A hospital is in the process of developing a comprehensive Hospital Management System to efficiently manage daily operations, including patient care, doctor assignments, room allocations, and billing. The database that supports this system needs to track various entities and their relationships within the hospital environment. Your task is to design an Entity-Relationship Diagram (ERD) that captures the key elements of the system.

The hospital keeps information about Patients, Doctors, Nurses, Rooms, Treatments, and Bills. Each of these should be represented as entities in your ERD. Additionally, each entity will have its own unique attributes. For example, a patient will have attributes such as PatientID, while doctors and nurses will have attributes like Name and Specialization. You are expected to include both single attributes (e.g., a patient’s date of birth) and composite attributes (e.g., a name, which can be broken down into first name and last name). There may also be multivalued attributes, such as a doctor having multiple specializations or a patient having multiple contact numbers.

In your ERD, certain entities may rely on other entities for their existence. For example, Appointments cannot exist without being associated with both a Patient and a Doctor. These kinds of entities are known as weak entities, and you must identify and represent them appropriately in your diagram. In these cases, use identifying relationships to show the dependence of weak entities on strong entities.

The hospital system will involve a variety of relationships between the entities. For instance, a doctor can treat multiple patients, and patients can receive treatment from multiple doctors. You will need to define the cardinality for these relationships, such as whether they are one-to-one, one-to-many, or many-to-many. Also, consider that a Patient can be assigned to a Room, and Nurses are responsible for certain rooms, with each room possibly having multiple nurses assigned to it.

Furthermore, the hospital generates Bills for patients based on their Treatments. Bills are generated only for patients who have received treatment, so you must account for this in your design. Additionally, constraints should be defined, such as a room being able to accommodate only a limited number of patients at any given time, and each patient being assigned to only one room at a time.

Finally, ensure that you identify key constraints such as primary keys and foreign keys to properly link the entities. Also, consider participation constraints, such as ensuring that every patient who receives treatment has a corresponding bill.

Create an ERD that represents the above hospital system. Your diagram should clearly show all entities, their attributes, relationships, cardinality, and any key constraints. You must provide a brief explanation of how your ERD addresses the hospital’s data management requirements.