University of Macau
Faculty of Business Administration
ISOM3000 – Database Management
1st Term of 2021/2022
Final examination

Date: 13 December, 2021 Time: 2:30 – 5:30pm

Instructions:

1. This is a closed-book exam, absolutely NO books or notes are allowed during the exam. If you feel necessary, you may use a traditional grammatical paper dictionary (i.e. no electronic dictionaries nor electronic devices) during the exam.
2. The total marks for this exam is 100. There are three sections in this exam.
   a) Section A: Multiple Choice questions(25 questions, 2 marks each)
   b) Section B: True/False questions(15 questions, 1 mark each)
   c) Section C: Essay questions/SQL statements(35 marks)
3. Answers for both Section A and Section B should be written on the multiple choice answer-sheet provided by shading the most appropriate box/choice with a dark pencil heavily. Nothing will be graded from this exam paper.
4. For international students, please put all of your answers on your own paper including both Section A and Section B.
5. Please be visible online via Zoom during the exam.
6. Please scan your answers with a printer/scanner/smartphone and upload the answers onto Moodle on or before 5:30pm.
7. This exam consists of 10 pages including this cover page.
8. Pay attention to any additional instructions announced during the exam.

Part A - Multiple Choice Questions(50%, each carries 2 marks).

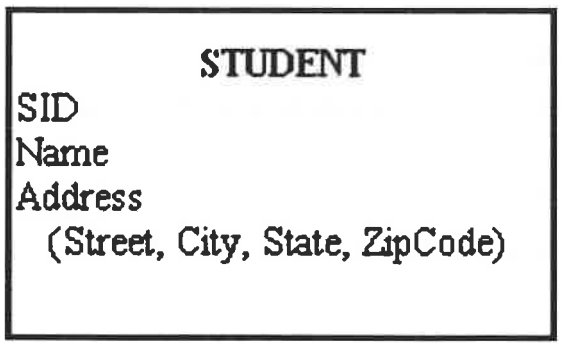
1) A database is an organized collection of _____ related data.
   A) logically
   B) physically
   C) loosely
   D) badly

2) All of the following are properties of metadata EXCEPT:
   A) data definitions.
   B) processing logic.
   C) rules or constraints.
   D) data structures.

3) Relational databases establish the relationships between entities by means of common fields included in a file called a(n):
   A) entity.
   B) relationship.
   C) relation.
   D) association.

4) The logical representation of an organization's data is called a(n):
   A) database model.
   B) entity-relationship model.
   C) relationship systems design.
   D) database entity diagram.

5) In the figure below, 'Address' is an example of:



   A) a composite attribute.
   B) a relational attribute.
   C) a derived attribute.
   D) a multivalued attribute.

6) In an E-R diagram, there are/is _____ business rule(s) for every relationship.
   A) two
   B) three

C) one
D) zero

7) Which of the following is an entity that exists independently of other entity types?
A) Codependent
B) Weak
C) Strong
D) Variant

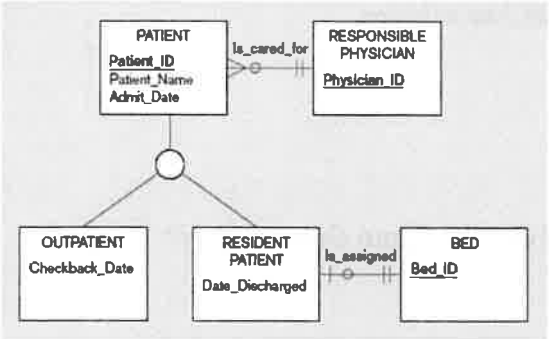
8) An attribute that must have a value for every entity (or relationship) instance is a(n):
A) composite attribute.
B) required attribute.
C) optional attribute.
D) multivalued attribute.

9) The number of entity types that participate in a unary relationship is:
A) zero.
B) one.
C) two.
D) three.

