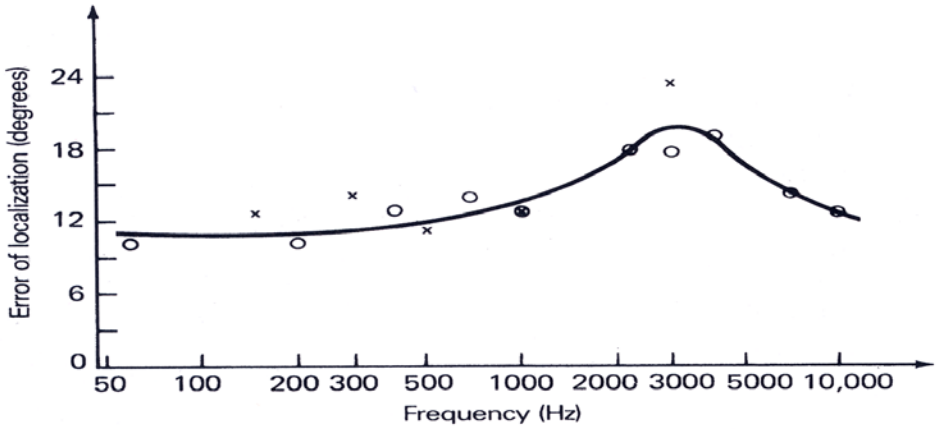
CS786 Quiz 3

100 points

Q1. See the graph below



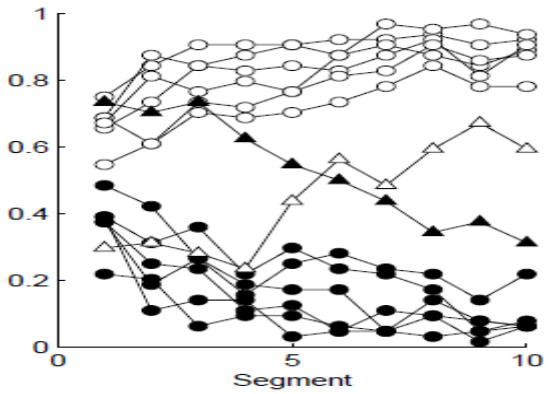
(a) Can you explain why the error in sound localization rises and then falls? (6 points)

(b) Why does it rise and fall at the particular frequency it does? (8 points)

(c) How do people differentiate between sound sources that are right in front of them and right behind them? (2 points)

(d) What are visemes, and how do they help in learning to speak? (4 points)

Q2. Results from the Smith and Minda (1986) experiment proved challenging for classical categorization theories to model. In this experiment, participants' saw two types of stimuli associated with corresponding labels, say 'white' and 'black'. The graph below plots the probability that participants called stimuli of any kind 'white' over multiple presentations of these stimuli across time. Circles represent typical stimuli of each variety; triangles represent atypical stimuli in each variety.



(a) Can you interpret this graph in terms of the behavior of the experiment's participants? (10 points)

(b) Can you explain why its conclusions cannot be explained by either prototype or exemplar models of categorization? (10 points)

(b) Anderson's Rational model of categorization could fit this data, by allowing multiple clusters to be fit per stimulus category. Describe how this model works. Be sure to specify what lets it decide how many clusters to use to fit the data? (10 points)

(c) Draw a plate notation diagram of the hierarchical Dirichlet process model of categorization, dereferencing all notation (10 points).

Q3. Assume that you have built a search engine that crawls 500k web pages, on average each one being 1000 words long. I want you to use a simple query likelihood model of document relevance to figure out which document would be most responsive to my query "computational cognitive science":

Document 1, which is 2000 words long, and contains two instances of 'computational', one of 'cognitive' and none of 'science'.

Document 2, which is 1000 words long, and contains one instance each of all the words.

(a) Calculate the query likelihood for both documents, assuming Dirichlet smoothing with parameters $\mu = 1000$, $\alpha = 0.1$ and collection-wide frequencies {1350, 1200, 10800} for the three terms computational, cognitive and science respectively. (15 points)

(It's ok to leave the answer as an expression)

(b) How would you change this model, such that documents that contain terms like 'cognition', 'compute' etc. may also be returned? (15 points)

Q4.

(a) What empirical variable did Cooper and Shepherd's mental rotation experiment measure? (5 points)

(b) What is the significance of the results of this experiment? (5 points)