

1) Huffman Coding

2) Hybrid Algorithms: Brute Force + Greedy

Chars in text file

encode them to reduce file size

(ZIP)

(1) each character will be substituted with
a bitstring

(2) No bitstring code can be a prefix
of another bitstring code

(3) One for one char substitutions

A 100
~~B 2~~
C 16
~~D 3~~
E 19
F 44
G 5
H 32



Alg

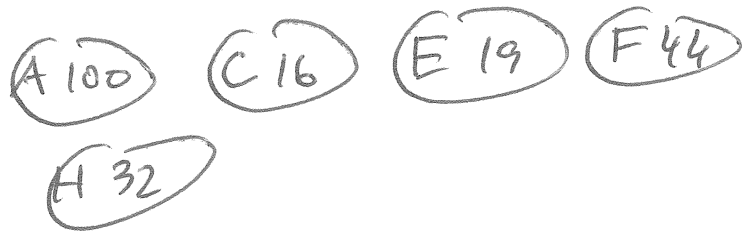
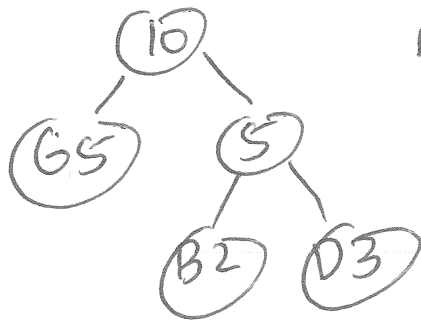
1. Put a node for each
letter/freq pair in PQ.
(Initially n separate trees)

2. While #trees > 1

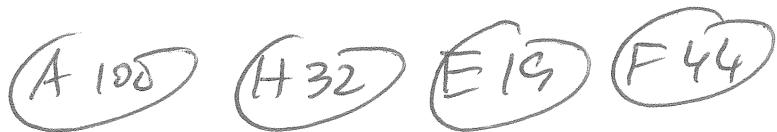
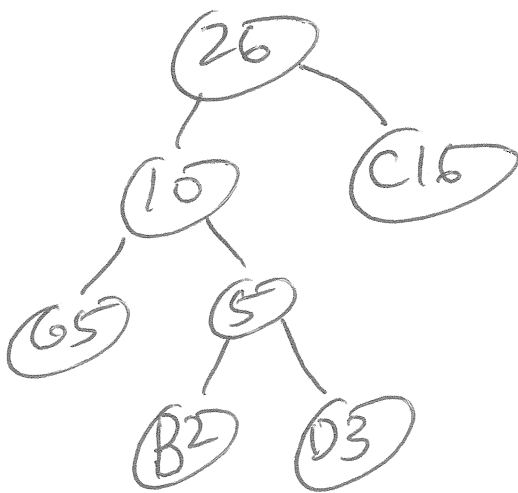
Ⓒ remove 2 trees w/
minimal freq + merge
together

Ⓓ Add merged tree
back to the PQ.

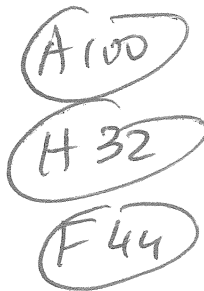
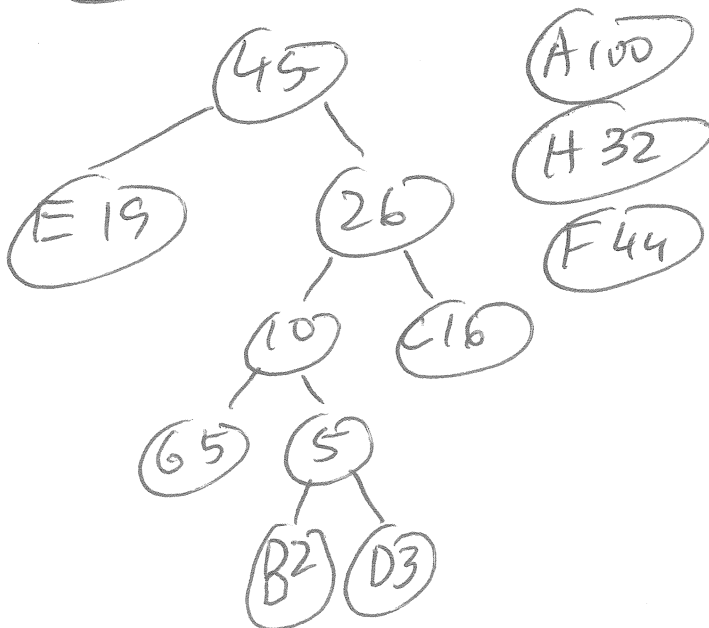
Iter #2