10) Which of the following is a generic entity type that has a relationship with one or more subtypes?
A) Megatype
B) Supertype
C) Subgroup
D) Class

11) The property by which subtype entities possess the values of all attributes of a supertype is called:
A) hierarchy reception.
B) class management.
C) attribute inheritance.
D) generalization.

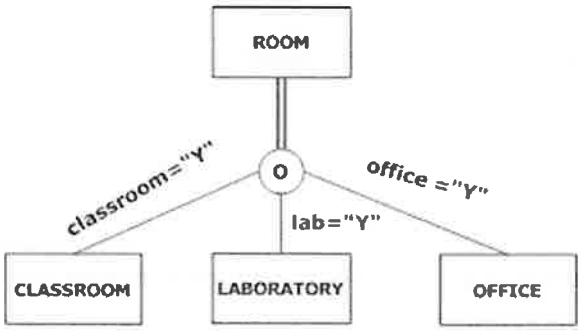
12) In the figure below, which of the following is a subtype of patient?



A) Outpatient
B) Physician
C) Bed
D) Date_Hired

13) The process of defining one or more subtypes of a supertype and forming relationships is called:
A) specialization.
B) generalization.
C) creating discord.
D) selecting classes.

14) The following figure is an example of:

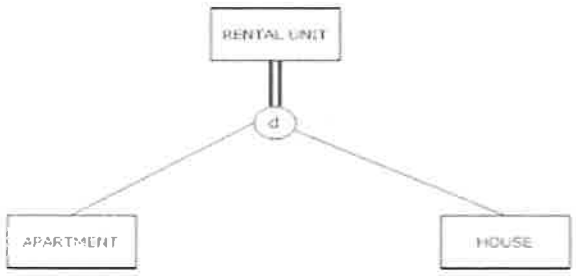


A) partial specialization.
B) completeness.
C) total specialization.
D) disjointness.

15) The _____ rule specifies that an entity instance of a supertype is allowed not to belong to any subtype.
A) semi-specialization
B) total specialization
C) partial specialization
D) disjointedness

16) A(n) _____ constraint is a type of constraint that addresses whether an instance of a supertype must also be an instance of at least one subtype.
A) disjoint
B) overlap
C) completeness
D) weak

17) Which of the following statements is true about the figure shown below?



A) A rental unit must be either an apartment or a house, and cannot be both at the same time.
B) A rental unit can be an apartment, house or just a rental unit; it may not be more than one at the same time.
C) A rental unit must be either an apartment or a house, and could be both.
D) A rental unit can be an apartment, a house or just a rental unit. It could be both an apartment and a house at the same time.

18) A two-dimensional table of data sometimes is called a:
A) set.
B) group.
C) relation.
D) declaration.

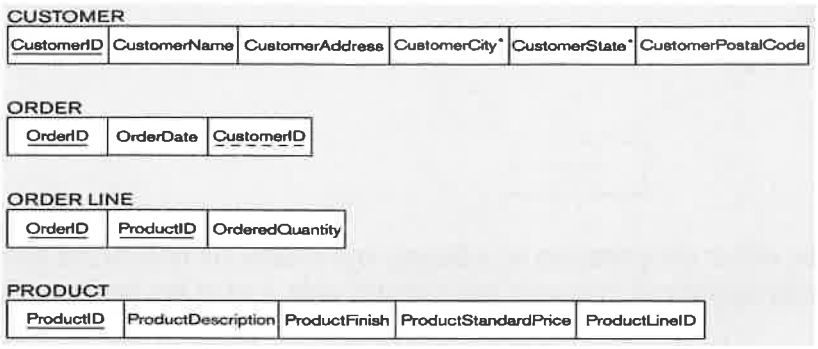
19) An attribute in a relation of a database that serves as the primary key of another relation in the same database is called a
A) foreign attribute.
B) foreign key.
C) link key.
D) link attribute.

20) Which of the following are properties of relations?
A) There are multivalued attributes in a relation.
B) Each attribute has the same name.
C) No two rows in a relation are the same.
D) All columns are numeric.

