UNIVERSITY OF GHANA
SECOND SEMESTER EXAMINATIONS, 2012/2013
LEVEL 100: BACHELOR OF SCIENCE IN ENGINEERING
CPEN 102: INTRODUCTION TO DATABASE SYSTEMS (3 Credits)
TIME ALLOWED: THREE HOURS (3hrs)

Attempt all questions.

SECTION A

1. A(n) _____ is a join where the tuples in a cartesian product of two relations satisfying some predicate which uses any of the following comparison signs $(>, <, =, \neq, \leq, \geq)$.

   A. equi-join   B. natural join   C. theta-join   D. outer-join

2. The _____ type of attribute cannot be created in a DBMS.

   A. derived   B. simple   C. multivalued   D. composite

3. A derived attribute _____.

   A. must be stored physically within the database

   B. need not be physically stored within the database

   C. has many values

   D. must be based on the value of three or more attributes

4. A relationship is an association between .

   A. objects   B. databases   C. entities   D. fields

5. _____ is the bottom-up process of identifying a higher-level, more generic entity supertype from lower-level entity subtypes.

   A. Specialization   B. Partial completeness   C. Generalization   D. Total completeness

6. The primary key's main function is to uniquely identify a(n) _____ within a table.

   A. attribute   B. entity subtype   C. entity instance or row   D. natural identifier

7. A relational table must not contain a(n) .

   A. entity   B. relationship   C. attribute   D. repeating group

8. _____ are important because they help to ensure data integrity.

   A. Attributes   B. Relationships   C. Entities   D. Constraints

9. Business rules are derived from .

    A. a detailed description of an organizations operations

    B. standards and practices developed over the years

    C. managers recommendations

    D. governmental oversight organization standards

10. The relational database model enables you to view data _____ rather than _____.

    A. relationally, hierarchically

    B. physically, logically

    C. hierarchically, relationally

    D. logically, physically

11. In the relational model, _____ are important because they are used to ensure that each row in a table is uniquely identifiable.

    A. relations   B. indexes   C. keys   D. logical structures

12. _____ combines all rows from two tables, excluding duplicate rows.

    A. INTERSECT   B. UNION   C. DIFFERENCE   D. SELECT

13. A(n) _____ is perceived as a two-dimensional structure composed of rows and columns.

    A. table   B. attribute   C. rowset   D. intersection

14. _____ attributes can have many values.

    A. composite   B. single-valued   C. simple   D. multivalued

15. A _____ entity has a primary key that is partially or totally derived from the parent entity in the relationship.

    A. strong   B. business   C. weak   D. relationship

16. Within a specialization hierarchy, every subtype can have _____ supertype(s) to which it is directly related.

    A. zero   B. one or many   C. only one   D. many

17. A(n) _____'s main function is to help you understand the complexities of the real-world environment.

    A. constraint   B. model   C. entity   D. database

18. Students and classes have a _____ relationship.

    A. one-to-one   B. many-to-one   C. one-to-many   D. many-to-many

19. A noun in a business rule translates to a(n) _____ in the data model.

    A. entity   B. relationship   C. attribute   D. constraint

20. A _____ identifier is composed of more than one attribute.

    A. primary   B. composite   C. foreign   D. domain

21. An entity is said to be _____-dependent if it can exist in the database only when it is associated with another related entity occurrence.

    A. existence   B. business   C. relationship   D. weak

22. If an employee within an EMPLOYEE entity has a relationship with itself, that relationship is known as a _____ relationship.

