Gen AI Assignment Questions

1) Generative AI is subfield of Artificial Intelligence focused on creating new data that resembles existing data. The main difference between traditional AI and generative AI lies in how their output is expected. For eg. in traditional AI, you train a model to classify emails as spam or not spam. In Generative AI, you train thousands of emails, it can write a new email that looks realistic.

2) Generative Models learn how the data is generated (i.e. full data distribution) where as Discriminative AI models learn boundaries between different classes. Hence the primary goal of Generative AI is new data or samples, and goal of discriminative models focus on classifying or predicting outputs.
   Eg. Generative Models are GPT, GANs, Naive Bayes and Discriminative Models are SVM, Logistic Regression and ResNet.

3) Generative Adversarial Networks (GANs) are a powerful type of generative AI models used to generate realistic data, such as images, audio or text. The main goal of a GAN is to generate new, realistic data samples that resemble a given dataset (like photos of human faces or handwritten digits).
   Eg. After training on thousands of real faces, a GAN can create entirely new, fake faces that look surprisingly real.

4) Latent space is an abstract, compressed representation of the underlying features of data. It's like a mathematical space where each point encodes meaningful characteristics of data (like shape, style or category). It's basically like a grid where each axis represents such features, and a point in this space represents a specific outfit.

5) VAE is a type of generative model that learns to encode data into a latent space and then decode it back to generate new samples. It's like a smart compressor-decompressor that also learns to sample and create new data. While GAN is a Generator + Discriminator, VAE is an encoder + decoder. VAE are often used for image generation, denoising, anomaly detection, data compression, latent space interpolation, molecule generation and speech synthesis.

6) Generative AI is being used in a wide range of industries, often transforming the way content is created and problems are solved. Four real-world applications of Gen AI are -
   A) Creative Content Generation (Art, Design and Media) :- Generating realistic images, artwork, music, or video content. Tools like DALL.E, Midjourney and Runway ML

B) Text Generation and Language Tasks :- Creating human-like text for writing summarization, translation, or chatbot conversations. Tools like ChatGPT, Claude
C) Healthcare and Drug discovery :- Generating molecular structures, synthetic medical data, and simulating biological processes, examples are VAEs or GANs
D) E-commerce and Marketing Personalization :- Generating product descriptions, personalized emails, virtual try-ons, and AI models for product images.

7) Generative AI has tremendous potential in healthcare, especially in tasks that require data synthesis, simulation, or exploration of new possibilities. Two powerful practical applications are,
A) **Drug Discovery** :- Generative models are trained on large datasets of known chemical compoundsand their properties, Once trained, the model an generate new molecules with desired biological properties. For example: Insilico Medicine and Deep Genomics.
B) **Medical Image Generation and Augmentation** :- Gen AI can create synthetic medical images that are realistic and statistically similar to real patient data. For eg, Hospitals or researches can use AI images to train diagnostic models.

8) Text Generation models are widely used in content creation because they can produce coherent, context-aware, and human like text based on prompts. These models are trained on vast amounts of internet data and can understand structure, tone, grammar, and even creativity. They can help in writing blog posts, generating social media captions, summarize articles, creative marketing copy etc.

9) The **GPT (Generative Pre-trained Transformer)** model is a powerful **language model** developed by OpenAI that generates **human-like text**. It's based on the **Transformer architecture**, which is known for its ability to understand and generate language by learning long-range dependencies and context.
GPT is trained on massive datasets (books, articles, web pages) to learn language structure, grammar, facts, and reasoning.
It learns to **predict the next word** in a sentence — like:
"The sky is ___" → likely predicts "blue".
Key applications of GPT are writing, conversation, coding education and business.

10) RNNs are neural networks with **loops** that allow them to maintain a **memory of previous inputs**. This makes them suitable for tasks where the **order and context** of data points matter — like sentences in a paragraph or notes in a

melody. Unlike traditional neural networks which treat inputs independently, RNNs take one input at a time, pass a hidden state forward - a memory of what was seen before, use the state to inform the next prediction.
Example : Let's say we want the RNN to generate the sentence:

"The cat sat"

1. The model sees **"The"**, and updates its hidden state.
2. Based on that state, it predicts the next word: maybe **"cat"**.
3. It feeds "cat" back in and predicts the next: **"sat"**, and so on.

Each prediction is informed by **what came before**.

11) BERT (**Bidirectional Encoder Representations from Transformers**), was introduced by Google in 2018 and is primarily designed for understanding text, not generating it. BERT reads text in both directions, which helps it develop a deep understanding of meaning and context.
Masked Language Modeling (MLM) and Next Sentence Prediction (NSP) are used to train BERT.
BERT is great for **natural language understanding tasks**:
- Text classification (e.g., spam detection)
- Sentiment analysis
- Named Entity Recognition (NER)
- Question answering (like in Google Search)
- Sentence similarity
  But BERT is **not a text generator** by design.