21) A rule that states that each foreign key value must match a primary key value in the other relation is called the:
A) entity key group rule.
B) referential integrity constraint.
C) key match rule.
D) foreign/primary match rule.

22) An attribute (or attributes) that uniquely identifies each row in a relation is called a:
A) foreign field.
B) column.
C) primary key.
D) duplicate key.

23) In the figure below, the primary key for "Order Line" is which type of key?

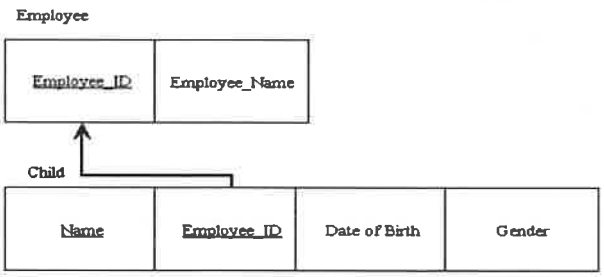


A) Foreign
B) Composite
C) Standard
D) Grouped

24) Which normal form is a relation that has the following properties?
(1) contains no multivalued attributes
(2) has nonkey attributes only dependent on the primary key, but
(3) contains transitive dependencies

A) First
B) Second
C) Third
D) Fourth

25) In the figure below, what type of relationship do the relations depict?



A) One-to-many
B) Identifying entity/weak entity
C) Multivalued
D) Composite foreign key

Part B - True/False Questions(15%, each carries 1 mark).

26) A person is an example of an entity.

27) A data model is a graphical system used to capture the nature and relationships among data.

28) Metadata are data that describe the properties of other data.

29) When choosing an identifier, choose one that will not change its value often.

30) A single occurrence of an entity is called an entity instance.

31) An attribute whose value can be calculated from related attribute values is called a derived attribute.

32) The overlap rule specifies that if an entity instance of the supertype is a member of one subtype, it can simultaneously be a member of two (or more) subtypes.

33) When subtypes are overlapping, an additional field must be added to the supertype to act as a discriminator.

34) In a supertype/subtype hierarchy, attributes are assigned at the highest logical level that is possible in the hierarchy.

35) The disjoint rule specifies that if an entity instance of the supertype is a member of one subtype, it MUST simultaneously be a member of another subtype.

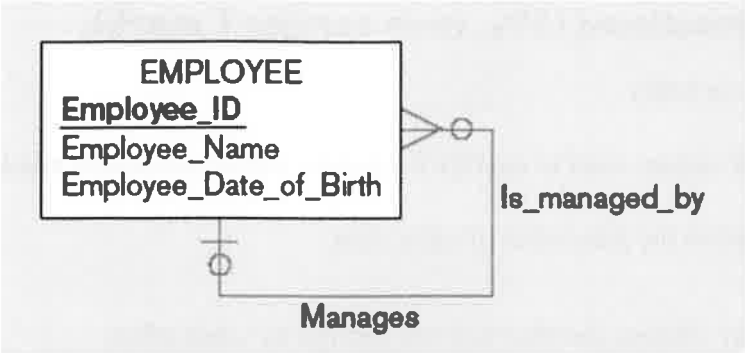
36) There can be multivalued attributes in a relation.

37) If an identifier is not assigned, the default primary key for an associative relation consists of the two primary key attributes from the other two relations.

38) The allowable range of values for a given attribute is part of the domain constraint.

39) The columns of a relation can be interchanged without changing the meaning or use of the relation.

40) In the figure below, each employee has exactly one manager.



Part C –Essay questions/SQL statements(35%)

1. The table below shows a grade report for a university. Perform the following tasks.
   a) Indicate what normal form this relation is in. (1%)
   b) Decompose the grade report into a set of 3NF relations and show the referential integrity constraints. (9%)

Grade Report

StudentID	StudentName	CampusAddress	Major	CourseID	CourseTitle	Instructor Name	Instructor Location	Grade
168300458	Williams	208 Brooks	IS	IS 350	Database Mgt	Codd	B 104	A
168300458	Williams	208 Brooks	IS	IS 465	Systems Analysis	Parsons	B 317	B
543291073	Baker	104 Phillips	Acctg	IS 350	Database Mgt	Codd	B 104	C
543291073	Baker	104 Phillips	Acctg	Acct 201	Fund Acctg	Miller	H 310	B
543291073	Baker	104 Phillips	Acctg	Mkgt 300	Intro Mktg	Bennett	B 212	A

2. Relationship in Figure (1) can be converted into two tables in Figure (2) by introducing an additional table "Component". See below figures.