    A. self   B. looping   C. self-referring   D. recursive

23. The insert anomaly refers to a situation where:

    A. An insert statement fails due to a duplicate primary key error.

    B. Data must be inserted before it can be deleted

    C. A required insert cannot be done due to an artificial dependency.

    D. Too many inserts cause a performance bottleneck in the DBMS.

24. The delete anomaly refers to a situation where:

    A. Data must be deleted before a new row may be inserted.

    B. Data deletion causes unintentional loss of another entity's data.

    C. Data must be inserted before it can be deleted.

    D. Data must be deleted before it can be inserted.

25. An SQL DELETE statement without a WHERE clause results in:

    A. An error message

    B. Every row in the table being deleted

    C. Every column in the table being deleted

    D. The table being dropped

26. In SQL, a join without a WHERE clause results in:

    A. An inner join

    B. An outer join

    C. A Cartesian product

    D. An error message

27. First normal form resolves anomalies caused by:

    A. Transitive dependencies

    B. Multivalued attributes

    C. Partial dependency on the primary key

    D. Repeating groups

28. Second normal form resolves anomalies caused by:
    - A. Transitive dependencies
    - B. Multivalued attributes
    - C. Partial dependency on the primary key
    - D. Repeating groups

29. Third normal form resolves anomalies caused by:
    - A. Transitive dependencies
    - B. Multivalued attributes
    - C. Partial dependency on the primary key
    - D. Repeating groups

30. The one-to-many (1:*) relationship is easily implemented in the relational model by putting the foreign key of the "1" side in the table of the "many" side as a primary key.

    A. True   B. False

31. In specialization hierarchies with multiple levels of supertype/subtypes, a lower-level supertype inherits all of the attributes and relationships from all of its upper-level subtypes.

    A. True   B. False

32. Because a partial dependency can exist only if a table's primary key is composed of several attributes, if a table in 1NF has a single-attribute primary key, then the table is automatically in 2NF.

    A. True   B. False

33. Business rules are derived from conversations with employees within the organization.

    A. True   B. False

34. An entity represents a particular type of object in the real world.

    A. True   B. False

35. In a natural join, the column on which the join was made occurs twice in the new table.

    A. True   B. False

36. Initially the files within a computer file system were similar to manual files.

    A. True   B. False

37. Structural dependence exists when it is possible to make changes in the file structure without affecting the application program's ability to access the data.

    A. True.   B. False

38. The DIVIDE operation uses one single-column table (e.g., column "a") as the divisor and one two-column table (e.g., columns "a" and "b") as the dividend.

    A. True   B. False

39. Multiplicity refers to the number of instances of one entity that are associated with one instance of a related entity.

    A. True   B. False

40. One important inheritance characteristic is that all entity subtypes inherit their primary key attribute from their supertype.

    A. True   B. False

41. The property of subtype discriminator enables an entity supertype to inherit the attributes and relationships of the subtype.

    A. True   B. False

42. An entity represents a particular type of object in the real world.

    A. True   B. False

43. A data manipulation language (DML) defines the environment in which data can be managed and is used to work with the data in the database.

    A. True   B. False

44. The ER model refers to a specific table row as an entity occurrence.

    A. True   B. False

45. In an ER diagram, primary keys are usually bolded.

    A. True   B. False

46. A simple attribute is an attribute that cannot be subdivided

    A. True   B. False

47. Cardinaility expresses the minimum and maximum number of entity occurrences associated with one occurrence of the related entity.

    A. True   B. False

48. A(n) _____ key can be described as a superkey without unnecessary attributes.

49. A relationship _____ indicates the number of entities or participants associated with a relationship.

50. Dependencies can be identified with the help of a dependency _____.

51. Each row in a relation is called a(n) _____.

52. A(n) _____ links tables on the basis of an equality condition that compares specified columns of each table.

53. _____ completeness means that every supertype occurrence must be a member of at least one subtype.

54. The _____ provides the big picture, or macro view, of an organizations data requirements and operations.

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55. Subtypes that contain nonunique subsets of the supertype entity set are known as _____

56. Each row in a relation is called a(n) _____.

57. When you can change the internal model without affecting the conceptual model, you have _____ independence.

58. Instead of storing a persons age, it is better to store the date of birth and use the difference between that value and the system date as a(n) _____ attribute.

59. When indicating multiplicity, the first value represents the _____ number of associated entities.

60. A(n) _____ process is based on repetition of processes and procedures.

SECTION B

> Answer all questions in this section into your answer booklets.

1. Enumerate the various data models for database design and discuss in detail two of the models by comparing and contrasting them.

2. An online used-car trading dot-com hires you to design a database for its Web site. The database will store information about used automobiles for sale.

