

ECE 417 MULTIMEDIA SIGNAL PROCESSING
Fall 2018 EXAM 2 SOLUTIONS

Problem 1 (16 points)

$$\begin{aligned} \frac{\partial E}{\partial b_j} &= - \sum_{\ell} \frac{\zeta_{\ell}}{z_{\ell}} \left(\frac{pb_j^{p-1} \delta_{j\ell}}{\sum_k b_k^p} - \frac{pb_{\ell}^p b_j^{p-1}}{(\sum_k b_k^p)^2} \right) = - \sum_{\ell} \frac{p}{b_j} \zeta_{\ell} (\delta_{j\ell} - z_j) \\ &= - \frac{p}{b_j} (\delta_{j\ell^*} - z_j) = - \frac{p}{b_j} (\zeta_j - z_j) \end{aligned}$$

Problem 2 (17 points)

$$\frac{\partial E}{\partial w} = \sum_{k=1}^5 \epsilon[k] x \left[\operatorname{argmax}_{2k-1 \leq n \leq 2k} a[n] \right]$$

Problem 3 (16 points)

$$u_0 = \frac{(e-1)c - bf}{\lambda}, \quad v_0 = \frac{-df + (a-1)f}{\lambda}$$

Problem 4 (17 points)

$$\nabla_{\vec{w}} E = \frac{1}{n} \sum_{i=1}^n ((1 - \zeta_i) z_i - \zeta_i (1 - z_i) + \vec{w}^T \vec{x}_i) \vec{x}_i^T$$

Problem 5 (17 points)

Line segment connects \vec{x}_3 , at (1, 2), to (1, 0), and passes through \vec{x}_0 .

Problem 6 (17 points)

$$y[n] = \sum_{m=1}^n \left(\frac{1}{2} \right)^{n-m+2} x[m]$$