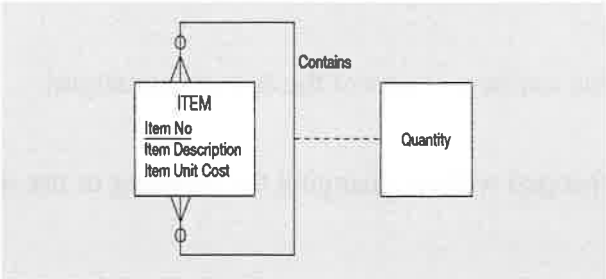


Figure (1) Bill-of materials relationship (M:N)

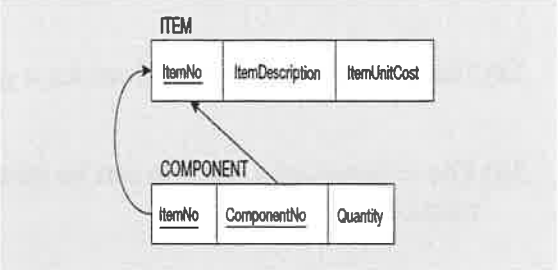


Figure (2) ITEM and COMPONENT tables

(a) Given the sample data in the ITEM table shown below, fill in the data in the table COMPONENT accordingly. (7%)

Assumptions:

"Desktop computer" has components "System Unit" and "Monitor"(quantities are all 1).
"System Unit" has CPU, Memory and Hard Disk (quantities are all 1).
"iPad" has component Memory (quantity is 1).
"Mini-computer" has component CPU (quantity is 4).

ITEM table

Item_no	Description	Unit-cost
1	Desktop computer	1000
2	System Unit	200
3	Monitor	220
4	CPU	150
5	Memory	100
6	Hard Disk	100
7	iPad	600
8	Mini-computer	5000

COMPONENT table

Item-no	Component_no	Quantity
:	:	:

(b) Identify the key fields in the above two tables?(3%)

(i) What is the primary key in ITEM table?
(ii) What is the primary key in COMPONENT table?

3. The following problems are on the table as below. Please write SQL statements to solve these problems.
   a) Add a record of a customer named "Jack Bauer", aged 20, and from Norway. Other information is unknown (CustomerID will be given automatically by the DBMS).(3%)
   b) Delete any customer whose name starts with "A" from the "Customers" table. (2%)
   c) Lists the number of customers in each country, and order by this number ascendingly. Note to only include countries with more than 5 customers. (5%)

CustomerID	CustomerName	ContactName	Address	Age	PostalCode	Country
1	Alfreds Futterkiste	Maria Anders	Obere Str. 57	55	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda. de la Constitución 2222	25	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	32	05023	Mexico
4	Around the Horn	Thomas Hardy	120 Hanover Sq.	18	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	67	S-958 22	Sweden

4. The following problems are based on the tables shown below. Please write SQL statements to accomplish the results. (5%)
   a) Use Right Outer Join clause to find the records from the following two tables(Hint: the results must show LastName, FirstName and OrderID, and sort the results by OrderID).

Orders

OrderID	CustomerID	EmployeeID	OrderDate
10308	2	1	1996-09-18
10309	5	3	1996-09-19
10310	7	2	1996-09-20

Employee

EmployeeID	LastName	FirstName	BirthDate
1	Trigeiros	Lancy	12/8/1968
2	Smith	Andrew	2/19/1952
3	Leverling	Samson	8/30/1963
4	Rodriques	Duarte	12/8/1969

*** End of final examination ***