Short Answer Questions

Q1: Explain how AI-driven code generation tools (e.g., GitHub Copilot) reduce development time. What are their limitations?

AI-driven code generation tools reduce development time by suggesting code completions, generating boilerplate code, and automating repetitive tasks such as function templates, test cases, and documentation. They speed up development by allowing developers to focus on core logic instead of writing routine code manually.

Limitations:

- The generated code may be syntactically correct but logically wrong.
- They depend on the quality of training data, which may include outdated or insecure patterns.
- They may introduce hidden bugs if suggestions are accepted without review.
- They cannot fully understand complex business rules or context, requiring human oversight.

Q2: Compare supervised and unsupervised learning in the context of automated bug detection.

In automated bug detection, supervised learning uses labeled datasets where examples of buggy and non-buggy code are provided. The model learns patterns associated with known bugs and predicts similar issues in new code. It is effective but relies on large, high-quality labeled datasets.

Unsupervised learning, however, does not require labeled data. It detects bugs by identifying anomalies or unusual patterns in code behavior, logs, or execution traces. It is useful for discovering new or unknown bug types, but may generate more false positives because it does not know what a true bug looks like.

Q3: Why is bias mitigation critical when using AI for user experience personalization?

Bias mitigation is critical because personalization systems influence what users see such as product recommendations, content, or features. If the AI model contains bias in its training data, it may produce unfair or discriminatory outcomes, leading to unequal user experiences. Bias can cause:

- Over-targeting or under-targeting certain user groups
- Reinforcing stereotypes
- Excluding legitimate user preferences
- Reduced trust in the system

Mitigating bias ensures that personalization is fair, inclusive, transparent, and ethical, improving both user satisfaction and system credibility.