Excuse me (sir, ma’am) do you have some spare change?

Profits:

Say “sir” to a male  +$4.00  
Say “sir” to a female  -$2.00 (balm for slapped face)  
Say “ma’am” to a male -$5.00 (nose splint)  
Say “ma’am” to a female  +$6.00

\[
\begin{array}{c|cc}
\text{Decision} & \text{M} & \text{F} \\
\hline
\text{Sir} & 4 & -2 \\
\text{Ma’am} & -5 & 6 \\
\end{array}
\]

\[
\begin{array}{c|cc}
\delta_{s,m} & \delta_{s,f} \\
\delta_{m,m} & \delta_{m,f} \\
\end{array}
\]

You look at features – (height, earrings, hair length, voice pitch, ….)
Based on features, estimate \( p_m = \text{Prob}\{\text{Male} | \text{features}\} \)

Expected profits

\[
\begin{align*}
\text{E\{profit for saying “sir”\}} & = 4 p_m - 2 (1-p_m) = \delta_{s,m} p_m + \delta_{s,f} (1-p_m) \\
\text{E\{profit for saying “ma’am”\}} & = -5 p_m + 6 (1-p_m) = \delta_{m,m} p_m + \delta_{m,f} (1-p_m)
\end{align*}
\]

For what value of \( p_m \) is \( \delta_{s,m} p_m + \delta_{s,f} (1-p_m) > \delta_{m,m} p_m + \delta_{m,f} (1-p_m) \) ?
Say “sir” whenever the features give estimated \( p_m \) greater than ______

\[
\begin{align*}
\delta_{s,m} p_m - \delta_{s,f} p_m - \delta_{m,m} p_m + \delta_{m,f} p_m & > \delta_{m,f} - \delta_{s,f} \\
p_m > (\delta_{m,f} - \delta_{s,f})/(\delta_{s,m} - \delta_{s,f} - \delta_{m,m} + \delta_{m,f}) = 1/[1 + (\delta_{s,m} - \delta_{s,f})/ (\delta_{m,f} - \delta_{m,m})]
\end{align*}
\]

Give, in terms of the deltas, the entries of these two equivalent (to the one above) specifications:

\[
\begin{array}{c|cc}
\text{Decision} & \text{M} & \text{F} \\
\hline
\text{Sir} & \_ & 0 \\
\text{Ma’am} & 0 & \_ \\
\end{array}
\]