Hw4 110550143 林巧芸

1. (a) Grassman's Law

It discribe that color matching is linear. In other words, if we match color1 with a linear combination of lights and match color2 with another set of weights, the combine color (color1 + color2) is matched by the sum of the 2 sets of weights.

ex. color1 = (R_1, G_1, B_1)
color2 = (R_2, G_2, B_2)
$\Rightarrow$ combine color (color1+color2) $= (R_1+R_2, G_1+G_2, B_1+B_2)$ #

(b) Weber's Law

It discribe a consistent relationship between the size of a physical stimulus and the perceived change in that stimulus.

① ΔResponse $\propto$ ΔStimulus / Stimulus

② $dr = k(1-s)ds$ (k: constant proportionality,
r: response
S: stimulus)

(c) quantization 8 bit → 10 bit

SQNR $6.02(10-8) = 12.04$ dB #

2. (a) entropy

$$H(s) = -\sum_{i=1}^{n} p_i \log_2 p_i$$

A→8
B→6
C→3
D→4
E→3
F→3
G→3

$$= -\left(\frac{8}{30}\log_2\frac{8}{30} + \frac{6}{30}\log_2\frac{6}{30} + \frac{3}{30}\log_2\frac{3}{30} + \frac{4}{30}\log_2\frac{4}{30} + \frac{3}{30}\log_2\frac{3}{30}\times 3\right)$$

$$= -\frac{1}{30}[8(3-\log_2 30) + 6(\log_2 6 - \log_2 30) + 3(\log_2 3 - \log_2 30) + 4(2-\log_2 30) + 9(\log_2 3 - \log_2 30)]$$

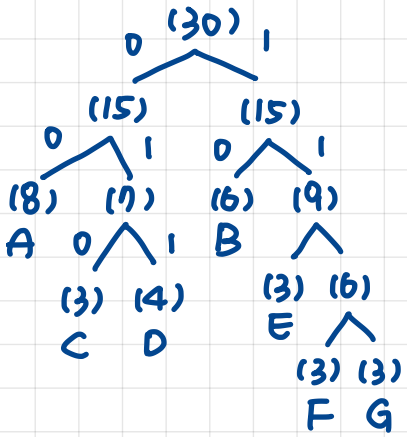
$$= -\frac{1}{30}(24 + 6\log_2 3 + 6 + 3\log_2 3 + 8 + 9\log_2 3 - 30\log_2 3 - 30 - 30\log_2 5)$$

$$= -\frac{1}{30}(8 - 12\log_2 3 - 30\log_2 5)$$

$$= -\frac{4}{15} + \frac{2}{5}\log_2 3 + \log_2 5 \fallingdotseq 2.69$$ #

(b) Shannon - Fano

Symbol	A	B	C	D	E	F	G
Count	8	6	3	4	3	3	3



A 00
B 10
C 010
D 011
E 110
F 1110
G 1111 *

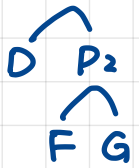
(c) Huffman coding

Symbol	A	B	C	D	E	F	G
Count	8	6	3	4	3	3	3

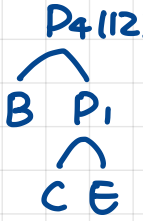
① $P_1(6)$ → (A, B, P_1, D, F, G)

② $P_2(6)$ → (A, B, P_1, P_2, D)

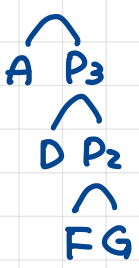
③ $P_3(10)$ → (P_3, A, B, P_1)



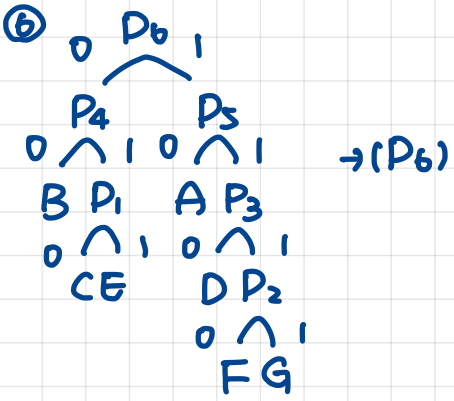
④ $P_4(12)$ → (P_4, P_3, A)



⑤ $P_5(18)$ → (P_5, P_4)



⑥



→ (P_6)

