Name: _____ **Roll No.:** _____

Exam: Set 1

Course: DS:246 — Generative and Agentic AI in Practice

Instructions: This exam consists of **20 MCQs** (1 mark each) and **10 MSQs** (2 marks each). Indicate the correct option(s) clearly. For MSQs, multiple answers may be correct. Write the correct option(s) inside the box provided at the right side of each question.

Set 1 — 30 questions

(Each question lists full text and options. Type: MCQ = single correct answer, MSQ = multiple correct answers.)

1. (MCQ) Decoder-only models are essentially trained based on probabilistic language modelling. Which of the following correctly represents the training objective of GPT-style models? [ ]

A. $P(y \mid x)$ where x is the input sequence and y is the gold output sequence

B. $P(x \mid y)$ where x is the input sequence and y is the gold output sequence

C. $P(w_t \mid w_{1:t-1})$, where w_t represents the token at position t, and $w_{1:t-1}$ is the sequence of tokens from position 1 to $t-1$

D. $P(w_t \mid w_{1:t+1})$, where w_t represents the token at position t, and $w_{1:t+1}$ is the sequence of tokens from position 1 to $t+1$

2. (MCQ) For a transformer with $d_{model} = 512$, calculate the positional encoding for position $p = 10$ and dimensions 2 and 3 using the sinusoidal formula: [ ]

$$PE(p, 2i) = \sin\left(\frac{p}{10000^{2i/d_{model}}}\right), \quad PE(p, 2i+1) = \cos\left(\frac{p}{10000^{2i/d_{model}}}\right).$$

Options:

A. $\sin\left(\frac{10}{10000^{1/256}}\right)$, $\cos\left(\frac{10}{10000^{1/256}}\right)$

B. $\cos\left(\frac{10}{10000^{1/512}}\right)$, $\sin\left(\frac{10}{10000^{1/512}}\right)$

C. $\cos\left(\frac{10}{10000^{4/512}}\right)$, $\sin\left(\frac{10}{10000^{2/256}}\right)$

D. $\sin\left(\frac{10}{10000^{2/512}}\right)$, $\cos\left(\frac{10}{10000^{3/512}}\right)$

3. (MCQ) What factors do not influence the effectiveness of instruction tuning (SFT)? [ ]

A. The number of instruction templates used in training

B. The tokenization algorithm used by the model

C. The diversity of tasks in the fine-tuning dataset

D. The order in which tasks are presented during finetuning

4. (MCQ) Which of the following are true about sequence-level distillation for LLMs?

A. It trains a student model by matching the teacher's sequence outputs (e.g., predicted token sequences) rather than just individual token distributions.

B. It requires storing only the top-1 predictions from the teacher model for each token.

C. It can be combined with word-level distillation to transfer both local and global knowledge.

D. It forces the teacher to produce a chain-of-thought explanation for each example.

5. (MCQ) Why is KL divergence minimized in regularized reward maximization?

A. To maximize the probability of generating high-reward responses.

B. To make training more computationally efficient.

C. To prevent the amplification of bias in training data.

D. To ensure models do not diverge too far from the reference model.

6. (MCQ) Which best describes the role of Double Quantization in QLoRA?

A. It quantizes the attention weights twice to achieve 1-bit representations.

B. It reinitializes parts of the model with random bit patterns for improved regularization.

C. It quantizes the quantization constants themselves for additional memory savings.

D. It systematically reverts partial quantized weights back to FP16 whenever performance degrades.

7. (MCQ) Why is instruction tuning not sufficient for aligning large language models?

A. It does not generalize to unseen tasks.

B. It cannot prevent models from generating undesired responses.

C. It reduces model performance on downstream tasks.

D. It makes models less capable of learning from new data.

8. (MCQ) A weight matrix of size 100×100 is trained using LoRA with rank r. How many trainable parameters are introduced when $r = 4$ and $r = 8$ respectively?

A. (400, 800)

B. (800, 1600)

C. (1600, 3200)

D. (2000, 4000)

9. (MCQ) Which statement best describes the impact of fine-tuning versus prompting in LLMs?

A. Fine-tuning is always superior to prompting in generalization tasks.

B. Prompting requires gradient updates, while fine-tuning does not.

C. Fine-tuning modifies the model weights permanently, while prompting does not.

D. Prompting performs better on in-domain tasks compared to fine-tuning.

10. (MCQ) In a RAG system, you chunk a document of length 4000 tokens into overlapping chunks of 200 tokens each, with stride 100. How many chunks are produced?

A. 20

B. 30

C. 39

D. 40

11. (MCQ) An LLM has a vocabulary size of 20,000 tokens and an embedding dimension of 256. How many parameters are in the embedding layer?

A. 0.5 million

B. 2.0 million

C. 5.0 million

D. 20.0 million

12. (MCQ) A Transformer has embedding size $d = 512$ and uses 8 attention heads. What is the dimension of the query/key/value subspace for each head?

A. 32

B. 64

C. 128

D. 512

13. (MSQ) Which of the following are essential components of the RLHF pipeline? (Select all that apply)

A. A supervised fine-tuned model to initialize the policy

B. A reward model trained from human preferences

C. A reinforcement learning loop (often PPO or similar)

D. Directly optimizing the model using backpropagation only

14. (MCQ) Which of the following does not describe the characteristics of Direct Preference Optimization (DPO)? (Select the single best option if treated as MCQ.)

