Part I -- MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (One point each)

1) A database is considered "self-describing" because _____.
   A) all the users' data is in one place
   B) it contains a description of its own structure
   C) it reduces data duplication
   D) it contains a listing of all the programs that use it
   E) All of the above.

2) Which of the following are basic components of an enterprise-class database system?
   A) The database management system (DBMS)
   B) The database application
   C) The user
   D) The database
   E) All of the above.

3) A database stores:
   A) data.
   B) relationships.
   C) metadata.
   D) data and relationships
   E) data, relationships and metadata

4) In an enterprise-class database system _____.
   A) the DBMS accesses the database data
   B) the database application(s) interact(s) with the DBMS
   C) the database application(s) access(es) the database data
   D) the database application(s) interact(s) with the DBMS and the database application(s) access(es) the database data
   E) the database application(s) interact(s) with the DBMS and the DBMS accesses the database data

5) Database professionals use a set of principles called _____ to guide and assess database design.
   A) data marts
   B) data models
   C) entity-relationship data modeling
   D) data migration
   E) normalization

6) In a relation _____.
   A) the order of the columns is important
   B) the order of the rows is unimportant
   C) entities in a column vary as to kind
   D) more than one column can use the same name
   E) All of the above.

7) Given the functional dependency $(A, B) \rightarrow C$, then _____.
   A) $B \rightarrow C$
   B) $A \rightarrow B$
   C) $A \rightarrow C$
   D) $B \rightarrow A$
   E) None of the above is correct.

8) A relation is in fourth normal form if it is in BCNF and it has no _____.
   A) deletion dependencies
   B) transitive dependencies
   C) referential integrity conflicts
   D) multivalued dependencies
   E) partial dependencies

9) Given the functional dependency $(A, B) \rightarrow C$, (A, B) is a(n) _____.
   A) independent variable
   B) dependent variable
   C) determinant
   D) composite determinant
   E) determinant and composite determinant

10) Which of the following is true about the functional dependency $(A, B) \rightarrow (C, D)$?
   A) A and B together determine D.
   B) A and B together are determined by C and D together.
   C) A determines B.
   D) C and D together determine A.
   E) A is the determinant of C.

11) A missing value is called a(n) _____.
   A) missing value
   B) null value
   C) empty value
   D) Any of the above can be used.
   E) None of the above is correct.

12) The disadvantages of normalization include
_____.
   A) the elimination of duplicated data
   B) more complex SQL for multitable subqueries
   and joins
   C) the elimination of modification anomalies
   D) the elimination of modification anomalies and
   the elimination of duplicated data
   E) the elimination of modification anomalies, the
   elimination of duplicated data and more complex
   SQL for multitable subqueries and joins

13) The defining characteristic of BCNF is that a
table is in BCNF if _____.
   A) all determinants are candidate keys
   B) all columns are consistent
   C) the primary key is a candidate key
   D) all rows are unique
   E) all candidate keys are determinants

14) A null value can indicate which of the following
conditions?
   A) The value is appropriate but unknown.
   B) The value is appropriate and known, but not
   entered into the database.
   C) The value is inappropriate.
   D) All of the above
   are correct.
   E) None of the above is correct.

Part II – PROBLEMS

1. For the following diagram: (2 points)

Write **four** cardinality statements (complete
sentences) that are symbolized in the E-R diagram.
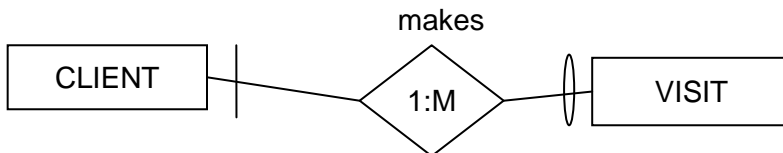
15) An entity that holds specialized attributes that
distinguish it from one or more other similar entities
is a (n) _____.
   A) supertype
   B) subtype
   C) discriminator
   D) supertype and discriminator
   E) subtype and discriminator

