Computational Psycholinguistics
Endsemester Examination, Form: [A]

Name: _____

Roll number: _____

Date: _____

Section 1. Short Answer Questions

Students can bring hardcopies of the two research papers we discussed in class. No other materials like notes, book chapters etc are permitted.

1. (10pts) Describe the reordered access theory of processing of ambiguous words. Your answer should be comprehensive and state evidence related to: 1. Context effects (5pts) 2. The effect of dominance of meanings (5pts).
2. (10pts) With reference to Dependency Locality Theory (DLT), answer the following questions:
   (a) (7 points) Write an informed critique of DLT.
   (b) (3 points) Connect DLT to Surprisal Theory
3. (10 points) Describe two accounts of long-distance dependency processing
4. (10pts) Explain how constraint-based models differ from two-stage models.
5. (10pts) Consider the grammar given below:

$S --> NP(Aux)(Neg)VP$
$S --> AdjPVP$
$NP --> (Det) * (Adj) * \mathbf{N}(PP)$
$VP --> \mathbf{V}(NP)(Adv)(PP) * (Adv)$
$PP --> \mathbf{P}NP$
$X --> XConjX$
$AdjP --> Det\mathbf{Adj}$

- Parentheseses around a constituent signify that the constituent is optional.
- Asterisk (*) means 0 or more instances of that constituent
- **Question**: Construct syntactic representation(s) for the following sentence: *The aged bottle flies fast.* Connect the meaning(s) with tree(s).

Answer Key for Exam A

Section 1. Short Answer Questions

Students can bring hardcopies of the two research papers we discussed in class. No other materials like notes, book chapters etc are permitted.

1. (10pts) Describe the reordered access theory of processing of ambiguous words. Your answer should be comprehensive and state evidence related to: 1. Context effects (5pts) 2. The effect of dominance of meanings (5pts). **Reordered Access Theory**: According to reordered access, access to word meanings is influenced by two interacting factors. The first factor is meaning dominancemore frequent meanings will be easier to access than infrequent meanings. When you encounter a word, the bottom-up input activates all of the semantic representations associated with the word. Word representations are organized as in the TRACE model, so that when more than one representation is activated by a word, the activated representations compete with one another. Biased ambiguous words are easy to process because the dominant meaning wins the competition quickly. Balanced ambiguous words are more difficult to process because the two competing representations are more evenly matched, and it takes longer for competition to select a winner. The second factor that influences meaning selection is the context that a word appears in. When context and meaning dominance both favor the frequent meaning of an ambiguous word, competition between multiple activated word meanings is short-livedthe dominant meaning wins the competition very quickly. When context favors the less frequent meaning, its activation is raised to the point where it becomes an effective competitor with the more dominant meaning. As a result, the subordinate meaning can be selected when context favors it, but it takes more time for the subordinate meaning to beat down the more frequent dominant meaning. Evidence from reading time experiments indicate:

   (a) **Neutral context**: Biased words read/processed as quickly as unambiguous words as only the dominant meaning is activated

   (b) **Biased context**

   - When context is biased and the dominant meaning of the biased word is being used, biased ambiguous words are read/processed faster compared to unambiguous words as only the dominant meaning is activated.
   - When context is biased and the subordinate meaning of the biased word is being used, biased ambiguous words are read/processed faster compared to unambiguous words as the activation of the dominant meaning is competing with the subordinate meaning before finally the latter meaning wins.

2. (10pts) With reference to Dependency Locality Theory (DLT), answer the following questions:

   (a) (7 points) Write an informed critique of DLT.

   (b) (3 points) Connect DLT to Surprisal Theory

Your critique of DLT should necessarily expand on the following points

(a) Reductionist approach: DLT proposes that only ONE factor, viz. dependency length matters in language comprehension. Other factors like discourse prominence could have an impact on language comprehension and production.

(b) Evidence for DLT arises primarily from reading time experiments. Other responses like BOLD fMRI have not been modelled by DLT.

(c) Does not account for anti-locality effects.

