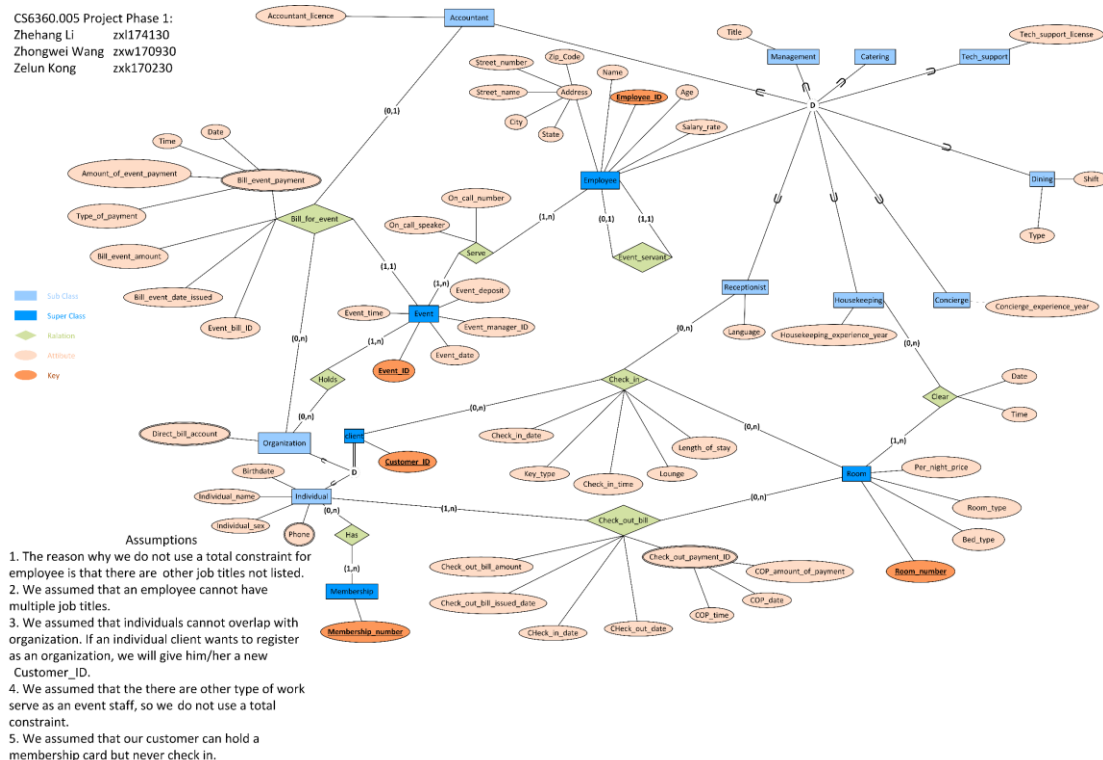


1 Modified EER Diagram

- The Union subclass: Event Staff is replaced by a self-recursive relationship within the employee. We use a foreign key(FK) to represent whether the employee is a staff for event.
- The (max, min) value is modified correctly according to original assumptions.
- See the new EER diagram is below:



2 Mapping (Foreign key is in red)

2.1 Regular Entity

Relation	Mapping Method
(All of the entities)	Create separate tables for each entity. Use the first approach. (create separate table for subclass entities.)

1. Employee:

<u>EmployeeID</u>	Age	Salary_rate	Name	Status	City	Street_name	Street_number	Zipcode
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2. Dinning:

<u>EmployeeID</u>	Shift	Type
-------------------	-------	------

EmployeeID is a FK referencing to the Employee.EmployeeID.

3. Concierge:

<u>EmployeeID</u>	Concierge_experience_year
-------------------	---------------------------

EmployeeID is a FK referencing to the Employee.EmployeeID.

4. Housekeeping:

<u>EmployeeID</u>	Housekeeping_experience_year
-------------------	------------------------------

EmployeeID is a FK referencing to the Employee.EmployeeID.

5. Receptionist:

<u>EmployeeID</u>	Language
-------------------	----------

EmployeeID is a FK referencing to the Employee.EmployeeID.

