Image Coding HW#1 이름 2022311285

1. a) $p = [0.25, 0.2, 0.1, 0.1, 0.1, 0.1, 0.05, 0.05, 0.05]$

Entropy $= \sum_i p_i \log_2 \frac{1}{p_i} \approx 2.941$

b)

p	0.25	0.2	0.1	0.1	0.1	0.1	0.05	0.05	0.05
code1	10	00	010	011	1100	1101	11100	11101	1111
code2	11	101	011	010	001	1001	1000	0001	0000

c) rate of code1 & code2 = 3

$3 \approx 2.941$ So the rate and entropy are almost same

2. a) A, B, C, E

D is not uniquely decodable ('1011O' → '10', '110' / '1011', '0')

F is not uniquely decodable ('00100' → '0', '0', '100' / '001', '0', '0')

b) A, C, E

c) average length of A → 3, B → 2.125, C → 2.125, E → 2

3.

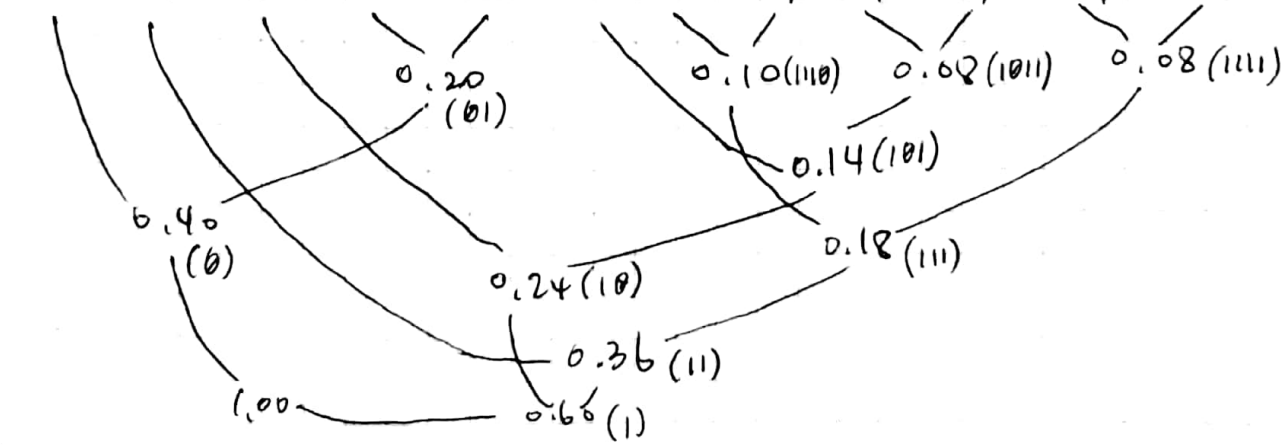
symbol	2	3	4	5	6
prob	1/11	4/11	3/11	1/11	2/11
code	100	00	01	101	11

Thus the sequence {2,3,3,3,4,4,4,5,6,6} → 1000000000000 (2,3,3,3)
01010111111 (4,4,4,5,6,6)

4.

(00) (110) (100) (010) (011) (1010) (11100) (11101) (10110) (10111) (11110) (11111)

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
0.20	0.18	0.10	0.10	0.10	0.06	0.06	0.04	0.04	0.04	0.04	0.04



4.

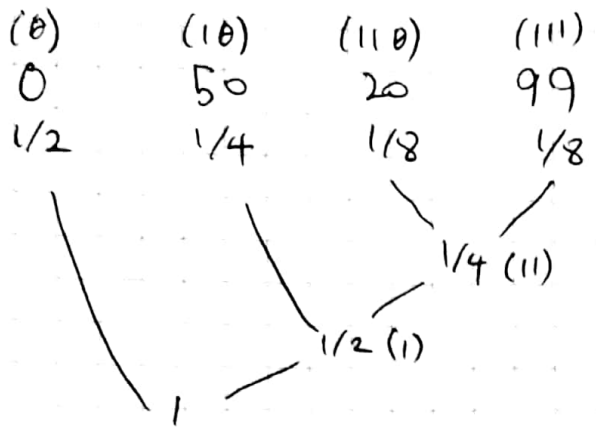
symbol	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12
code	00	110	100	0101	0111	10101	111000	11101	101100	10111	11110	11111

5. a)

symbol	0	50	20	99
prob	1/2	1/4	1/8	1/8

Entropy = 1.75

b)



symbol	0	50	20	99
code	0	10	110	111

c) average bit rate = 1.75 = Entropy

6. 1125 horizontal lines with 16:9 aspect ratio

→ width = 1125 × (16/9) = 2000

Bits needed for 2 hour = ~~—~~ interlacing

(2000 × 1125 / 2) pixel/frame ×

60 frame/sec × 24 bits/pixel × (2 × 60 × 60) sec

= 1.1664 × 10^{13} bits