This homework is done by Tianwei Mo.

1.

a) 256*256*100
b) 40*80*2400
c) 32*300*512*512

2.

a) K1 and k2 are in [0, 1]
b) 5*4
c) The largest positive Z[I, j] appears when X[I, j] and X[i+1, j] are the biggest and X[I, j+1] and X[i+1, j+1] are the smallest. That is 3 + 3 = 6 when I = [1, 2, 3, 4] and j = 3.
d) The largest negative Z[I, j] appears when X[I, j] and X[i+1, j] are the smallest and X[I, j+1] and X[i+1, j+1] are the biggest. That is -3 + -3 = -6 when I = [1, 2, 3, 4] and j = 0.
e) Z[I, j] = 0 when I, j = [0, 1], [0, 2], [1, 1], [1, 2]

3.

a) Z has shape [46, 62, 20]. U has the same shape as Z.
b) The number of input channels is [48, 64, 10]. The number of output channels is [46, 62, 20]
c) For each z, there are k1+k2+n multiplications. The total number is (3+3+10)*46*62*20=912640
d) 3*3*10*20+20=1820

4.

a) Dj/dz = dj/du * du/dz = dj/du * (exp(-z)/(1+exp(-z))^2)
b) Dj/dw = dj/dz * dz/dw = dj/dz * $\sum_{k_1}\sum_{k_2}\sum_{n} X[i, j_1 + k_1, j_2 + k_2, n]$
c) Dj/dx = dj/dz * dz/dx = dj/dz * $\sum_{k_1}\sum_{k_2}\sum_{n} W[k_1, k_2, n, m]$

5.

a) Y = [1, 3, 0, 1]
b) Y = [2, 3, 10, 1]
c) Y[I, j, n] = $\max_{m=0,1,..,p-1} x[i, sj + m, sn + m], \quad j, n = 0, 1, .., \left\lceil \frac{n-1}{s} \right\rceil$