Q1. What is the difference between getattr and getattribute?

A1. Both getattr and getattribute are methods used for attribute access in Python classes. The key difference between them is that getattr is called only when an attribute cannot be found through the usual means (i.e., the instance dictionary, the class hierarchy, and any slots defined for the class), whereas getattribute is called for every attribute access, even if the attribute is present in the instance dictionary. Because of this, getattribute can be used to implement custom behavior for all attribute accesses on a class, whereas getattr is typically used only for specific cases where a fallback behavior is needed.

Q2. What is the difference between properties and descriptors?

A2. Both properties and descriptors are ways to define custom behavior for attribute access in Python classes. The main difference between them is that properties are a high-level construct that allows us to define getter, setter, and deleter methods for a single attribute, while descriptors are a lower-level construct that allow us to define custom behavior for attribute access more generally. Descriptors can be used to implement properties, but they can also be used for other purposes, such as implementing lazy loading or computed attributes.

Q3. What are the key differences in functionality between getattr and getattribute, as well as properties and descriptors?

A3. The key differences between getattr and getattribute are that getattr is called only when an attribute is not found through normal means, while getattribute is called for every attribute access, and that getattr can be used to provide a fallback behavior for specific cases, while getattribute is used to provide custom behavior for all attribute accesses. The key differences between properties and descriptors are that properties provide a high-level interface for defining custom behavior for a single attribute, while descriptors provide a lower-level interface for defining custom behavior for attribute access more generally, and that properties are typically used for simple cases where only getter, setter, and deleter methods are needed, while descriptors are used for more complex cases where additional behavior is required, such as lazy loading or computed attributes.