Assignment 10

Group D

Exercise 1

1. A → (3)
   B → (2)
   C → (1)

2.

Set R_i	p_i	$Q_m(p_i)$	$Q_g(p_i)$	$Q_e(p_i)$	notes
R_1	$(\frac{1}{5}, \frac{4}{5})$	0,2	$\frac{8}{25} = 0,32$	0,72	symmetry
R_2	$(\frac{4}{5}, \frac{1}{5})$	0,2	0,32	0,72	
R_3	$(\frac{1}{2}, \frac{1}{2})$	0,5	0,5	1	maximum
R_4	$(1, 0)$	0	0	0	minimum

Exercise 2

1. Temperature : nominal / binary
   # guests : metric
   food : nominal

   → 2-class output

2 a) $\quad P = (P_{\text{wit}}, P_{\text{flop}}) = \left(\frac{4}{7}, \frac{3}{7}\right)$

$\quad Q(R) = 1 - \max(P) = \frac{3}{7}$

b) i) $\quad R_1 = \{x_1, x_2, x_3, x_4\} \qquad \text{"Cold"}$

$\quad R_2 = \{x_5, x_6, x_7\} \qquad \text{"warm"}$

ii) $\quad P_{R_1} = \frac{4}{7}$

$\quad P_{R_2} = \frac{3}{7}$

iii) $\quad P_1 = \left(\frac{1}{2}, \frac{1}{2}\right) \quad \rightarrow \quad Q_m(R_1) = \frac{1}{2}$

$\quad P_2 = \left(\frac{1}{3}, \frac{2}{3}\right) \quad \rightarrow \quad Q_m(R_2) = \frac{1}{3}$

iv) $\quad \Delta Q(R, R_1, R_2) = Q(R) - \left(P_{R_1} Q(R_1) + P_{R_2} Q(R_2)\right)$

$$= \frac{3}{7} - \left(\frac{4}{7} \cdot \frac{1}{2} + \frac{3}{7} \cdot \frac{1}{3}\right) = 0$$

c) i) $\quad \mu_1 = \frac{1}{4}(20 + 8 + 30 + 28) = 21,5$

$\quad \mu_2 = \frac{1}{3}(10 + 2 + 5) = 5,67$

$\quad \Theta = \frac{\mu_1 + \mu_2}{2} = 13,58$

$\quad R_1 = \{x_1, x_3, x_4, x_6\} \qquad \text{"} < \Theta \text{"}$

$\quad R_2 = \{x_2, x_5, x_7\} \qquad \text{"} \geq \Theta \text{"}$

ii) $\quad P_{R_1} = \frac{4}{7}$

$\quad P_{R_2} = \frac{3}{7}$

$\quad P_1 = \left(\frac{3}{4}, \frac{1}{4}\right) \qquad \rightarrow \quad Q_m(R_1) = 0,25$

$\quad P_2 = (0, 1) \qquad \rightarrow \quad Q_m(R_2) = 0$

$\quad \Delta Q(R, R_1, R_2) = Q(R) - \left(P_{R_1} Q(R_1) + P_{R_2} Q(R_2)\right)$

$$= \frac{3}{7} - \left(\frac{4}{7} \cdot \frac{1}{4} + \frac{3}{7} \cdot 0\right) = \frac{2}{7}$$

d) $R_1 = \{x_1, x_6, x_7\}$ "Nothing"

$R_2 = \{x_2, x_3\}$ "Vegetables"

$R_3 = \{x_4, x_5\}$ "Snacks"

$p_{R1} = \frac{3}{7}$

$p_{R2} = \frac{2}{7}$

$p_{R3} = \frac{2}{7}$

$P_1 = \left(\frac{2}{3}, \frac{1}{3}\right)$ $\rightarrow$ $Q_m(R_1) = \frac{1}{3}$

$P_2 = \left(\frac{1}{2}, \frac{1}{2}\right)$ $\rightarrow$ $Q_m(R_2) = \frac{1}{2}$

$P_3 = (0, 1)$ $\rightarrow$ $Q_m(R_3) = 0$

$\Delta Q(R, R_1, R_2, R_3) = Q(R) - \left(p_{R_1} Q(R_1) + p_{R_2} Q(R_2) + p_{R_3} Q(R_3)\right)$

$= \frac{3}{7} - \left(\frac{3}{7} \cdot \frac{1}{3} + \frac{2}{7} \cdot \frac{1}{2} + \frac{2}{7} \cdot 0\right) = \underline{\underline{\frac{1}{7}}}$

e) use feature "<u>number of guests</u>" with $\theta = 13,58$ since it yields the highest impurity gain ΔQ

3.   . . .

4.