6. Tech_support:

<u>EmployeeID</u>	Tech_support_licence
-------------------	----------------------

EmployeeID is a FK referencing to the Employee.EmployeeID.

7. Management:

<u>EmployeeID</u>	Title
-------------------	-------

EmployeeID is a FK referencing to the Employee.EmployeeID.

8. Catering:

<u>EmployeeID</u>

EmployeeID is a FK referencing to the Employee.EmployeeID.

9. Accountant:

<u>EmployeeID</u>	Accountant_licence
-------------------	--------------------

EmployeeID is a FK referencing to the Employee.EmployeeID.

10. Event:

<u>Event_ID</u>	Event_date	Event_time	Event_manager_ID	Event_deposit
-----------------	------------	------------	------------------	---------------

Event_manager_ID is a FK referencing to the Management.EmployeeID.

11. Client:

Customer_ID

12. Organization:

<u>Customer_ID</u>

Customer_ID is a FK referencing to the Client. Customer_ID.

13. Individual:

<u>Customer_ID</u>	Birthdate	Individual_name	Individual_sex
--------------------	-----------	-----------------	----------------

Customer_ID is a FK referencing to the Client. Customer_ID.

14. Membership:

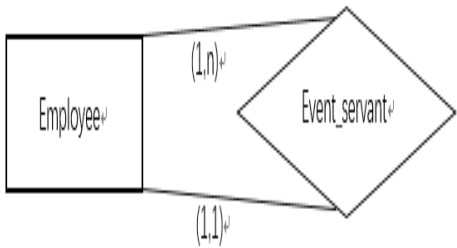
<u>Membership_number</u>

15. Room:

<u>Room_number</u>	Bed_type	Room_type	Per_night_price
--------------------	----------	-----------	-----------------

2.2: Weak Entity (We do not have this☹)

2.3: Mapping 1:1 relationship

Relation	Mapping Method
	<p>We use Foreign key approach to map this relationship. Since on one side, the self-recursive is total participation, we include the Event_staff_ID as a foreign key in the Employee table, which referencing the primary key of</p>

	Employee.EmployeeID.
--	----------------------

Employee:

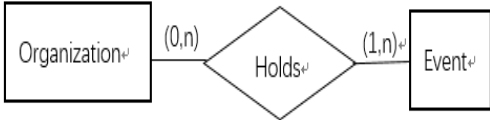

<u>EmployeeID</u>	Age	Salary_rate	Name	State	City	Street_name	Street_number	Zipcode	Event_staff_ID
-------------------	-----	-------------	------	-------	------	-------------	---------------	---------	----------------

Event_staff_ID is a FK referencing to the Employee. EmployeeID.

2.4 Mapping 1:N relationship (We do not have this☺)

2.5 Mapping M:N relationship

Relation	Mapping Method
	<p>Since it is a M:N relationship, we create a new table and add the two entities' primary key as foreign keys. Employee_ID is a FK referencing to the Housekeeping.EmployeeID.</p> <p>Room_number is a FK referencing to the Room. Room_number.</p>
	<p>Since it is a M:N relationship, we create a new table and add the two entities' primary key as foreign keys. Room_number is a FK referencing to the Room. Room_number. Customer_ID is a FK referencing to the Individual. Customer_ID.</p>
	<p>Since it is a M:N relationship, we create a new table and add the two entities' primary key as foreign keys. Customer_ID is a FK</p>

	<p>referencing to the Individual. Customer_ID.</p> <p>Membership_number is a FK referencing to the Membership. Membership_number.</p>
 <pre> graph LR Org[Organization] -- "(0,n)" --- Holds{Holds} Holds -- "(1,n)" --- Event[Event] </pre>	<p>Since it is a M:N relationship, we create a new table and add the two entities' primary key as foreign keys. Event_ID is a FK referencing to the Event.Event_ID. Customer_ID is a FK referencing to the Organization.Customer_ID.</p>
 <pre> graph LR Emp[Employee] -- "(1,n)" --- Serve{Serve} Serve -- "(1,n)" --- Event[Event] </pre>	<p>Since it is a M:N relationship, we create a new table and add the two entities' primary key as foreign keys. Event_ID is a FK referencing to the Event.Event_ID. Employee_ID is a FK referencing to the Employee.Employee_ID.</p>

16. Clear:

<u>Employee_ID</u>	<u>Room_number</u>	Date	Time
--------------------	--------------------	------	------

Employee_ID is a FK referencing to the Housekeeping.EmployeeID.