The main difference between between BERT and GPT-3 is that GPT-3 generates language while BERT understands it (NLP comprehension)

12) "Generate a 150-word description of futuristic city. The description must focuses on it's technological and societal aspects. Highlight the structure of the city, as well it's economic and political backbone. Don't make it a cyberpunk themed city, instead give the city a personality which matches current existing cities with a touch of modernity."
In this description clarity plays the role of defining what needs to the qualities of the city, Specificity defines the exact features the user is expecting.

13) In GPT, temperature and max tokens help control how creative and long the generated output is.
Temperature :- Temperature is a parameter that controls the randomness or creativity of the model's output. Low temperature means more deterministic, focused and repetitive output. High temperature means more creative, varied and risky outputs. The model explores more unusual word choices.
Max tokens:- Max tokens sets the maximum number of tokens (words or

word-parts) the model is allowed to generate. Small number means short, concise answers and large number means longer, more detailed output. Full paragraphs or stories.

14) Generate a dialogue between two characters. The environment is set in a mysterious setting where a police officer interrogates a wealthy businessman after his daughter is missing since 10 days. Set a unsettling tone in the conversation, in the way the father interacts with the officer feels shady. Also highlight the internal thoughts of the police officer.

15) Three key points to assess quality of GPT-3 model are-
A) **Coherence and Fluency** :- The text should be logical structured, grammatically correct, and easy to read. Sentences should flow smoothly, and ideas should connect naturally.
B) **Relevance to Prompt or Context**: The response should accurately address the user's prompt and stay on topic.
C) **Factual Accuracy** :- The model mustn't blabber anything, also called "hallcuination". The facts must be verified and cited.

16) Hallucination is the problem with Gen AI like GPT3 in which it generates false or madeup information. Like making up statistics or quotes, or citing non existence sources and stating fictional events as facts.
Other problems include irrelevant or off topic responses and repetition and redundancy.
To minimize these issues through prompt design, the prompt must be
1. Specific and Clear
2. Have constraints or format expectations.
3. Include Role or Context
4. Use step by step instructions for complex tasks
5. Discourage guessing

17) Feedback loops play a crucial role in improving the performance and output quality of generative models like GPT. These loops involve iterative testing, evaluation and refinement either by humans or automated systems, to progressively enhance how well the model meets a goal.
Feedback loop refers to process of
A. Generating output
B. Evaluating output
C. Providing feedback
D. Refining the prompt or retraining the model
E. Repeating the process to get better results.
Feedback loops work by refining prompt strategy, improves factuality & relevance, encourages structure and boosting user trust.

18) Summarize the research paper about Machine Learning, attached in the message. Highlight the key points, also put important citations where needed, along with author's name. Avoid redundant and repetitive information. Avoid over-explaining or using facts outside of domain of the research paper. Make it concise and readable.

19) **1**. **Habit Buddy - AI Accountability Partner** → A productivity app where users set habits or goals, and an AI buddy checks in daily offers encouragement, and adjusts tasks based on user mood and progress.
2. MindEase - Instant Mood Journal + Therapy Tools → A mental wellness app that lets users log feelings in a tap, and get instant coping strategies using AI-driven therapy techniques (CBT, mindfulness).
3. SplitCart - Smart Group Shopping Organizer → An app to coordinate and split grocery or travel shopping lists among friends, roomates, or family. Tracks who's buying what and settles bills.
4. StyleSwap - AI-Powered Virtual Wardrobe → Snap photos of your clothes, and the app helps your mix & match outfits, suggests new combinations, and even lets you try on clothes from popular brands virtually.
5. SafeTrail - Emergency Tracker for Outdoor Activites → Ideal for hikers, runners, and solo travelers. Sends real time-location to trusted contacts, with check-in timers, and an emergency SOS if you don't respond.

20) **<u>Product : Stainless Steel Insulated Water Bottle (750ml)</u>**
Stay hydrated in style with our 750ml Stainless Steel Insulated Water Bottle. Designed to keep your drinks cold for up to 24 hours and hot for 12, it's the perfect companion for workouts, travel, or your daily commute. The sleek matte finish and leak-proof lid make it both functional and fashionable.

Assessment : Very clear, highly persusaivness and accurate

<u>Product: Wireless Bluetooth Earbuds with Charging Case</u>
Experience true freedom with our Wireless Bluetooth Earbuds. Featuring crystal-clear sound, intuitive touch controls, and a compact charging case that provides up to 20 hours of playtime, these earbuds are perfect for music lovers on the move. Compatible with iOS and Android.

Assessment : The clarity is high, emotional appeal is strong hence the persuasiveness, but the accuracy is questionable at some places.

<u>Product: Organic Cotton T-Shirt – Unisex</u>
Discover comfort redefined with our Unisex Organic Cotton T-Shirt. Made from 100% GOTS-certified cotton, it's soft on your skin and the planet. With a classic fit and breathable fabric, this tee is perfect for casual wear, layering, or lounging.
Assessment : Clarity is excellent, persuasivenss is strong and accuracy is good

adding elements like GOTS certified.