   - Each automobile has a VIN (vehicle identification number), a model (e.g., Camero), a make (e.g., Chevrolet), a year (e.g., 1999), a color (e.g., red), a mileage (e.g., 50,000 miles), and a body style (e.g., coupe).
   - Each automobile has a seller, which may be either a dealer or an individual. For each dealer, the database stores name, address, phone number. For each individual, only phone number and email address are recorded.
   - In addition, the Web site maintains reviews about automobiles. Each review is about one particular model, make, and year. Each review has an author. The same author may write several reviews about the same model, make, and year. The database should connect each car with the reviews about the make, model, and year of that car, although it need not make a direct connection.

   (a) Design an E/R diagram for this database. Very briefly explain the intuitive meaning of any entity and relationship sets. Do not forget to indicate keys, multiplicity of relationships, and weak entity sets in appropriate ways.

   (b) Design a relational schema for this database. You may ignore attribute types, and you do not need to show any sample data. Indicate all keys and non-trivial functional dependencies in the schema.

3. Karl Andersson has a boat rental. As summer season approaches, he thinks of the mess of paper that he has to deal with every year. It would be so much more convenient to have everything organized digitally. His friend comes up with a first draft of an ER model shown in Figure
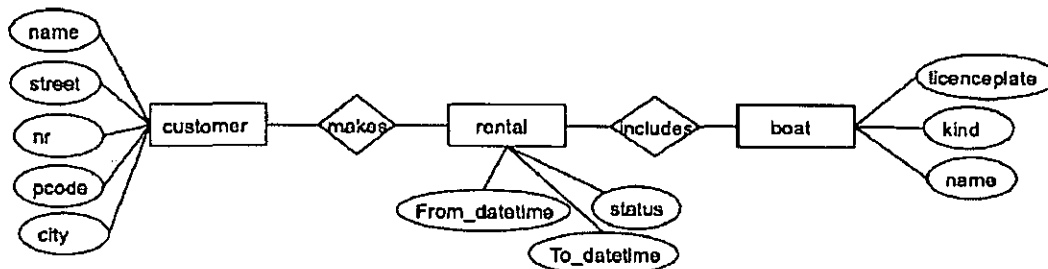
Every boat has a license plate that identifies the boat, a name, and a type (sailing, motor boat etc.). Furthermore, Karl stores the customers name and address (pcode is the postal code). Every rental has a number. A boat is rented from a certain date and time to a certain date and time. The status stores the information whether the boat has been returned or not.

a. Mark the primary keys in the ER model (adjust the model if necessary) and give a short explanation, why the primary keys are possible to use.

b. Add cardinality ratios and briefly explain your decision.

c. Translate the ER model to the relational model. For the relationship types: Do you need an extra table? Why or why not?

d. Karl employs a few students during the summer, when there are a lot of customers. During that time, the boat rental is organized in early and late shifts every day from 8am to 14:30pm and from 14:30pm to 21pm. Karl often schedules more than one student for one shift. The employees can rent boats to the customers. In that case, Karl wants to know which student has done the rental. Karl can contact the students via mail and phone. Extend the ERM by that information (dont forget keys and cardinality ratios).

4. Consider the relation Employee_Department in Figure

Ename	Pnum	Bdate	Dnumber	Department	Dhomepage
John B	100	1965-01-03	2	Computing Science	www/it/cos
Smith L	105	1955-10-12	2	Computing Science	www/it/cos
James P	110	1962-03-03	1	Computer Systems	www/it/sys
Anna R	111	1976-11-23	4	Scientific Computing	www/it/sci
Pia S	112	1964-10-10	4	Scientific Computing	www/it/sci

The relation contains the following attributes: Ename: Employee name, Pnum: Employee number, Bdate: Employees birthdate, Dnumber: Department number, Dhomepage: Department homepage.

(a) What update anomalies may occur in Employee_Department?

(b) Is the relation Employee_Department above normalised? If yes, which normal form (NF) is it in? Motivate your answer!

(c) Decompose the relation so that the result relations are in the third normal form (3NF) showing the steps taken to arrive at 3NF.