Room_number is a FK referencing to the Room. Room_number.

17. Check_out_bill:

<u>Room_number</u>	<u>Customer_ID</u>	Check_out_bill_amount	Check_out_bill_is_sued_date	Check_in_date	Check_out_date
--------------------	--------------------	-----------------------	-----------------------------	---------------	----------------

Room_number is a FK referencing to the Room. Room_number.

Customer_ID is a FK referencing to the Individual. Customer_ID.

18. Has:

<u>Customer_ID</u>	<u>Membership_number</u>
--------------------	--------------------------

Customer_ID is a FK referencing to the Individual.Customer_ID.

Membership_number is a FK referencing to the Membership.Membership_number.

19. Holds:

<u>Event_ID</u>	<u>Customer_ID</u>
-----------------	--------------------

Event_ID is a FK referencing to the Event.Event_ID.

Customer_ID is a FK referencing to the Organization.Customer_ID.

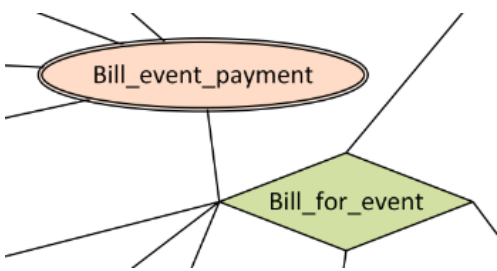
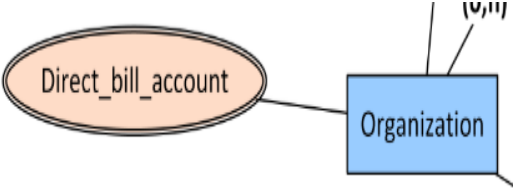
20. Serve:

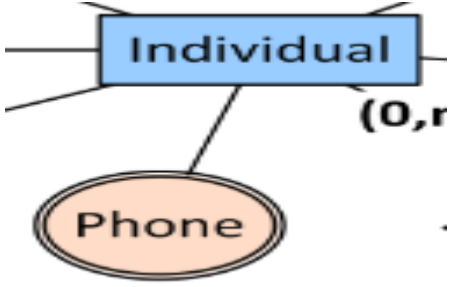
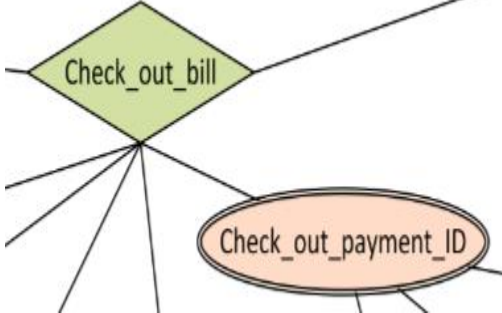
<u>Event_ID</u>	<u>Employee_ID</u>	On_call_speaker	On_call_number
-----------------	--------------------	-----------------	----------------

Event_ID is a FK referencing to the Event.Event_ID.

Employee_ID is a FK referencing to the Employee.Employee_ID.

