Q2 1

Bayes Theorem $P(A/B) = \frac{P(B/A) \cdot P(A)}{P(B)}$

So, classification prob. given by

$$P(c_i/x) = \frac{P(x/c_i)\, P(c_i)}{P(x)}$$

$$= \frac{P(x/c_i)\, P(c_i)}{\sum_{j=1}^{J} P(x/c_j)\, P(c_j)}$$

for using Gaussian likelihood (Gaussian / Normal Distribution)

$$P(x/c_i) = \frac{1}{\sqrt{2\pi}\,\sigma_i^2} \cdot e^{-\frac{1}{2}\left\{\frac{x-\mu_i}{\sigma_i}\right\}^2}$$

$$\hat{\mu}_i = \frac{1}{N_i} \sum_{k=1}^{N} x_k \quad ; \quad \hat{\sigma}_i^2 = \frac{1}{N_i} \sum_{k=1}^{N} (x_k - \mu_i)^2$$

$$P(c_j) = \frac{N_i}{\sum_{k=1}^{N} N_k} \qquad \frac{0.5+0.1+0.2+0.4+0.3+0.2+0.2+0.1+0.35+0.25}{10}$$

$\hat{\mu}_1 = 0.26$, $\hat{\mu}_2 = 0.8625$ $\left(0.9+0.8+0.75+1.0/4\right)$

$\sigma_1^2 = 0.0149$ $\sigma_2^2 = 0.0092$

$P(C_1) = 0.714$ $P(C_2) = 0.28$

$$\boxed{P(C_1/0.6) = 0.6305}$$

MLE of class P1 $= \frac{\#\text{ occurrence of P1}}{\text{Total \# of occurrence of P1 \& P2}} = \frac{10}{14}$

MLE of class P2 $=$ ~~# of occ~~ $1 -$ MLE of P1 $= 1 - \frac{10}{14}$

$= \frac{4}{14}$

Q 2 (b)

$X = (goal, football, golf, defence, offence, wicket, office, Strategy)$

$x_{politics} = \begin{bmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$

$P(\frac{goal}{Politics}) = 2/6$

$P(\frac{football}{Politics}) = 1/6$

$P(\frac{golf}{Politics}) = 1/6$

$P(\frac{defence}{Politics}) = 5/6$

$Pr(\frac{offence}{Politics}) = 5/6.$

$Pr(wicket) = 1/6$

$Pr(office) = 4/6 = 2/3$

$Pr(Strategy) = 5/6$

$x_{sport} = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \end{bmatrix}$

$P(goal) = 4/6$

$P(football) = 4/6$

$P(golf) = 1/6$

$P(defence) = 4/6$

$P(offence) = 1/6$

$P(wicket) = 1/6$

$P(office) = 0$

$P(Strategy) = 1/6$

$X = [1\ 0\ 0\ 1\ 1\ 1\ 1\ 0]$

$P(a/b) = \frac{P(b/a)\,P(a)}{P(b)}$

$P(X/politics) = \frac{\cancel{1/2}\left(\frac{2}{6}\times\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}\times\frac{1}{6}\times\frac{4}{6}\times\frac{1}{6}\right)}{\cancel{1/2}\left(\frac{2}{6}\times\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}\times\frac{1}{6}\times\frac{4}{6}\times\frac{1}{6}\right)+\frac{1}{2}\left(\frac{4}{6}\times\frac{3}{6}\times\frac{5}{6}\times\frac{4}{6}\times\frac{1}{6}\times\frac{1}{6}\times\frac{1}{6}\times 0\right)}$

$= 1$

$\boxed{P(x/politics) = 1}$