FAQ

Module-4	
Question 1.	**What exactly is Linear Programming (LP) and why is it important in data science?**
Answer	Linear Programming (LP) is a mathematical method used to find the best possible solution to a problem by optimising a linear objective function, subject to linear equality and inequality constraints. Its essence lies in using mathematical models to represent complex real-world problems and then solving them to achieve desired outcomes. In the context of data science, LP is pivotal for several reasons: • **Optimization**: Data science often deals with optimising resources, whether it's minimising costs, maximising profits, or optimising other metrics. LP provides the tools to achieve these. • **Complex Decision-making**: LP can help in making decisions across multiple variables and constraints, something commonly encountered in industries like logistics, finance, or manufacturing. • **Scalability**: LP techniques can handle problems of substantial size, making them apt for big data

	challenges.
Question 2.	**Can you give a real-world example where Linear Programming might be applied?**
Answer	Certainly! A classic example is the "Diet Problem". Consider a situation where a dietician wants to design a daily diet for a hospital's patients. The goal is to minimise the cost of the diet while ensuring that the nutritional requirements (like calories, proteins, vitamins, etc.) are met. The cost and nutritional content of each food item are known. In this scenario, the objective function would be the total cost of the diet, which we aim to minimise. The decision variables represent the amount of each food item to include in the diet, and the constraints ensure that the chosen foods collectively meet all the nutritional requirements.
Question 3.	**What does 'feasibility' mean in the context of LP, and why is it crucial?**
Answer	In the realm of LP, 'feasibility' refers to whether a particular solution satisfies all the given constraints of the problem. A solution is 'feasible' if it lies within the constraints defined, and 'infeasible' if it doesn't. Feasibility is crucial because:

	● It ensures that the solution aligns with the real-world limitations set by the problem. ● An infeasible solution, no matter how optimal it might seem, is impractical for implementation. Only feasible solutions can be considered viable options. ● Identifying feasibility helps prevent wasted resources on unattainable solutions.
Question 4.	**Why might someone choose to solve an LP problem in Python over Excel?**
Answer	While Excel offers a user-friendly interface and the Solver add-in to handle LP problems, Python provides several advantages: ● **Scalability**: Python can handle much larger datasets and more complex problems than Excel. This makes Python more suited for big data applications. ● **Flexibility**: Python has several libraries (like PuLP, SciPy, and others) that provide more advanced tools and techniques to tackle not just LP but also other optimization problems. ● **Integration**: Python can be seamlessly integrated with other data processing, machine learning, and visualisation tools, making the end-to-end analytics process smoother. ● **Automation**: Python scripts can be automated, facilitating repetitive tasks or dynamic

	problem-solving.
Question 5.	**How do I handle situations where there are multiple optimal solutions in LP?**
Answer	When an LP problem has multiple optimal solutions, it's referred to as 'degeneracy'. This situation arises when there is more than one solution that provides the same optimal value for the objective function. In practical terms: ● Recognize that having multiple optimal solutions gives flexibility. This means there are several ways to achieve the best outcome, allowing for additional considerations like risk, future scalability, or stakeholder preferences. ● Sensitivity analysis can be performed to understand how changes in the problem's parameters might impact these solutions. This analysis can provide insights into which solution might be more robust in the face of changes. ● Stakeholder consultation and domain knowledge can guide the final decision among the multiple optimal options, ensuring the chosen solution aligns best with the broader goals or constraints not captured in the original model.