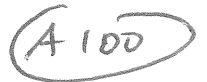
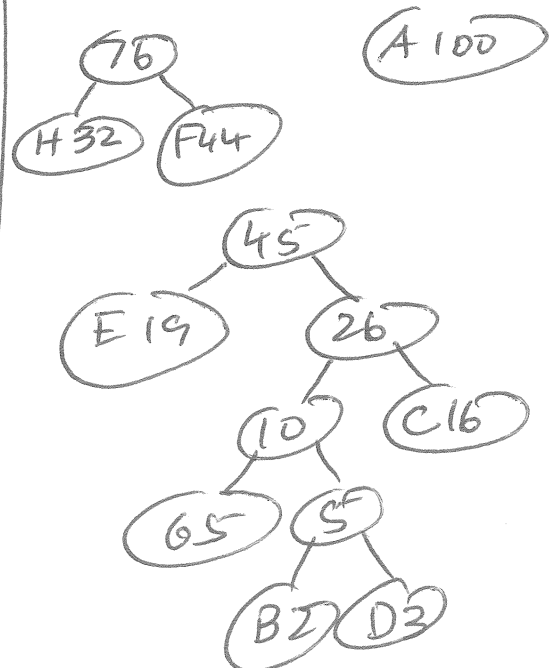
Iter #3