2.6: Mapping of Multivalued Attributes

Relation	Mapping Method
	<p>Bill_event_payment is a multivalued attribute. It is mapped as a new table. CustomerID is a foreign key referencing to the Organization.Customer_ID.</p> <p>Customer_ID and Event_bill_ID are the primary key.</p>
	<p>Direct_bill_account is a multivalued attribute. It is mapped as a new table. Customer_ID is a FK from Organization.Customer_ID.</p> <p>Customer_ID and Direct_bill_account are the primary key.</p>

	<p>Phone is a multivalued attribute. It is mapped as a new table. Customer_ID is a FK from Individual.Customer_ID. Customer_ID and Phone are the primary key.</p>
	<p>Check_out_payment_ID is a multivalued attribute. It is mapped as a new table. Customer_ID is a FK referencing to the Individual.Customer_ID. Room_number is a FK referencing to the Room.Room_number. Customer_ID, Room_number, COP_time and COP_date are the primary key.</p>

21. Bill_event_payment:

(Implemented after 2.7)

<u>Customer_ID</u>	<u>Event_bill_ID</u>	Date	Time	Amount_of_event_payment	Date_of_payment
--------------------	----------------------	------	------	-------------------------	-----------------

Customer_ID is a FK referencing to the Organization.Customer_ID.

22. Direct_bill_account:

<u>Customer_ID</u>	<u>Direct_bill_account</u>
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Customer_ID is a FK referencing to the Organization.Customer_ID.

23. Phone:

<u>Customer_ID</u>	<u>Phone</u>
--------------------	--------------

Customer_ID is a FK referencing to the Individual.Customer_ID.

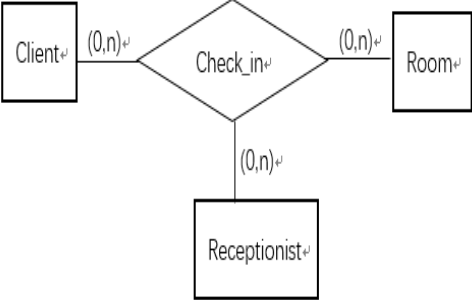
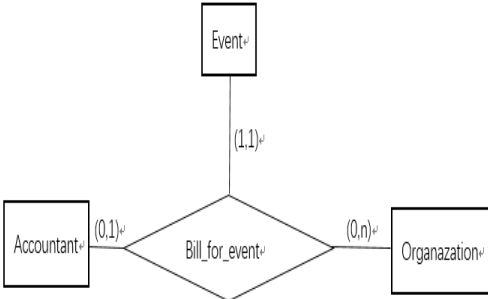
24. Check_out_payment_ID:

<u>Customer_ID</u>	<u>Room_number</u>	<u>COP_time</u>	<u>COP_date</u>	COP_amount_of_payment
<u>D</u>	<u>r</u>	<u>e</u>	<u>e</u>	nt

Customer_ID is a FK referencing to the Individual.Customer_ID.

Room_number is a FK referencing to the Room.Room_number.

2.7: Mapping n-ary relationship

Relation	Mapping Method
	<p>Check_in is a ternary relationship. Customer_ID is a FK referencing to the Client.Customer_ID. Employee_ID is a FK referencing to the Receptionist.Employee_ID. Room_number is a FK referencing to the Room.Room_number. Customer_ID, Employee_ID, Room_number, Check_in_date, and Check_in_time are the primary key.</p>
	<p>Bill_for_event is a ternary relationship. Customer_ID is a FK referencing to the Organization.Customer_ID. Event_ID is a FK referencing to the Event.Event_ID. Employee_ID is a FK referencing to the Accountant.Employee_ID. Customer_ID and Event_bill_ID are the primary key.</p>

25. Check_in:

<u>Customer_ID</u>	<u>Employee_ID</u>	<u>Room_number</u>	<u>Check_in_date</u>	Key_type	<u>Check_in_time</u>	Length_of_stay
<u>er_ID</u>	<u>ee_ID</u>	<u>umber</u>	<u>_date</u>	ype	<u>_time</u>	f_stay

Customer_ID is a FK referencing to the Client.Customer_ID.

Employee_ID is a FK referencing to the Receptionist.Employee_ID.

Room_number is a FK referencing to the Room.Room_number.

26. Bill_for_event:

<u>Customer_ID</u>	<u>Event_bill_ID</u>	Event_ID	Employee_ID	Bill_event_date_issued	Bill_event_amount
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Customer_ID is a FK referencing to the Organization.Customer_ID.

