What does the curse of dimensionality mean? What is the big O of $f(x)=1/x+e^{(-x)}+0.9$? (5 points)

Which characteristic makes HMM so special compared with other classification models? What is its disadvantage? What does evaluation mean and how many possible cases should be added if T=4 and the model has 5 hidden states and 6 visible states? (10 points)

Let x has an exponential distribution:

$$p(x|\theta)=\begin{cases}\theta e^{-\theta x} & x\geq 0\\ 0 & otherwise\end{cases}$$

Suppose that n samples $x_1,\ldots,x_n$ are drawn independently according to $p(x|\theta)$.

Compute the ML estimation of θ.

Compute its MAP estimation. (10 points)

What is the basic concept of PCA as well as FLD. If two classes in 2D space have circle and ellipse distributions, give an example graphically for them in which PCA line is perpendicular to FLD line.

Start from $J(w)=\dfrac{w^t S_B w}{w^t S_w w}$ to drive $S_w^{-1}S_B w=\lambda w$ (10 points)

Class A has a symmetric triangular density for x in the range 1 to 3, while B is uniformly distributed in the range 2 to 6. P(B)=4P(A). (20points)

a. Where are the optimal decision regions according to Bayesian decision? What is the total probability of error for this decision?
b. Where are the optimal decision regions according to minimum risk if bellow loss function is also used (actions are the same as class selections)?

$$\begin{bmatrix} 0 & 3 \\ 1 & 0 \end{bmatrix}$$

(note $R(\alpha_i \mid x) = \sum_{j=1}^{j=c} \lambda(\alpha_i \mid \omega_j) P(\omega_j \mid x)$)

A classification system includes which steps? Which characteristics a good feature should have (name five)? (5 points)