Task 3:

Ethical Analysis: AI Bias in Personalized Cancer Treatment

The use of AI in personalized medicine—particularly with datasets like The Cancer Genome Atlas (TCGA)—holds great promise for improving patient outcomes. However, it also introduces significant ethical challenges, especially regarding bias and fairness. One of the primary concerns is **demographic imbalance** in the data. Studies have shown that the TCGA dataset is **heavily skewed toward patients of European descent**, with **limited representation from African, Asian, Hispanic, and Indigenous populations**. This underrepresentation can cause AI models to perform poorly on minority groups, leading to **inaccurate diagnoses, suboptimal treatment recommendations, or even overlooked risk factors**.

Another source of bias lies in **clinical and socioeconomic variation**. Patients from underrepresented groups may have different comorbidities, access to healthcare, or environmental exposures that are not adequately captured in the training data. If AI models are not designed to account for these differences, their recommendations may exacerbate existing health disparities.

To address these issues, **fairness strategies** must be integrated into AI development. First, efforts should be made to **augment the training dataset with diverse, representative samples**, either through inclusion of global datasets or oversampling techniques. Second, **bias auditing tools** can be used to evaluate model performance across demographic subgroups and flag disparities. Third, **interpretable AI models** should be prioritized, so clinicians can understand the basis for each recommendation and spot errors rooted in biased logic. Lastly, involving **ethics boards and multidisciplinary teams** in model development can ensure that fairness and transparency remain central.

In conclusion, while AI in personalized medicine has transformative potential, it must be developed responsibly. Ensuring equity in training data, interpretability in recommendations, and accountability in deployment will help prevent harm and promote trust in AI-assisted healthcare.