Event_ID is a FK referencing to the Event.Event_ID.

Employee_ID is a FK referencing to the Accountant.Employee_ID.

2.8: Final relational schema

Employee:

<u>EmployeeID</u>	Age	Salary_rate	Name	State	City	Street_name	Street_number	Zipcode	Event_staff_ID
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Dinning:

<u>EmployeeID</u>	Shift	Type
-------------------	-------	------

EmployeeID is a FK referencing to the Employee.EmployeeID.

Concierge:

<u>EmployeeID</u>	Concierge_experience_year
-------------------	---------------------------

EmployeeID is a FK referencing to the Employee.EmployeeID.

Housekeeping:

<u>EmployeeID</u>	Housekeeping_experience_year
-------------------	------------------------------

EmployeeID is a FK referencing to the Employee.EmployeeID.

Receptionist:

<u>EmployeeID</u>	Language
-------------------	----------

EmployeeID is a FK referencing to the Employee.EmployeeID.

Tech_support:

<u>EmployeeID</u>	Tech_support_licence
-------------------	----------------------

EmployeeID is a FK referencing to the Employee.EmployeeID.

Management:

<u>EmployeeID</u>	Title
-------------------	-------

EmployeeID is a FK referencing to the Employee.EmployeeID.

Catering:

<u>EmployeeID</u>

EmployeeID is a FK referencing to the Employee.EmployeeID.

Accountant:

<u>EmployeeID</u>	Accountant_licence
-------------------	--------------------

EmployeeID is a FK referencing to the Employee.EmployeeID.

Event:

<u>Event_ID</u>	Event_date	Event_time	<u>Event_manager_ID</u>	Event_deposit
-----------------	------------	------------	-------------------------	---------------

Event_manager_ID is a FK referencing to the Management.EmployeeID.

Client:

Customer_ID

Organization:

<u>Customer_ID</u>

Customer_ID is a FK referencing to the Client. Customer_ID.

Individual:

<u>Customer_ID</u>	Birthdate	Individual_name	Individual_sex
--------------------	-----------	-----------------	----------------

Customer_ID is a FK referencing to the Client. Customer_ID.

Membership:

<u>Membership_number</u>

Room:

<u>Room_number</u>	Bed_type	Room_type	Per_night_price
--------------------	----------	-----------	-----------------

Clear:

<u>Employee_ID</u>	<u>Room_number</u>	Date	Time
--------------------	--------------------	------	------

Employee_ID is a FK referencing to the Housekeeping.EmployeeID.

Room_number is a FK referencing to the Room. Room_number

Check_out_bill:

<u>Room_n umber</u>	<u>Custom er_ID</u>	Check_out_bill _amount	Check_out_bill_is sued_date	Check_in _date	Check_ou t_date
-------------------------	-------------------------	---------------------------	--------------------------------	-------------------	--------------------

Room_number is a FK referencing to the Room. Room_number.

Customer_ID is a FK referencing to the Individual. Customer_ID.

Has:

<u>Customer_ID</u>	<u>Membership_number</u>
--------------------	--------------------------

Customer_ID is a FK referencing to the Individual. Customer_ID.

Membership_number is a FK referencing to the Membership.
Membership_number.

Holds:

<u>Event_ID</u>	<u>Customer_ID</u>
-----------------	--------------------

Event_ID is a FK referencing to the Event.Event_ID.

Customer_ID is a FK referencing to the Organization.Customer_ID.

Serve:

<u>Event_ID</u>	<u>Employee_ID</u>	On_call_speaker	On-call_number
-----------------	--------------------	-----------------	----------------

Event_ID is a FK referencing to the Event.Event_ID.

Employee_ID is a FK referencing to the Employee.Employee_ID.

Bill_event_payment:

<u>Customer ID</u>	<u>Event_bill ID</u>	Dat e	Tim e	Amount_of_event_pay ment	Date_of_paym ent
------------------------	--------------------------	----------	----------	-----------------------------	---------------------

Customer_ID is a FK referencing to the Organization.Customer_ID.