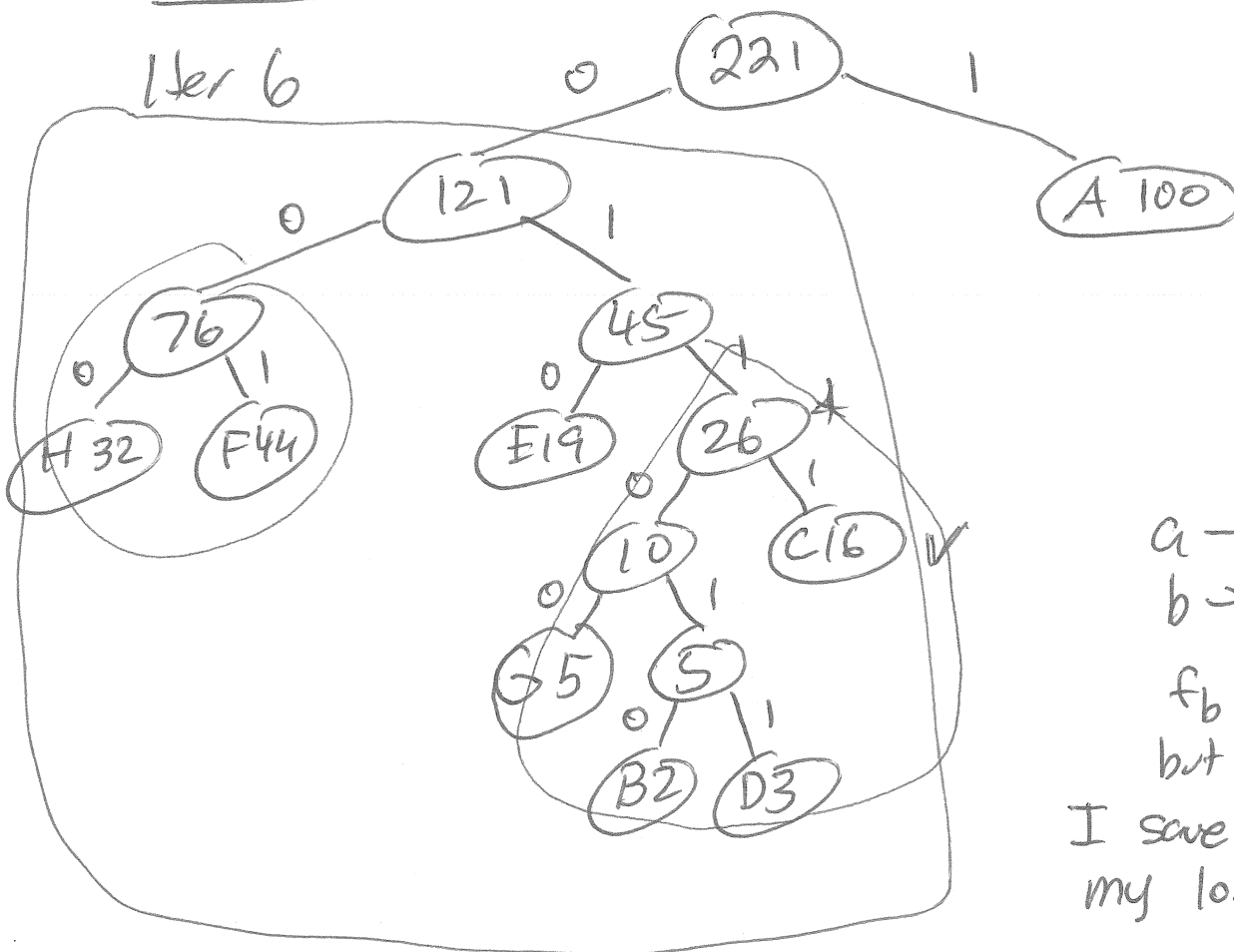
Iter #4



Iter #5



Iter 6, 7



$a \rightarrow f_a \quad l_a$
 $b \rightarrow f_b \quad l_b$
 $f_b < f_a$
 but you did $l_a \geq l_b$

I save $f_a - f_b$ times
my longer ~~code~~ code.

<u>Letter</u>	<u>f_x</u>	<u>Code</u>	<u># bits</u>	<u>bits saved</u>
A	100	1	1	200
B	2	011010	6	-6
C	16	0111	4	-16 // 178
D	3	011011	6	-9
E	19	010	3	0 // 169
F	44	001	3	0
G	5	01100	5	-10
H	32	000	3	0
				159

Hybrid Strategy

Welcome Party

People FIRST, LAST

26

18

poss

poss

letter

letters

Goal: MINIMIZE # group such that every person can join at least 1 group

Groups: FIRST NAME STARTING LETTER
OR

LAST NAME = =

Max 300 people

BF - WORST

try both choices for each person

$\Rightarrow 2^{300} \times 300$

VERY BAD!

BF - Better

2^{44} possible subsets of group

$26+18$

What IF I told you what the
last letter tents had to be

2nd Sample

fixed
Last Letter H M R

best

↓

⑤

R H

M M

J M

E D

D K

M R

J B

R F

T H

→ FIRST E

→ FIRST D

→ FIRST J

→ FIRST R

Alg:

try each subset of last row

for each subset

greedily assign first row tents

count total

if better than previous best

UPDATE

Walls

Input: Some points on Cartesian Grid
 (x, y) $0 \leq x, y \leq 36$, even

Goal: Partition region into rectangles with ~~min~~ minimum # walls so no rectangle has ≥ 1 point.

36 possible walls to build

Brute Force: $2^{36} \times 100^2$ too much!
 $P_{\#pts}$

Ides What if Vertical walls were fixed?

Everyone is a Winner

Input: n , $1 \leq n \leq 10^9$

Goal: Output all possible values of

$$\left\lfloor \frac{n}{k} \right\rfloor, k \in \mathbb{Z}^+$$

$$n=7$$

$$\frac{7}{1}, \frac{7}{2}, \frac{7}{3}, \frac{7}{4}, \frac{7}{5}, \frac{7}{6}, \frac{7}{7}$$

$$7 \ 3 \ 2 \ 1 \ 1 \ 1 \ 1$$

$$1, 2, 3, 7$$

Reg BF try all k !

$$\frac{10^9}{1}, \frac{10^9}{2} \rightarrow \frac{10^9}{\sqrt{10^9}}$$

100,000,000 — 500,000,000 3B, ...

enumerate $\left\lfloor \frac{n}{k} \right\rfloor$ for $k \leq \sqrt{n}$

then know all answer left $\leq \sqrt{n}$.

$$X+1 > \frac{n}{k} \geq X$$

$$k(X+1) > n \geq X \cdot k$$

$$n = 10^9$$

$$X = 30,000$$

$$30001 > \frac{10^9}{k} \geq 30000$$

$$30001k > 10^9$$

$$k > \frac{10^9}{30001}$$

fractional

$$30000k \leq 10^9$$

$$k \leq \frac{10^9}{30,000}$$

int division
ok.