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# Computer science

## Higher level

### Paper 3

5 May 2025

Zone A morning | Zone B morning | Zone C morning

1 hour

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#### Instructions to candidates

- Do not turn over this examination paper until instructed to do so.
- A clean copy of the **computer science case study** is required for this examination paper.
- Read the case study carefully.
- Answer all questions.
- The maximum mark for this examination paper is **[30 marks]**.

Answer **all** questions.

1. (a) A long short-term memory (LSTM) unit is shown in **Figure 4** of the case study.  
  
Identify **two** characteristics of an LSTM neural network **other than** the mitigation of vanishing gradients. [2]
  - (b) "Can you pass the salt?" is a common phrase used to ask someone to pass the salt to another person. Pragmatic analysis can be applied to capture this nuance.  
  
Outline what pragmatic analysis is. [2]
  2. (a) A key innovation of a transformer neural network (transformer NN) is the self-attention mechanism, which captures the relationships between different words in an input sequence.  
  
The sentence "The cat chased the mouse" is input into the self-attention mechanism.  
  
Describe the process used by the self-attention mechanism to capture the relationship between the words in this sentence. [4]
  - (b) Large language models (LLMs) are more prone to overfitting than recurrent neural networks (RNNs).  
  
Outline **two** reasons why LLMs are more prone to overfitting than RNNs. [4]
  3. LLMs are usually trained with data from the internet.  
  
Discuss the advantages **and** disadvantages of using data from the internet to train an LLM. [6]
  4. *RAKT* have identified several problems with their insurance chatbot. They have decided to improve the quality of its responses.  
  
Discuss the key aspects of a comprehensive plan to improve the quality of the chatbot's responses in an acceptable time frame by increasing computational processing power and improving dataset quality. [12]
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