Q.2 :→

New Instance 1 :→

$$P(y=\text{Low} \mid X=\text{High School, Service, <3}) = P(X=\text{H.S} \mid y=\text{Low}) * P(X=\text{Service} \mid y=\text{Low}) * P(X=\text{<3} \mid y=\text{Low}) * P(y=\text{Low})$$

$$= \frac{4}{6} * \frac{4}{6} * \frac{2}{6} * \frac{6}{10}$$

After Applying Laplace Smoothing :—

$$= \frac{4+1}{6+2} * \frac{4+1}{6+2} * \frac{2+1}{6+3} * \frac{6}{10}$$

$$= \frac{5}{8} * \frac{5}{8} * \frac{3}{9} * \frac{6}{10}$$

$$= \frac{450}{5760} = \boxed{7.80\%}$$

$$P(y=\text{High} \mid X=\text{H.S, Service, <3}) = P(X=\text{H.S} \mid y=\text{High}) * P(X=\text{Service} \mid y=\text{High}) * P(X=\text{<3} \mid y=\text{High}) * P(y=\text{high})$$

$$= \frac{1}{4} * \frac{1}{4} * \frac{1}{4} * \frac{4}{10}$$

After Applying laplace Smoothing :→

$$= \frac{1+1}{4+2} * \frac{1+1}{4+2} * \frac{1+1}{4+3} * \frac{4}{10}$$

$$= \frac{2}{6} * \frac{2}{6} * \frac{2}{7} * \frac{4}{10} = \frac{32}{2520}$$

$$= \boxed{1.27\%}$$

Since the y = low Probability is high

$$\boxed{\text{Predicted Class} = \text{Low}}$$

For Instance 2:-

$P(y=Low \mid X=College, Retail, <3) = P(X=College/y=low) * P(X=Retail/y=Low) * P(X=<3/y=low) * P(y=Low)$

$= \frac{2}{6} * \frac{0}{6} * \frac{3}{6} * \frac{6}{10}$

After applying Laplac Smoothing :-

$= \frac{2+1}{6+2} * \frac{0+1}{6+3} * \frac{2+1}{6+3} * \frac{6}{10}$

$= \frac{3}{8} * \frac{1}{9} * \frac{3}{9} * \frac{6}{10}$

$= \frac{54}{6480}$

$= \boxed{0.83\%}$

$P(y=high \mid X=College, Retail, <3) = P(X=College/y=high) * P(X=Retail/y=high) * P(X=<3/y=high) * P(y=Low)$

$= \frac{3}{4} * \frac{0}{4} * \frac{1}{4} * \frac{4}{10}$

After applying Laplac Smoothing :-

$= \frac{3+1}{4+2} * \frac{0+1}{4+3} * \frac{1+1}{4+3} * \frac{4}{10}$

$= \frac{4}{6} * \frac{1}{7} * \frac{2}{7} * \frac{4}{10}$

$= \frac{32}{2940}$

$= \boxed{1.1\%}$

Final Predicted Class = High

For Instance 3:→

$P(y=Low \mid X=Graduate, Service, 3\text{-}10) = P(X=Graduate \mid y=Low) * P(X=Service \mid y=Low) * P(X=3\text{-}10 \mid y=Low) * P(y=Low)$

$= \frac{0}{6} * \frac{4}{6} * \frac{3}{6} * \frac{6}{10}$

After Laplace Smoothing :-

$= \frac{0+1}{6+3} * \frac{4+1}{6+2} * \frac{3+1}{6+3} * \frac{6}{10}$

$= \frac{1}{9} * \frac{5}{8} * \frac{3}{9} * \frac{6}{10}$

$= \frac{90}{6480}$

$= \boxed{1.4\%}$

$P(y=high \mid X=Graduate, Service, 3\text{-}10) = P(X=Graduate \mid y=high) * P(X=Service \mid y=high) * P(X=3\text{-}10 \mid y=high) * P(y=high)$

$= \frac{0}{4} * \frac{1}{4} * \frac{1}{4} * \frac{4}{10}$

After Laplace Smoothing :-

$= \frac{0+1}{4+3} * \frac{1+1}{4+2} * \frac{1+1}{4+3} * \frac{4}{10}$

$= \frac{1}{7} * \frac{2}{6} * \frac{2}{7} * \frac{4}{10}$

$= \frac{16}{2940}$

$= \boxed{0.54\%}$

Final Predicted class = Low