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**REG: INTE/MG/1744/09/20**

**INTE 412: ASSIGNMENT 1**

**1. Calculate entropy.**

**A = 0.25, B = 0.25, C = 0.14, D = 0.14, E = 0.055, F = 0.055, G = 0.055, H = 0.055**

$$H = -\sum(p_i * \log_2(p_i))$$

H – is the entropy in bits

P<sub>i</sub> – is the probability of the i<sup>th</sup> character

$$H = -((0.25 * \log_2(0.25)) + (0.25 * \log_2(0.25)) + (0.14 * \log_2(0.14)) + (0.14 * \log_2(0.14)) + (0.055 * \log_2(0.055)) + (0.055 * \log_2(0.055)) + (0.055 * \log_2(0.055)) + (0.055 * \log_2(0.055)))$$

**ANSWER = 2.71bits**

**2. Huffman code tree**

$$A = 0.25$$

$$B = 0.25$$

$$C = 0.14$$

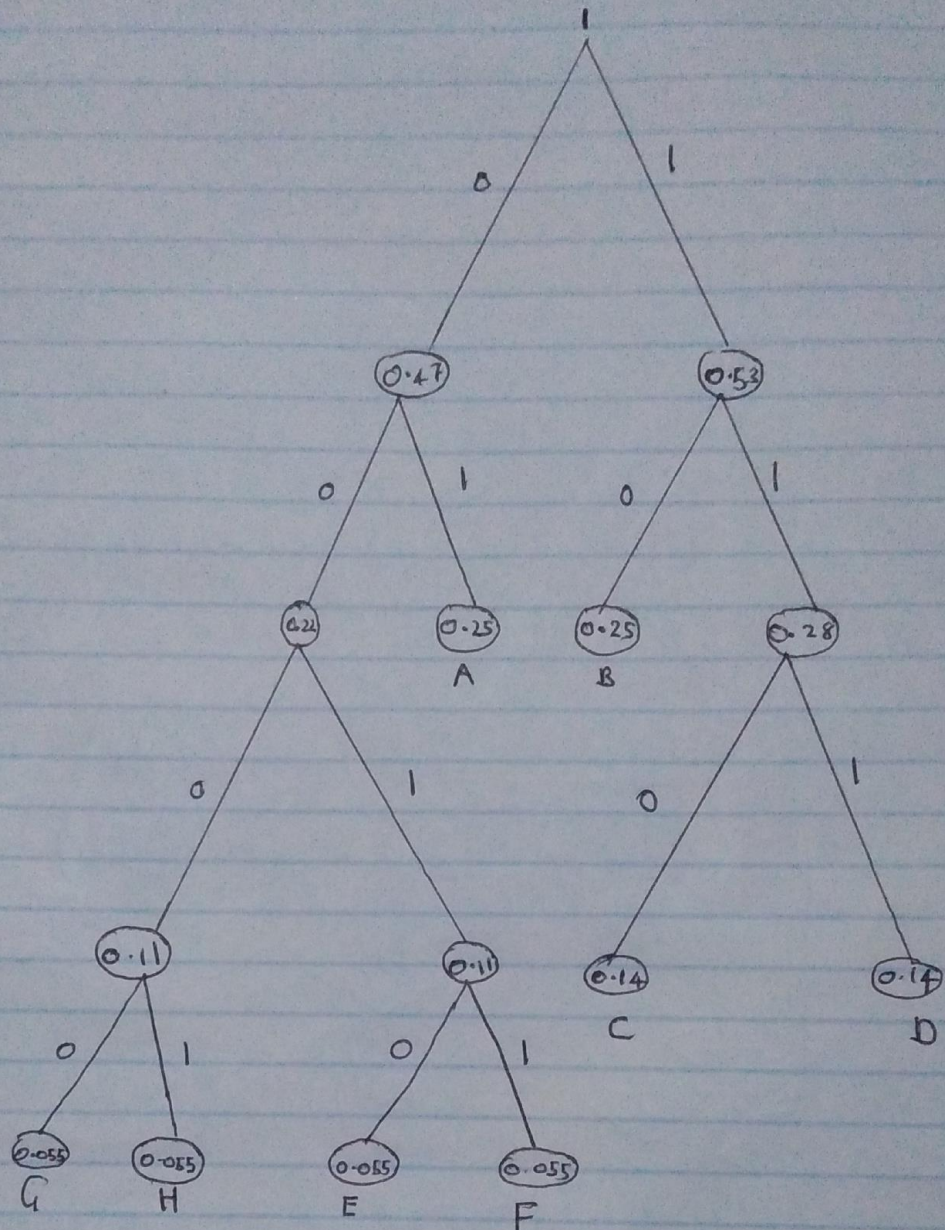
$$D = 0.14$$

$$E = 0.055$$

$$F = 0.055$$

$$G = 0.055$$

$$H = 0.055$$



3. Codeword for each character.

Character	Huffman code
A	01
B	10
C	110
D	111
E	0010
F	0011
G	0000
H	0001

#### 4. Average code length per character

Solution

Weighted formula = code length \* probability

Character	Huffman code	Code length	Probability	Weighted average
A	1	2	0.25	0.50 bits
B	10	2	0.25	0.50 bits
C	110	3	0.14	0.42 bits
D	111	3	0.14	0.42 bits
E	10	4	0.055	0.22 bits
F	11	4	0.055	0.22 bits
G	0	4	0.055	0.22 bits
H	1	4	0.055	0.22 bits

Average code length =  $((0.25 * 2) + (0.25 * 2) + (0.14 * 3) + (0.14 * 3) + (0.055 * 4) + (0.055 * 4) + (0.055 * 4) + (0.055 * 4)) / (0.25 + 0.25 + 0.14 + 0.14 + 0.055 + 0.055 + 0.055 + 0.055) = 2.50 \text{ bits}$