Direct_bill_account:

<u>Customer_ID</u>	<u>Direct_bill_account</u>
--------------------	----------------------------

Customer_ID is a FK referencing to the Organization.Customer_ID.

Phone:

<u>Customer_ID</u>	<u>Phone</u>
--------------------	--------------

Customer_ID is a FK referencing to the Individual.Customer_ID.

Check_out_payment_ID:

<u>Customer_ID</u>	<u>Room_number</u>	<u>COP_time</u>	<u>COP_date</u>	COP_amount_of_payment
--------------------	--------------------	-----------------	-----------------	-----------------------

Customer_ID is a FK referencing to the Individual.Customer_ID.

Room_number is a FK referencing to the Room.Room_number.

Check_in:

<u>Customer_ID</u>	<u>Employee_ID</u>	<u>Room_number</u>	<u>Check_in_date</u>	Key_type	<u>Check_in_time</u>	Lounge	Length_of_stay
--------------------	--------------------	--------------------	----------------------	----------	----------------------	--------	----------------

Customer_ID is a FK referencing to the Client.Customer_ID.

Employee_ID is a FK referencing to the Receptionist.Employee_ID.

Room_number is a FK referencing to the Room.Room_number.

Bill_for_event:

<u>Customer_ID</u>	<u>Event_bill_ID</u>	<u>Event_ID</u>	<u>Employee_ID</u>	Bill_event_date_issued	Bill_event_amount
--------------------	----------------------	-----------------	--------------------	------------------------	-------------------

Customer_ID is a FK referencing to the Organization.Customer_ID.

Event_ID is a FK referencing to the Event.Event_ID.

Employee_ID is a FK referencing to the Accountant.Employee_ID.

3.1 Explanation for Format Design

Assumption:

- Data format for all Employee ID is an integer with length of 9.
- Age is an integer without any further restriction.
- Salary_rate is a number within [0, 9999999.99].
- Event_deposit is a number within [0, 99999.99]. (Max deposit is roughly one hundred thousand dollars.)
- Room number is a 4 digits number.
- Membership number is a 11 digits number.
- Direct bill account is a 20 char-long string.
- Length of stay is an integer greater than 0.

3.2 Format for Every Relation

1.

Relation Name	Attributes	Data Type
Employee	<u>EmployeeID</u>	Numeric(9,0)
	Age	Integer
	Salary_rate	Numeric(9,2)
	Name	String<=20
	State	String<=2
	City	String<=20
	Street_name	String<=20
	Street_number	String<=20
	Zipcode	String<=10
	Event_staff_ID	Numeric(9,0)

2.

Relation Name	Attributes	Data Type
Dinning	<u>EmployeeID</u>	Numeric(9,0)
	Shift	String<=10
	Type	String<=20

3.

Relation Name	Attributes	Data Type
Concierge	<u>EmployeeID</u>	Numeric(9,0)
	Concierge_experience_year	Interger

4.

Relation Name	Attributes	Data Type
Housekeeping	<u>EmployeeID</u>	Numeric(9,0)
	Housekeeping_experience_year	Interger

5.

Relation Name	Attributes	Data Type
Receptionist	<u>EmployeeID</u>	Numeric(9,0)
	Language	String<=10

6.

Relation Name	Attributes	Data Type
Tech_support	<u>EmployeeID</u>	Numeric(9,0)
	Tech_support_licence	String<=100

7.

Relation Name	Attributes	Data Type
Management	<u>EmployeeID</u>	Numeric(9,0)
	Title	String<=20

8.

Relation Name	Attributes	Data Type
Catering	<u>EmployeeID</u>	Numeric(9,0)

9.

Relation Name	Attributes	Data Type
Accountant	<u>EmployeeID</u>	Numeric(9,0)
	Accountant_licence	String<=20

10.

Relation Name	Attributes	Data Type
---------------	------------	-----------

Event	<u>Event_ID</u>	Numeric(4,0)
	Event_date	MM/DD/YYYY, STRING = 10 CHARS
	Event_time	hh-mm-ss, string = 8 chars
	Event_manager_ID	Numeric(9,0)
	Event_deposit	Numeric(7,2)

11.

