1. **Name the three stages in the process of developing database systems. Summarize the tasks in each.**
   The three stages are:
   - Requirements analysis - interview users, find forms, reports, etc., develop use cases, build data model.
   - Component design - transform data model into relations and relationships.
   - Implementation - build database, relations, relationships, populated the database, construct application programs.

2. **What is a data model, and what is its purpose?**
   A data model is a representation of the content, relationships, and constraints of the data needed to support the requirements. It is used to document data requirements in a way that can be later transformed into a database design.

3. **What is a prototype, and what is its purpose?**
   A prototype is a working demonstration of selected portions of a future system. A prototype is an easy way to show elements of the database model design to users and to get their feedback.

4. **What is a use case, and what is its purpose?**
   Use cases are descriptions of the ways users will employ the features and functions of the new information system. The purpose of a use case is to help determine requirements.

5. **Give an example of a data constraint.**
   Hours worked must be greater than zero and less than 65.

6. **Give an example of a business rule that would need to be documented in a database development project.**
   Students must declare a major before enrolling in any class.

7. **Define the term *entity* and give an example other than those used in this book.**
   An entity is something that the users want to track, and is readily identifiable in their environment. We'll use the example of the Pacific Northwest Real Estate Agency (PNREA). Example entities are AGENT AgentName: John Smith, PROPERTY Address: 568 12th Street, and CASH_RECEIPT ReceiptNumber: CR2004001.

8. **Explain the difference between an entity class and an entity instance.**
   An entity class is a collection of entities and is described by the structure or format of the entities in that class. An entity instance of an entity class is the representation of a particular entity, such as AGENT John Smith; it is described by the values of attributes of the entity. There are usually many instances of an entity in an entity class.

9. **Define the term attribute and give examples for the entity you described in question 4.7.**
   Attributes describe the entity's characteristics: AgentName, Address, and ReceiptNumber

10. **Define the term identifier and indicate which attribute defined in your answer to question 4.9 identifies the entity.**
    Identifiers are attributes that name, specify, locate (or otherwise identify) entity instances. AgentName is identified by the agent's name.

11. **Define the term composite identifier and give an example other than those used in the book.**
    A composite identifier is an identifier that consists of two or more attributes.

12. **Define the term relationship and give an example other than those used in this book.**
    A relationship is an association between two or more entity classes. For example, in the PNREA data model example, assume you have an entity class named AGENT and an entity class named PROPERTY. AGENTs list PROPERTIES, so you would have a relationship named Listed-By.

13. **Explain the difference between a relationship class and a relationship instance.**
    A relationship class is an association among entity classes; a relationship instance is an association among entity instances.

14. **Define the term degree of relationship. Give an example, other than one used in this text, of a relationship greater than degree two.**
    The number of entity classes in the relationship is the degree of the relationship. For example, in the PNREA data model, there is a relationship of degree three between AGENT, CLIENT and PROPERTY. In this case we are documenting the PROPERTIES that AGENTS showed their CLIENTS.

15. **List and give an example of three types of binary relationships other than the ones used in this book. Draw both a traditional E-R diagram and an IE Crow's Foot E-R diagram for each.**
    1:1 AGENT to CAR
    1:N AGENT to CLIENT
    N:M POPERTY to CLIENT

16. **Define the terms maximum cardinality and minimum cardinality.**
    Maximum cardinality is the maximum number of instances of an entity that can participate in an instance of a relationship. Minimum cardinality is the least number of instances of an entity that can participate in an instance of a relationship.

17. **Draw an IE Crow's Foot E-R diagram for the entities DEPARTMENT and EMPLOYEE and the 1:N relationship between them. Assume that a DEPARTMENT does not need to have an EMPLOYEE, but that every EMPLOYEE is assigned to a DEPARTMENT. Include appropriate identifiers and attributes for each entity.**

18. **Define the term ID-dependent entity and give an example other than one used in this text. Draw an IE Crow's Foot E-R diagram for your example.**
    It is an entity that cannot logically exist without the existence of another entity. CABLE cannot exist without COMPANY.

19. **Define the term weak entity and give an example other than one used in this text. Draw an IE Crow's Foot E-R Diagram for your example.**
    A weak entity is an entity that cannot exist in a database unless another type of entity also exists in that database.

20. **Explain the ambiguity in the definition of the term weak entity. Explain how this book interprets this term.**
    Some say any entity whose presence depends on the presence of another entity in the database; hence any entity in a relationship having a minimum cardinality greater than or equal to one. Others say only ID-Dependent entities. The text says any entity that is logically dependent on another entity.

21. **Define the terms supertype, subtype, and discriminator.**
    A subtype entity is an entity or object that is a subcategoryof a higher-level type; a supertype entity is an entity or object that logically contains subtypes; and a discriminator is an attribute of a supertype entity that determines which subtype pertains to the supertype.

22. **What is an exclusive subtype relationship? Give an example other than one shown in this book. Draw an IE Crow's Foot E-R diagram for your example.**
    An exclusive subtype is a supertype instance that is related to at most one subtype.

23. **What is an inclusive subtype relationship? Give an example other than one shown in this chapter. Draw an IE Crow's Foot E-R Diagram for your example.**
    An inclusive subtype is a supertype instance can relate to one or more subtypes.

24. **Give an example of a recursive relationship other than the one shown in this chapter. Draw on IE Crow's Foot E-R Diagram for your example.**
    1:1 Recursive: Agents at the NWREA are assigned as a mentor to one of the other agents. Each NWREA mentor can only work with one agent at a time. Further, each agent is only mentored by one PNREA agent. However, while being mentored is required, being a mentor is not. Therefore each agent mentor is optionally associated with exactly one other mentored agent.

25. **List important attribute properties that need to be developed as part of a data model.**
    Column name, data type, key required, default value, and remarks.

26. **Create sample properties for the attributes in your E-R Diagram for DEPARTMENT and EMPLOYEE in question 4.17.**

Column Name	Data Type	Key	Required	Default Value	Remarks
Department	Int	PK	Yes	DBMS supplied	
Dept_Name	Char(35)	No	Yes	None	
Dept_id	Int	No	Yes	None	

Column Name	Data Type	Key	Required	Default Value	Remarks
Employee	Char(35)	PK	Yes	None	
Emp_id	Int	PK	Yes	None	
Designation	Char	No	Yes	None	
Emp_Name	Char(35)	No	Yes	None	
DOB	Date	No	Yes	None	
Dept_Name	Char(35)	No	Yes	None	

27. **Give an example of a business rule for your work for question 4.17.**
No employee can be designated in more than one department name.

28. **Describe why it is important to evaluate a data model.**
To ensure the accuracy and to validate the data model.

29. **Summarize one technique for evaluating a data model and explain how that technique could be used to evaluate the data model in Figure 4-20 (c).**
A data model needs to be evaluated in terms that it is correctly operates in any given scenario. It would be implanted into 4-20(c), because you need to ensure that SEMINAR and CUSTOMER are both linked to CONTACT otherwise, you will not come up with the proper data.