1. [3 points] True or False
   a. T  F  The number of sentences in the English language is infinite.
   b. T  F  The glottis is the space between the vocal cords. (Andreas)
   c. T  F  The F-measure can be greater than the precision.

2. [5] One of the major advances in the first Amazon Echo, in 2014, was the use of far-range microphones to enable better identification of the speaker’s location and better separation of his/her signal from ambient noise. If Amazon had instead delivered Alexa on a device with only one microphone:
   a. T  F  The entropy would be higher.
   b. T  F  The perplexity would be higher.
   c. T  F  The word error rate would be higher.
   d. T  F  The need for smoothing would have increased.
   e. T  F  The size of the acoustic feature vectors would have increased.

3. [2] In speech recognition, what is the role of the decoder?

4. [2] Name two acoustic features that an automatic speech recognition system can use in distinguishing phones.
5. [5] Pick two of the following and explain how crowdsourcing could be used:
   a. building a language model for a dictation system
   b. building acoustic models for the numbers 1 through 10
   c. picking $\alpha$ for the pagerank algorithm
   d. building an automated essay grader
   e. building a morphological analyzer

6. [2] Chunking is a simple form of partial parsing. A chunker takes an input sentence and identifies the flat, non-overlapping segments that constitute the basic non-recursive phrases, such as noun phrases. For example, a chunker might output [NP The morning flight] [PP from] [NP Dallas] [VP has arrived]. For evaluating a chunker, we are interested in two measures: the percentage of system-provided chunks that were correct (matching in both boundaries and label), and the percentage of chunks present in the input that were correctly identified by the system. When a chunker is used as a component of a larger system, usually the former measure is more important, but of course the latter cannot be ignored.

Paraphrase this last sentence using at least three of the following terms: {accuracy, precision, recall, F-measure}. 
7. Imagine you are hired to create a sentiment analyzer for Amharic. The customer is intending to sell ads on Amharic websites, but of course would like to avoid placing ads on pages involving strong negative emotion, such as ከዕስትራሊዊ ይብተሰብ እባላት ያመነርበት ያቅ ከፍራ ያመተ ያገኙ. Assume that there is no possibility to hire or consult with Amharic speakers, that there is no sentiment dictionary for Amharic, and that there is no sentiment-tagged Amharic corpus to use for training. Briefly explain two techniques that you could use.
   a. Recalling that Siri include many modules (including an acoustic model, a language model, an intent classifier, a frame-slot extractor, backend logic, and a response generator), which module is most directly responsible for this problem?
   b. How would you modify the system to fix this problem? Ensure that your fix does not cause worse problems for other users.

9. [4] In a certain word embedding $d(\text{dos, uno}) > d(\text{dos, tres})$. Why might this be? (Hint: uno≈one, dos≈two, tres≈three)
10. [5] Give a reason why co-articulation makes automatic speech recognition easier, or a reason why it makes it more difficult. (Gerry)

11. [8] For the sentence “call my hairdresser and reschedule tomorrow’s appointment for next week,”
   a. identify the parts of speech for each word
   b. identify one constituent
   c. identify one chunk
   d. sketch out a meaning representation that would be useful for a system able to comply with this command
12. Some search engines can handle both spoken queries and typed queries. We know that the distributions of intents and of topics tend to differ across the two modalities. For example, “cephalopod intelligence testing” may be more common in text queries and “I-10 closures schedule” may be more common in spoken queries. Explain how you could use such knowledge to improve the quality of results for such a search engine. In your answer, discuss at least two of the following: disambiguation, cosine metric, stemming, inverse document frequency, indexing, semantic grammar, entropy, query expansion, and chunking.