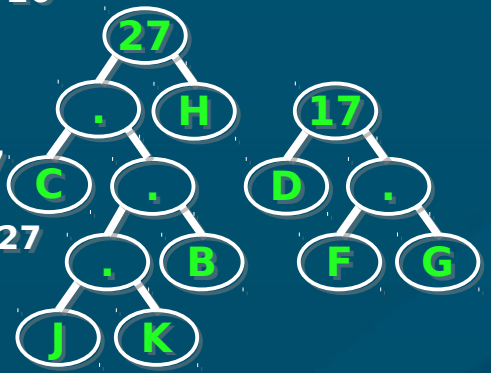


D: 8
FG: 9
CJKB: 13
H: 14
I: 14
A: 16
E: 26

CJKB: 13
H: 14
I: 14
A: 16
DFG: 17
E: 26

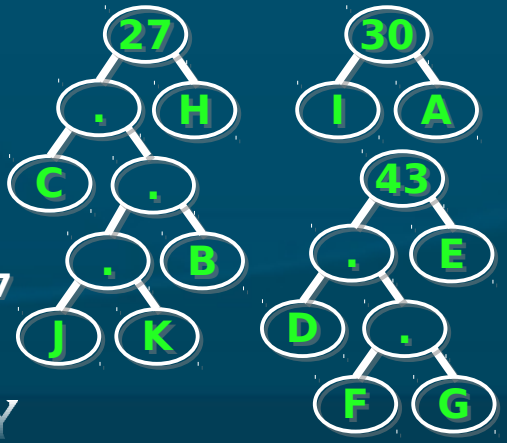


I: 14
A: 16
DFG: 17
E: 26
CJKBH: 27



DFG: 17
E: 26
CJKBH: 27
IA: 30

CJKBH: 27
IA: 30
DFGE: 43



DFGE: 43
CJKBHIA: 57

Quiz 3: solutions #3, cont.

- [2] Encode the string HEADACHE
  - 101 01 111 000 111 1000 101 01
- [2] Decode the bitstream 1000101111110100011001001
  - CHAICAFE
- [4] On a 1000-symbol text, what is the compression ratio?
  - Huffman: A:160*3 bits, B:40*5, C:60*4, D:80*3, E:260*2, F:40*4, G:50*4, H:140*3, I:140*3, J:10*6, K:20*6
    - Total: 3060 bits
  - Fixed length: 1000*4bits = 4000
  - Compression: 3060/4000 = 76.5%