1.1(a) $(h, w) = (10, 11)$

$k = 3$

$s = 2$

$h' = (h + 2P - f)/s + 1$

$= (10 - 3)/2 + 1$

$= 4$

$w' = (11 - 3)/2 + 1 = 5$

$\boxed{(h', w') = (4, 5)}$

(b) $C' = F$

$H' = \dfrac{(H + 2P - D(k-1) - 1)}{S} + 1$

$W' = \dfrac{(W + 2P - D(k-1) - 1)}{S} + 1$

(C', H', W')

(c) $x \in R^{5\times 2}$ $\quad w \in R^{1\times 2\times 3}$ ← one kernel of size '3'.

output size $\equiv \underline{5-3} + 1 = 3 \equiv (1 \times 3)$

$w = \begin{bmatrix} w_{11} & w_{12} & w_{13} \\ w_{21} & w_{22} & w_{23} \end{bmatrix}$ $\quad x = \begin{bmatrix} x_{11} & x_{12} & x_{13} & x_{14} & x_{15} \\ x_{21} & x_{22} & x_{23} & x_{24} & x_{25} \end{bmatrix}$

(i) $O_1 = w_{11}x_{11} + w_{12}x_{12} + w_{13}x_{13} + w_{21}x_{21} + w_{22}x_{22} + w_{23}x_{23}$

$= \sum_{c=1}^{2} \sum_{i=1}^{3} w_{ci} x_{ci}$

or, $O_j = \sum_{c=1}^{2} \sum_{i=j}^{j+2} w_{c(j-i+1)} x_{ci}$

$f_w(x) = \text{output} = [O_1, O_2, O_3] \in R^{1\times 3}$

(ii) $\dfrac{\partial \text{output}}{\partial w}, \in R^{1\times 2\times 3}$ $\qquad \dfrac{do_1}{dw_{ij}} = x_{ij}$, $\dfrac{do_2}{dw_{ij}} = x_{i(j+1)}$, $\dfrac{do_3}{dw_{ij}} = x_{i(j+2)}$

$\dfrac{\partial o}{\partial w} \in R^{1\times 3 \times 2\times 3}$, omit dim = 1

(iii) $\underset{\text{else } 0}{\dfrac{do_1}{dx_{ij}} = w_{ij}}$, $\dfrac{do_2}{dx_{ij}} = w_{i(j-1)}$, $\dfrac{do_3}{dx_{ij}} = w_{i(j-2)}$

$\dfrac{\partial o}{\partial x} \in R^{1\times 3\times 5\times 2}$ $\qquad$ omit dim = 1

(iv) $\dfrac{dl}{dw} \in R^{1\times 2\times 3}$ $\qquad \dfrac{dl}{dw} = \underbrace{\dfrac{dl}{d\text{output}}}_{\text{given}} \times \dfrac{dout}{dw}$