A 10
B 00
C 010
D 110
E 011
F 1110
G 1111 *

(d) extended Huffman coding

k=2, AA, DB, AB, CA, BA, DA, BD, EE, DG, GF,
AC, BF, GE
2 2

① P_1 (2)
AA DB → (P_1, AB, CA, BA, DA, BD, EE, DG, GF, AC, BF, GE)

② P_2 (2)
AB CA → (P_1, P_2, BA, DA, BD, EE, DG, GF, AC, BF, GE)

③ P_3 (2)
BA DA → (P_1, P_2, P_3, BD, EE, DG, GF, AC, BF, GE)

④ P_4 (2)
BD EE → (P_1, P_2, P_3, P_4, DG, GF, AC, BF, GE)

⑤ P_5 (2)
DG GF → (P_1, P_2, P_3, P_4, P_5, AC, BF, GE)

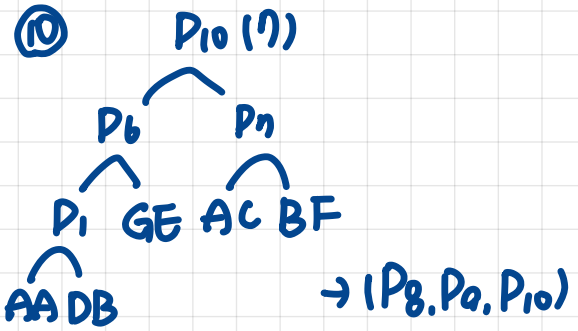
⑥ P_6 (3)
P_1 GE → (P_2, P_3, P_4, P_5, P_6, AC, BF)
AA DB

⑦ P_7 (4)
AC BF → (P_2, P_3, P_4, P_5, P_6, P_7)

⑧ P_8 (4)
P_2 P_3 → (P_4, P_5, P_6, P_7, P_8)
2 2 3 4 4
AB CA BA DA

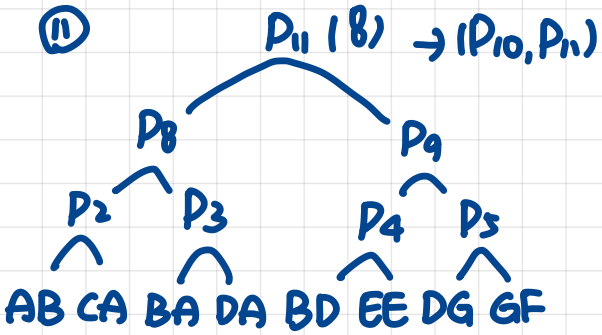
⑨ P_9 (4)
P_4 P_5 → (P_6, P_7, P_8, P_9)
BD EE DG GF

(10)



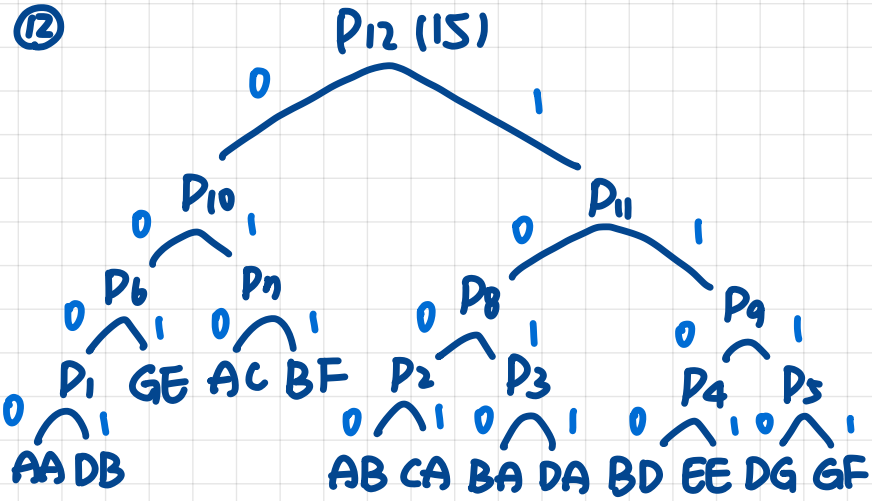
→ (P8, P9, P10)

(11)



→ (P10, P11)

(12)



AA	0000	AC	010
DB	0001	BF	011
AB	1000	GE	001
CA	1001		
BA	1010		
DA	1011		
BD	1100		
EE	1101		
DG	1110		
GF	1111		