HUL381/ELL457: Mind, Machines and Language

Major Test, Maximum marks: 30

Note: Please answer Sections 1 and 2 on *separate* answer scripts.

Section 1. (SM)

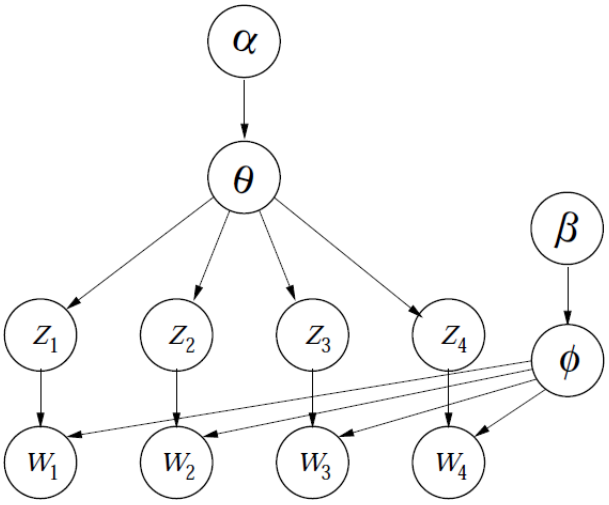
1. What was the problem with Turing's imitation test? Suggest a test based on the concept of embodiment which is not based purely on thinking and symbolic manipulation and imitates an aspect of behavior that requires intelligence. **[2+2]**

2. State and explain four characteristics of modularity in the brain (as suggested by J. Fodor). **[4]**

3. What is the difference between the physical symbol system hypothesis and grounded system hypothesis? What does that say about the different levels of representation? **[2]**

Section 2. (SA)

4. Consider the below graphical representation of the LDA model for semantic memory we discussed in class.



(a) Suppose I wish to include as *prior knowledge* in this model (*i.e.*, before estimating the parameters from a data set) the fact that most documents will contain only one or at most a few topics. Which of the parameters/hyperparameters shown here will I set for this purpose? By setting this parameter, what kinds of values of the child parameter(s) will I be giving higher prior probabilities to, and what kinds of values will I be making improbable? Give 2 example values of each kind. (For this purpose, you may take the number of topics to be set to 3.) **[2.5]**

(b) Suppose I have now trained my model on a corpus of documents to infer the following three topics (for each topic, the top 10 words are listed):

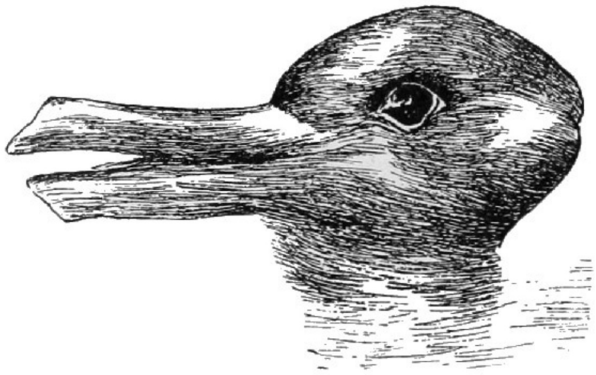
- Topic 1: *play, stage, audience, theatre, actors, drama, performance, costumes, comedy, tragedy.*
- Topic 2: *team, game, cricket, football, tennis, player, play, ball, field, court.*
- Topic 3: *judge, trial, case, jury, court, accused, guilty, defendant, lawyer, justice.*

Now consider the following new document:

Last evening's performance of the classic Shakespearean tragedy Romeo and Juliet *at the Kamani Theatre was very well-received by the audience. The star-cast of actors, adorned in period costumes, movingly brought to life the drama of the fates of the star-crossed lovers in the timeless play.*

Which of the above topics do you think will be assigned as the most probable one to the word *play* in this document? Explain why, based on your knowledge of how the model works. What will the role of the prior knowledge incorporated in part (a) be here? **[2.5]**

5. Consider any of the examples of bistable visual perception we saw in class, for instance the famous duck-rabbit image:



(a) In what way do such examples provide evidence for a dynamical systems account of perception? How is this linked to the evidence for perceptual hysteresis which was discussed in class? **[1.5]**

(b) What is *unique instantiation*, in the context of dynamical systems? Why do such examples of visual perception not satisfy this property of a typical dynamical system account? **[1.5]**

6. (a) For each of the following sentences, identify which conceptual metaphor is being invoked.

   (a) I spent too much time watching TV and didn't have enough left to finish my homework.

   (b) The feeling of having a newborn child is hard to put into words.

   (c) After she took up the new job, their relationship ran into rough weather.

   (d) Ever since she got offered a place at MIT she's been on cloud nine. **[2]**

   (b) Explain the key reasons why Lakoff and Johnson claim that the use of metaphor involves embodied cognition. Can you make use of any of the above examples to illustrate their point? **[2]**

7. (a) Consider the below stimuli:

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How do such instances relate to the Second AI Debate? Which side of the debate have they been used to argue for, and why? **[2.5]**

(b) Consider the following two sentence completion tasks:

(a) The keys to the cabinet _____ on the table.

(b) These cabinets _____ all empty.

What is the key difference between the nature of the cognitive processing involved in these two tasks? Which of these examples has been used argue for connectionist cognitive modelling? What kind of connectionist model, and why? **[2.5]**

8. Suppose a 'scoffer' in the First AI Debate comes and shows you some examples of how badly Google Translate performs on metaphors, and says, "look, this is exactly why machines can never have *real* understanding! How can you ever make sense of things like metaphors via mere symbol manipulation? It needs *intentionality*, it needs the symbols to *stand* for something in the real, physical world!"

   (a) This argument appears similar to Searle's Chinese Room argument. But there is a clear logical flaw in equating these two arguments. What is it? **[1.5]**

   (b) How might someone like Turing use the above argument (and the mentioned logical flaw) to turn the tables, and show that this way of thinking actually supports the validity of the Turing test as a means of assessing machine intelligence? **[1.5]**