Hw 4 problem 3

3)

c) Compute a_{ij} for each word pair

i) Initialize attention weights: $a_{ij} = q_i \cdot k_j$

$$a_{11} = 6 \qquad a_{21} = 7 \qquad a_{31} = 18$$
$$a_{12} = 0 \qquad a_{22} = 0 \qquad a_{32} = 0$$
$$a_{13} = 6 \qquad a_{23} = 10 \qquad a_{33} = 22$$

(ii) Divide by $\sqrt{|K_1|} = \sqrt{3}$

$$a_{11} = \frac{6}{\sqrt{3}} \qquad a_{21} = \frac{7}{\sqrt{3}} \qquad a_{31} = \frac{18}{\sqrt{3}}$$
$$a_{12} = 0 \qquad a_{22} = 0 \qquad a_{32} = 0$$
$$a_{13} = \frac{6}{\sqrt{3}} \qquad a_{23} = \frac{10}{\sqrt{3}} \qquad a_{33} = \frac{22}{\sqrt{3}}$$

b) Normalize

$$\sum a_{1k} = \frac{12}{\sqrt{3}} \qquad a_{11} = \frac{6}{12} \qquad a_{21} = \frac{7}{17} \qquad a_{31} = \frac{9}{20}$$
$$\sum a_{2k} = \frac{17}{\sqrt{3}} \qquad a_{12} = 0 \qquad a_{22} = 0 \qquad a_{32} = 0$$
$$\sum a_{3k} = \frac{40}{\sqrt{3}} \qquad a_{13} = \frac{6}{12} \qquad a_{23} = \frac{10}{17} \qquad a_{33} = \frac{11}{20}$$

c) Compute z_i

$$z_1 = a_{11} v_1 + a_{12} v_2 + a_{13} v_3 = \frac{6}{12}(2,0,1) + \frac{6}{12}(1,2,2) = \left(\frac{3}{2}, 1, \frac{3}{2}\right)$$
$$z_2 = a_{21} v_1 + a_{22} v_2 + a_{23} v_3 = \frac{7}{17}(2,0,1) + \frac{10}{17}(1,2,2) = \left(\frac{24}{17}, \frac{20}{17}, \frac{27}{17}\right)$$
$$z_3 = a_{31} v_1 + a_{32} v_2 + a_{33} v_3 = \frac{9}{20}(2,0,1) + \frac{11}{20}(1,2,2) = \left(\frac{29}{20}, \frac{11}{10}, \frac{31}{20}\right)$$

$$z_1 = \left[\frac{3}{2}, 1, \frac{3}{2}\right]$$
$$z_2 = \left[\frac{24}{17}, \frac{20}{17}, \frac{27}{17}\right]$$
$$z_3 = \left[\frac{29}{20}, \frac{11}{10}, \frac{31}{20}\right]$$