A. DPO eliminates the need for a separate reward model

B. DPO directly optimizes on preference pairs of responses

C. DPO requires an explicit reinforcement learning loop

D. DPO uses the base model as a reference for optimization

15. (MSQ) Which statements correctly distinguish instruction fine-tuning from RLHF? (Select all that apply)

A. Instruction tuning requires labeled (instruction, response) pairs

B. RLHF requires preference data rather than explicit labels

C. RLHF almost always produces safer and more helpful outputs than instruction tuning alone

D. Instruction tuning is computationally cheaper than full RLHF

16. (MSQ) Which of the following are true about DPO and GRPO? (Select all that apply)

A. Both methods avoid training a separate reward model

B. GRPO reduces to DPO when the group size is two

C. DPO requires importance sampling to match the reference model distribution

D. GRPO uses KL-divergence regularization to keep the model close to a reference

17. (MCQ) A research lab has collected 50,000 labeled math problem–solution pairs. They notice that reasoning chains significantly improve accuracy. Which approach should they use?

A. RLHF

B. RFT

C. SFT

D. Unsupervised pretraining

18. (MCQ) Which transformer-based model architecture has the objective of guessing a masked token based on the previous sequence of tokens by building bidirectional representations of the input sequence?

A. Autoregressive

B. Sequence-to-sequence

C. Autoencoder

D. Decoder-only

19. (MCQ) Scaling laws for pre-training large language models consider several aspects to maximise performance. Select the alternative that is *not* normally considered for scaling when performing model pre-training.

A. Batch size: Number of samples per iteration

B. Model size: Number of parameters

C. Compute budget: Compute constraints

D. Dataset size: Number of tokens

20. (MCQ) What is the self-attention that powers the transformer architecture?

A. The ability of the transformer to analyze its own performance and make adjustments accordingly.

B. A mechanism that allows a model to focus on different parts of the input sequence during computation.

C. A technique used to improve the generalization capabilities of a model by training it on diverse datasets.

D. A measure of how well a model can understand and generate human-like language.

21. (MCQ) Which transformer-based model architecture is well-suited to the task of text translation?

A. Sequence-to-sequence

B. Autoregressive

C. Autoencoder

D. Decoder-only

22. (MCQ) Fill in the blanks: _____ involves using many prompt-completion examples as the labeled training dataset to continue training the model by updating its weights. This is different from _____ where you provide prompt-completion examples during inference.

A. Pre-training, Instruction fine-tuning

B. In-context learning, Instruction fine-tuning

C. Prompt engineering, Pre-training

D. Instruction fine-tuning, In-context learning

23. (MCQ) Fine-tuning a model on a single task can improve model performance specifically on that task; however, it can also degrade the performance of other tasks as a side effect. This phenomenon is known as:

A. Catastrophic forgetting

B. Model toxicity

C. Instruction bias

D. Catastrophic loss

24. (MSQ) A research lab has: 1) 200,000 labeled sentiment analysis examples; 2) 60,000 labeled math word problems where chain-of-thought improves accuracy. Which training strategies are best suited for these tasks? (Select all that apply)

A. SFT for sentiment analysis

B. RFT for sentiment analysis

C. RFT for math word problems

D. RLHF for math word problems

25. (MSQ) Which of the following methods are examples of parameter-efficient fine-tuning techniques? (Select all that apply)

A. LoRA (Low-Rank Adaptation)

B. Full fine-tuning of all model parameters

C. Prefix-tuning

D. Adapter modules

26. (MSQ) Which of the following are key benefits of using self-attention in Transformers? (Select all that apply)

A. Parallelization of sequence processing

B. Long-range dependency modeling

C. Reduced computational complexity compared to RNNs

D. Elimination of positional information

27. (MSQ) A team is building a RAG system on long legal documents. They notice that when they use very large chunk sizes, retrieval becomes less accurate. Which of the following explain why this happens? (Select all that apply)

A. Large chunks may include irrelevant text that dilutes retrieval relevance

B. Large chunks reduce the number of chunks, so the retriever has fewer candidates

C. Larger chunks always improve retrieval because more context is stored together

D. Embeddings for large chunks may become less discriminative

28. (MSQ) In which situations is a RAG pipeline most likely to fail or underperform? (Select all that apply)

A. The underlying vector embeddings are poorly trained or domain-mismatched

B. The retriever fails to find relevant chunks, but the generator hallucinates a confident answer

C. The documents are extremely short (1–2 sentences each), so chunking is unnecessary

D. The vector database uses approximate search instead of exact search

29. (MSQ) You're designing a multi-modal system that processes video (temporal visual data), audio, and text simultaneously for real-time emotion recognition. Which architectural approach would be most appropriate? (Select all that apply as applicable)

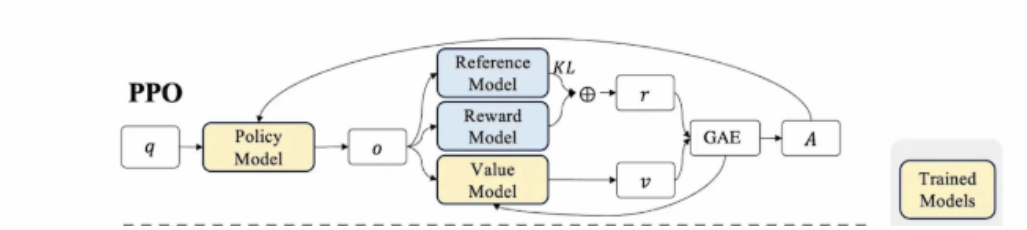
A. Use separate LSTM encoders for each modality, then apply cross-modal attention with temporal pooling before fusion

B. Concatenate flattened features from each modality and use a single MLP classifier

C. Apply early fusion by concatenating raw inputs and processing through a single transformer

D. Use late fusion by training separate classifiers for each modality and averaging their outputs

30. (MSQ) Consider the following: Select the correct statements (Select all that apply).



A. KL divergence term is added to help the model be creative

B. Among the models in the image, only reward and value models give scalar output

C. GAE estimates advantages efficiently for token-level updates

D. Policy model scores generated outputs