Relation Name	Attributes	Data Type
Client	CustomerID	Numeric(6,0)

12.

Relation Name	Attributes	Data Type
Organization	CustomerID	Numeric(6,0)

13.

Relation Name	Attributes	Data Type
Individual	CustomerID	Numeric(6,0)
	Birthdate	MM/DD/YYYY, STRING = 10 CHARS
	Individual_name	String<=20
	Individual_sex	String<=20

14.

Relation Name	Attributes	Data Type
Membership	<u>Membership_number</u>	Numeric(11,0)

15.

Relation Name	Attributes	Data Type
Room	<u>Room_number</u>	Numeric(4,0)
	Bed_type	String<=20
	Room_type	String<=20
	Per_night_price	Integer

16.

Relation Name	Attributes	Data Type
Clear	<u>EmployeeID</u>	Numeric(9,0)
	Room_number	Numeric(4,0)
	Date	MM/DD/YYYY, STRING = 10 CHARS
	Time	hh-mm-ss, string = 8 chars

17.

Relation Name	Attributes	Data Type
Check_out_bill	Room_number	Numeric(4,0)
	CustomerID	Numeric(6,0)
	Check_out_bill_amount	Integer
	Check_out_bill_issued_date	MM/DD/YYYY, STRING = 10 CHARS
	Check_in_date	MM/DD/YYYY, STRING = 10 CHARS
	Check_out_date	MM/DD/YYYY, STRING = 10 CHARS

18.

Relation Name	Attributes	Data Type
Has	CustomerID	Numeric(6,0)
	<u>Membership_number</u>	Numeric(11,0)

19.

Relation Name	Attributes	Data Type
Holds	CustomerID	Numeric(6,0)
	<u>Event_ID</u>	Numeric(4,0)

20.

Relation Name	Attributes	Data Type
Serve	<u>Event_ID</u>	Numeric(4,0)
	<u>EmployeeID</u>	Numeric(9,0)

	On_call_speaker	String<=20
	On-call_number	Numeric(4,0)

21.

Relation Name	Attributes	Data Type
Bill_event_payment	CustomerID	Numeric(6,0)
	Event_bill_ID	Numeric(6,0)
	Date	MM/DD/YYYY, STRING = 10 CHARS
	Time	hh-mm-ss, string = 8 chars
	Amount_of_event_payment	Numeric(8,2)
	Date_of_payment	MM/DD/YYYY, STRING = 10 CHARS

22.

Relation Name	Attributes	Data Type
Direct_bill_account	CustomerID	Numeric(6,0)
	<u>Direct_bill_account</u>	String=20

23.

Relation Name	Attributes	Data Type
Phone	CustomerID	Numeric(6,0)
	<u>Phone</u>	Numeric(10,0)

24.

Relation Name	Attributes	Data Type
Bill_event_payment	CustomerID	Numeric(6,0)
	Room_number	Numeric(4,0)
	<u>COP_time</u>	hh-mm-ss, string = 8 chars
	<u>COP_date</u>	MM/DD/YYYY, STRING = 10 CHARS
	COP_amount_of_payment	Numeric(8,2)

25.

Relation Name	Attributes	Data Type
Check_in	CustomerID	Numeric(6,0)
	<u>EmployeeID</u>	Numeric(9,0)
	Room_number	Numeric(4,0)
	<u>Check_in_date</u>	MM/DD/YYYY, STRING = 10 CHARS
	Key_type	String<=20
	<u>Check_in_time</u>	hh-mm-ss, string = 8 chars
	Lounge	Boolean
	Length_of_stay	Integer>0

26.

Relation Name	Attributes	Data Type
Bill_for_event	CustomerID	Numeric(6,0)
	Event_bill_ID	Numeric(6,0)
	<u>Event_ID</u>	Numeric(4,0)
	<u>EmployeeID</u>	Numeric(9,0)
	Bill_event_date_issued	MM/DD/YYYY, STRING = 10 CHARS
	Bill_event_amount	Numeric(8,2)