1 Exercise *(Probabilities (2p))*

1.

$$
\begin{aligned}
P(red|b_1) = \frac{h(red, b_1)}{h(b1)} &= \frac{5}{5+3+2} = \frac{5}{10} &= \frac{1}{2} \\
P(green|b_1) = \frac{h(green, b_1)}{h(b1)} &= \frac{3}{5+3+2} &= \frac{3}{10} \\
P(yellow|b_1) = \frac{h(yellow, b_1)}{h(b1)} &= \frac{2}{5+3+2} = \frac{2}{10} &= \frac{1}{5}
\end{aligned}
$$

2. $p(b_1) = 0.2, p(b_2) = 0.3, p(b_3) = 0.5$

$$
\begin{aligned}
P(red) &= P(red|b_1)P(b_1) + P(red|b_2)P(b_2) + P(red|b_3)P(b_3) \\
&= 0.2\frac{5}{5+3+2} + 0.3\frac{1}{1+2+3} + 0.5\frac{4}{4+2+5} \\
&= \frac{73}{220} \\
&= 0.3319 \\
P(yellow) &= P(yellow|b_1)P(b_1) + P(yellow|b_2)P(b_2) + P(yellow|b_3)P(b_3) \\
&= 0.2\frac{3}{5+3+2} + 0.3\frac{2}{1+2+3} + 0.5\frac{2}{4+2+5} \\
&= \frac{69}{275} \\
&= 0.251 \\
P(yellow) &= P(yellow|b_1)P(b_1) + P(yellow|b_2)P(b_2) + P(green) \\
&= P(green|b_1)P(b_1) + P(green|b_2)P(b_2) + P(green|b_3)P(b_3) \\
&= 0.2\frac{2}{5+3+2} + 0.3\frac{3}{1+2+3} + 0.5\frac{5}{4+2+5} \\
&= \frac{459}{1100} \\
&= 0.417
\end{aligned}
$$

2 Exercise *(Bayes Classifier (8p))*

1.

2.

3.

3 Exercise *(Reinforcement (10p))*

1.
2.

4 Exercise *(LDA (6p))*

1.
2.
3.