(d) DLT tends to be too specialized to language comprehension as it does not have foundations in general cognitive principles that have been proved effective in other domains of cognitions. For example ACTR has been found useful for other symbol manipulation tasks like arthmetic problem solving, tower of Hanoi etc.

(e) Storage costs are about prediction, the main focus of Surprisal Theory.

3. (10 points) Describe two accounts of long-distance dependency processing Two accounts of long-distance dependency processing:

(a) Gaps-and-traces account

Thats the boy that the people at the party liked [gap site] very much.

In the above sentence, the boy is a filler phrase, and the gap site appears right after the verb liked. If gap filling is a real psychological process, something special should happen when people reach the gap site. To find out whether something special happens, researchers showed participants target words on a computer screen at different points in time as the participants were listening to sentences like the above sentence. The researchers measured how long it took participants to respond to the visual target words. If the participants responded quickly, that suggests that information associated with the target words was particularly activated or accessible. If people responded more slowly, that suggests that information associated with the target words was less activated. According to the gaps-and-traces account, information about the filler phrase (the boy) should be particularly active and accessible right at the gap site. So, if you measured how long it takes people to respond to the filler word itself, people should respond especially quickly right after the verb liked.

To test that prediction, researchers interrupted the spoken sentence right before the verb liked (where nothing special should be happening) and right after the verb liked (i.e., at the gap site, where something special should be happening), and presented a visual target word. Participants would have to respond to the target word by saying it out loud ("naming" it) as fast as they could. In the experiment, participants responded to target words like the boy, or semantically associated words (like the girl), faster after than before the verb liked. So it looks like something special did happen right where the gaps-and-traces account says it should.

(b) Gap-free parsing account

Local dependencies and long-distance dependencies are handled in the same way: words are associated directly with one another. So, rather than finding a gap site, when the parser spots a filler phrase, it looks for a word that is missing one of its partners. For example, instead of associating a filler with a gap, and then associating the gap with a verb, the parser associates the filler directly with the verb. How can we decide whether the gaps-and-traces account or the gap-free account does a better job of describing what people actually do when they parse and interpret sentences? The approach taken by some researchers is to look for sentences where the critical verb comes before the hypothetical gap site. If something special happens at the verb, that would suggest that the filler is associated directly with the verb. If nothing special happens before people get to the gap site, then that would suggest that the filler is associated with the gap, and not directly with the verb.

4. (10pts) Explain how constraint-based models differ from two-stage models.

(a) 2 stage models are serial, while constraint-based models can activate multiple syntactic structures simultaneously.

(b) Constraint-based model ranks different structures based on how much evidence is available for each in the input while 2-stage models use heuristics to process upcoming structure

(c) Garden path parser relies solely on word category information for its inputs, but constraint-based parsers can draw on a much wider variety of cues including story context, visual context,

subcategory information, and the semantic properties of specific wordsto decide what structures to build and the relative emphasis to place on each alternative structure.

(d) Finally, constraint-based parsers are often referred to as one-stage models because lexical, syntactic, and semantic processes are all viewed as taking place simultaneously (as opposed to lexical processing preceding syntactic processing preceding semantic processing, which is the general approach taken by two-stage models).

5. (10pts) Consider the grammar given below:

$S - - > NP(Aux)(Neg)VP$
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$VP - - > \mathbf{V}(NP)(Adv)(PP) * (Adv)$
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- Parentheseses around a constituent signify that the constituent is optional.
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- **Question**: Construct syntactic representation(s) for the following sentence: *The aged bottle flies fast.* Connect the meaning(s) with tree(s).

The 3 meanings associated with the sentence *The aged bottle flies fast.* are:

(a) [The aged bottle]$_{NP}$ flies fast: The old bottle travels fast through the air

(b) [The aged]$_{NP}$ bottle flies fast: Old people put flies in a bottle quickly

(c) [The aged bottle flies]$_{NP}$ fast: The old bottle flies are fasting (i.e. eating no food).