16) An entity whose existence depends on the
presence of another entity, but whose identifier does
not include the identifier of the other entity is a(n)
_____.
   A) ID-dependent entity
   B) weak entity
   C) strong entity
   D) strong entity and ID-dependent entity
   E) weak entity and ID-dependent entity

17) An entity whose identifier includes the identifier
of another entity is a(n) _____.
   A) weak entity
   B) strong entity
   C) ID-dependent entity
   D) strong entity and ID-dependent entity
   E) weak entity and ID-dependent entity

18) To represent an association pattern in an E-R
model, _____.
   A) create a new ID-dependent entity with a 1:1
   relationship to one other entity
   B) create a new weak, but not ID-dependent entity
   with a 1:1 relationship to one other entity
   C) create a new strong entity with a 1:1
   relationship to one other entity
   D) create a new ID-dependent entity with a 1:N
   relationship to one of two parent entities
   E) create a new weak, but not ID-dependent entity
   with a 1:N relationship to one of two parent
   entities

makes

CLIENT   1:M   VISIT

2. With a grammatically correct and complete sentence provide the meaning of the following symbolic statements(0.5 points each):
    a. AccountNo → Balance

    b. (Date, FlightNo) →Departure

3. In question 2a, above, what is the determinant (0.5 points)?

4. Consider the following relation and sample data to complete the following items:

ITEM

ItemNo	Description	RetailPrice	Supplier	Quote
100	Drill Press	4500	Bristol Systems	3500
100	Drill Press	4500	ERS Systems	3700
200	Lathe	4750	Bristol Systems	4000
200	Lathe	4750	ERS Systems	3750
300	Mill	27300	Ajax Manufacturing	18000

ITEM(ItemNo, Description, RetailPrice, Supplier, Quote)
    Where
        ItemNo is a unique number that identifies a particular item that our company sells.
        Description is the name of the item and two different items could have the same description.
        RetailPrice is the price we charge when we sell the item; two different items could sell for the
            same retail price.
        Supplier is wholesaler from whom we buy items to resell.
        Quote is the wholesale price quoted to us by a supplier for an item if the company purchases the
            item from that supplier.

Using the white space to the right of the table, state any additional rules or assumptions that you make to determine the truth value of the following statements or to answer the following questions (even if you think they are obvious). However, **do not violate the problem statement or the rules implied by the current data.**

    a. Describe one modification anomaly in the above table. What problem exists? What kind of anomaly is your example (0.5 points)?

    b. Is Item a relation (0.1 Points)? Use the definition of a relation to justify your answer (0.9 Points).

c. List the functional dependencies that exist that are NOT partial dependencies(1 points).

d. List any partial dependencies that have a composite determinant with two attributes. (1point)

e. Using definitions and your answers above, demonstrate that **ITEM** is or is NOT in BCNF (1 point).

5. Use Kroenke's method to redesign the **FUEL_ESTIMATE** table below to eliminate the modification anomalies. Your final tables will be in BCNF if you use the rule correctly. The first step is done for you; the functional dependencies are listed next to the table. **Justify each step of your solution. The tables alone are not worth many points.** Use the back of the previous page, if you need more space. (4 points)

FUEL_ESTIMATE

Plane	Range	GallonsPerHour	Trip	FlyingHours	FuelCost
Boeing-727	2,200	1,100	MIA-JFK	2.75	$ 5,899
DC-9	1,200	740	MIA-ATL	1.25	$ 1,804
DC-9	1,200	740	MIA-DFW	3.15	$ 4,545
L-1011	3,000	3,200	MIA-SJU	3.5	$ 18,200
L-1011	3,000	3,200	MIA-IAH	2.25	$ 11,700
Boeing-727	2,200	1,100	MIA-LAX	5.5	$ 9,831
DC-9	1,200	740	MIA-MSY	1.5	$ 2,165

Plane→ (Range, GallonsPerHour)
(Trip, Plane) → (FlyingHours, FuelCost)

Continue your work on this page if necessary.