Generative AI Assignment Questions

1. Introduction to Generative AI:

Q1: What is Generative AI? How does it differ from traditional AI models that focus on classification or regression tasks?

- Generative AI: AI that creates new content, such as images, text, or music, by learning patterns from data.

- Difference: Traditional AI focuses on predicting labels or values, while Generative AI focuses on producing original outputs based on learned patterns.

Q2: Explain the key differences between Generative AI and Discriminative AI models. Provide examples of each.

- Generative AI: Models that generate data distributions (e.g., GANs, VAEs).

- Discriminative AI: Models that classify data or make predictions (e.g., Logistic Regression, SVM).

Q3: Describe the purpose and basic functioning of Generative Adversarial Networks (GANs). What are the roles of the generator and discriminator in a GAN?

- GANs generate realistic data by training two models:

- Generator: Creates fake data.

- Discriminator: Differentiates between real and fake data. Both compete to improve their performance.

Q4: What is a latent space in Generative AI? Explain how it is used to generate new data (e.g., images, text).

- Latent Space: A compressed representation of data. Generative models use latent space vectors to map and produce new data points.

Q5: Explain how Variational Autoencoders (VAEs) work. How are VAEs different from GANs, and what types of tasks are VAEs typically used for?

- VAEs: Encode data into a latent space, then decode it to reconstruct the input. Useful for anomaly detection and data compression.

- Difference: GANs are adversarial, VAEs use probabilistic reconstruction.

2. Applications of Generative AI:

Q6: What are some real-world applications of Generative AI? List at least four areas where generative models are applied and provide a brief description of each.

- Image Synthesis: Creating realistic images (e.g., deepfakes).

- Text Generation: Writing articles, stories (e.g., ChatGPT).

- Music Composition: Generating original music.

- Healthcare: Synthesizing medical images for training models.

Q7: How can Generative AI be applied in the field of healthcare? Provide two examples where it can be useful, such as in drug discovery or medical image generation.

- Drug Discovery: Predicting molecular structures.

- Medical Image Generation: Creating synthetic images for training models.

Q8: Explain how text generation models (e.g., GPT-3) can be used in content creation. Give an example of how these models can generate blog posts or social media content.

- Generate structured content based on prompts (e.g., a tech blog post summarizing trends).

3. Popular Generative AI Models:

Q9: Describe the GPT (Generative Pre-trained Transformer) model. How does it generate human-like text, and what are its key applications?

- GPT: Uses transformer architecture to predict the next word in a sequence. Applications include chatbots, summarization, and translation.

Q10: Explain how Recurrent Neural Networks (RNNs) can be used for generating sequences, such as text or music. How do RNNs handle sequential data differently from other models?

- RNNs: Process sequential data by maintaining hidden states, making them suitable for time-series tasks.

Q11: What is BERT (Bidirectional Encoder Representations from Transformers), and how is it different from models like GPT-3 in the context of text generation?

- BERT: Focuses on understanding context in both directions for better predictions, primarily for comprehension tasks.

4. Prompt Engineering and Control of Output:

Q12: Write a prompt for a language model to generate a 150-word description of a futuristic city. Explain the role of clarity and specificity in the prompt.

- Prompt: "Describe a futuristic city in 150 words, focusing on architecture, technology, and transportation systems."

- Clarity and Specificity: Ensures relevant and targeted responses.

Q13: How can temperature and max tokens be adjusted in a language generation model to control the creativity and length of the generated output? Provide examples of both adjustments.

- Temperature: Lower values (e.g., 0.2) make outputs deterministic; higher values (e.g., 1.0) increase creativity.

- Max Tokens: Limits the length of the output (e.g., 50 tokens for concise answers).

Q14: Write a prompt to generate a dialogue between two characters in a mystery novel. Provide guidelines in your prompt for tone and character development.

- Prompt: "Write a tense dialogue between a detective and a suspect in a mystery novel. The detective is calm but firm, while the suspect is defensive and nervous. Use descriptive language to convey emotions."

5. Evaluating the Output of Generative AI Models:

Q15: How would you evaluate the quality of text generated by a model like GPT-3? List at least three criteria you would consider when assessing its output.

- Criteria: Relevance, coherence, and grammatical accuracy.

Q16: What are some common problems with generated content, such as hallucinations or irrelevant responses? How can these issues be minimized in prompt design?

- Problems: Fabricated facts, off-topic responses.

- Solution: Use clear, specific prompts and iterate designs.

Q17: How can feedback loops be used to improve generative models? Explain how iterative testing and refinement of prompts can enhance the output.

- Feedback Loops: Analyze model outputs, refine prompts, and retrain if necessary.

6. Hands-on Practice with Generative AI:

Q18: Write a prompt that will instruct a language model to summarize a research paper about machine learning. Include specific instructions to highlight the main points and avoid irrelevant details.

- Prompt: "Summarize the main findings and methods of a machine learning research paper in 100 words. Focus on the objective, methodology, and key results. Exclude unnecessary details."

Q19: Generate a list of ideas for a new mobile app using a language generation model. Provide at least five app ideas and explain how the model can generate creative suggestions.

- Ideas:

1. Personalized fitness tracker.

2. AI-powered language tutor.

3. Eco-friendly shopping assistant.

4. Virtual event organizer.

5. Mental health journal.

Q21: Generate a set of product descriptions for an e-commerce website using a language model. Evaluate the clarity, persuasiveness, and accuracy of the descriptions.

- Product Descriptions:

1. "Ultra-soft cotton t-shirt, perfect for casual wear. Available in multiple colors."

2. "Sleek stainless-steel water bottle with a 1-liter capacity. Keeps drinks hot or cold for hours."

- Evaluation: Assess for clear language, compelling features, and correct details.