CS491/691 Quiz 6 Name _____

**Algorithm 32** AdaBoost($\mathcal{W}$, $\mathcal{D}$, $K$)

1: $\boldsymbol{d}^{(0)} \leftarrow \langle \frac{1}{N}, \frac{1}{N}, \ldots, \frac{1}{N} \rangle$
2: **for** $k = 1 \ldots K$ **do**
3: $f^{(k)} \leftarrow \mathcal{W}(\mathcal{D}, \boldsymbol{d}^{(k-1)})$
4: $\hat{y}_n \leftarrow f^{(k)}(\boldsymbol{x}_n), \forall n$
5: $\hat{\epsilon}^{(k)} \leftarrow \sum_n d_n^{(k-1)} [y_n \neq \hat{y}_n]$
6: $\alpha^{(k)} \leftarrow \frac{1}{2} \log \left( \frac{1-\hat{\epsilon}^{(k)}}{\hat{\epsilon}^{(k)}} \right)$
7: $d_n^{(k)} \leftarrow \frac{1}{Z} d_n^{(k-1)} \exp[-\alpha^{(k)} y_n \hat{y}_n], \forall n$
8: **end for**
9: **return** $f(\hat{\boldsymbol{x}}) = \text{sgn}\left[\sum_k \alpha^{(k)} f^{(k)}(\hat{\boldsymbol{x}})\right]$

1. The algorithm for Adaboost is given above. For each line number 1-9 (excluding 8), explain in English what is happening. Clearly indicate each step and your explanation with a number. (10 points)

1. Initialize weights for the training samples. Even weight for each at the beginning. N is the # of training samples.
2. Iterate over all classifiers (or for a fixed number K times, train a few classifiers)
3. Train the weak classifier on the training data with the current set of sample weights. f is a function that can then be applied to new samples.
4. Classify all training samples using your weak classifier f.
5. Calculate weighted training error using sample weights and a 0/1 error.
6. Using the error, calculate the new weights for the classifiers.
7. Update sample weights using the new classifier weights and the old sample weights.
9. Return the weighted vote of all weak classifiers on some test sample.