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Zoo Database Management System

JARETT KOELMEL. SFSU ID: 920135967

GITHUB USERNAME: JKOELMEL

Milestone/Version	Date
M1V1	06OCT2020

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Section 1: Project Description

A zoo database management system needs to address a multitude of different data-related problems. Classifying it in simplistic terms, this ranges from management of animals and veterinarians to administrative staff and visitors, and everything in between. Creating a database to solve the issues inherent in an organization of this type is much different than a standard company. The integration of a large variety of different animals and species, as is common with zoos, exponentially increases the complexity of tracking all pertinent data but also provides an opportunity to solve this problem in a more efficient way than already exists. Constructing a relational database around this concept, when well-designed and implemented, will allow for greater organizational efficiency and faster queries to find specific information on demand. The benefits expand to management of personnel that is specific to this use-case, which is how the personnel and the animals, to include their habitats, interact with one another. On the public-facing side of the zoo, the database will provide ease of access to statistics tracking visitor attendance as well as organization of annual pass membership information. This database will allow for quicker assessment of labor division and provide administrative personnel the ability to load balance their personnel easier and with greater control. Quickly and easily compiling data on key metrics of the business will also be a major focus of the database's structure.

Section 2: Use Cases

Use Case Table	
Entities Involved: User, Account, Employee, Manager, Visitor, Member, Address, Phone Number, Tour, Show	Alice is a manager that oversees public relations and marketing for a zoo. She needs to login to her account in a management portal. Within the portal, she can search for statistics and metrics related to visitor counts enumerated daily. For annual pass membership, she can search all registered accounts for pertinent information regarding any members for the purpose to monitoring success of marketing and churn rate on a monthly and annual basis. Her access to information is limited to that which is required for the duties of her job.
Entities Involved: User, Account, Member, Address, Phone Number, Tour, Show	John has been an annual pass holder for the zoo for a long time but needs to update his information on file. The system requires John to login into his account using the credentials established when he first created his membership. Then, he can access his personal information, account number, and verify its integrity. If needed, he can update the database to reflect his new address and payment information for usage by the automatic renewal system. He has family coming into town in the near future and wants hold tour and show spots in advance. He uses the system to look up tour dates and times and current available slots left to see what will work best for him.
Entities Involved: User, Account, Employee, Manager, Executive, Department, Veterinarian, Area, Habitat, Animal, Zookeepers	Bob is the director of animal services for the zoo and needs to oversee the total operations of the veterinarians currently employed. He logs into his respective management portal. He can view and search the status of all the habitats and animals at the zoo. He notices some veterinarians are overseeing too many animals and can assign personnel as necessary to ensure proper workload across all staff.

Entities Involved: User, Account, Employee, Manager, Veterinarian, Animal, Habitat, Zookeeper, Diet, Medicine, Item, Shipment, Inventory, Tour, Show, Area, Zookeepers	Sally is a veterinarian for the zoo. She has a login to access management of the animals under her purview and their associated enclosures. She can search which habitats she is responsible for. Within the enclosure, information pertaining to the number of animals, to include species and gender, contained within can be found. She can assign groundskeeping and maintenance staff to ensure upkeep of her areas and balance load across all staff. She can also quickly see which of her animals have health conditions or specialized dietary needs. As a specialist, she can look up any information related to her field.
Entities Involved: User, Employee, Manager, Accountant, Budget, Department, Salary, Payment, Revenue, Expense	David is the accountant for the zoo. He oversees the budget for every division and the sub-divisions within the animal services department. He wants to reallocate the budget for some of the animals because of their dynamic needs. He logs into the system to see all current financials. His total budget cannot be exceeded, so reallocation requires a movement of funds from one area to another in order to maintain proper bookkeeping.

Section 3: Database Requirements

1. User
    a. A user can create only one account
    b. A user can only login using their assigned account number
    c. A user can have only one email address attached to it
    d. A user can have only one person's name
    e. A user can have only one person's date of birth
    f. A user can have many addresses
2. Account
    a. An account belongs to only one user
    b. An account can have only one account number
    c. An account can have many passwords
3. Company
    a. A company can have many employees
    b. A company can have many managers
    c. A company can have many departments
    d. A company can have many department heads
    e. A company can have many addresses
4. Employee
    a. An employee is a user
    b. An employee shall have only one user identification number
    c. An employee is managed by only one manager
    d. An employee can have many roles
    e. An employee should be able to only view information pertinent to their job
5. Hourly Worker
    a. An hourly worker is an employee
    b. An hourly worker shall have an hourly wage
    c. An hourly worker shall have a count of hours worked in current pay period
    d. An hourly worker shall have a count of hours worked total
6. Salary Worker
    a. A salary worker is an employee
    b. A salary worker shall have an annual salary
    c. A salary worker shall have a monthly wage
    d. A salary worker shall have a count of hours worked total
7. Department
    a. A department can have many employees

   b. A department can have one department head
   c. A department can have many managers
   d. A department can have only one name
8. Department head
   a. An executive is an employee
   b. An executive can oversee many managers
   c. An executive can manage budgets internal to their department
   d. An executive can adjust salaries internal to their department
9. Manager
   a. A manager is an employee
   b. A manager can have many employees as subordinates
   c. A manager should be able to allocate resources as needed
   d. A manager should be able to view all metrics regarding business operations
   e. A manager should be able to remove user accounts
10. Accountant
   a. An accountant is a manager
   b. An accountant should be able to control allocation of budgets between departments
   c. An accountant should be able to view and edit salaries
   d. An account should be able to view reports of payments from members
11. Income
   a. A payment can have many payment sources
   b. A payment can have many payment dates
   c. A payment can have many total dollar amounts
   d. A payment can have many membership accounts
   e. A payment can have many shops
   f. A payment can have only one transaction ID number
   g. A payment can be tied many visitors or membership accounts
   h. A payment can have many revenue sources
   i. A payment can come from cash, check, debit or credit card
12. Expense
   a. An expense can have many sources
   b. An expense can have many dates
   c. An expense can have many total dollar amounts
   d. An expense can have many departments
   e. An expense can have many vendors
   f. An expense can have many employees
   g. An expense can have only one transaction ID number
13. Veterinarian
   a. A veterinarian is an employee
   b. A veterinarian manages many habitats

c. A veterinarian should be able to assign zookeeper to habitats under their control
d. A veterinarian should be able to view all relevant data for animals within their assigned habitats
e. A veterinarian should be able to edit health and dietary information for the animals

14. Trainer
    a. A trainer is an employee
    b. A trainer can be assigned to many habitats
    c. A trainer can be assigned to many animals
    d. A trainer should be able to assign zookeeper to habitats under their control
15. Zookeeper
    a. A groundskeeper is an employee
    b. A groundskeeper can be assigned to many habitats
    c. A groundskeeper can have many roles
    d. A groundskeeper's roles can be janitorial, electrical, maintenance, or landscaping
16. Radio
    a. A radio is assigned to only one department
    b. A radio can have many owners within that department
    c. A radio can have only one serial number
    d. A radio should only be able to be signed out to one employee at a time
17. Animal
    a. An animal shall have only one identification number
    b. An animal can have only one birth date
    c. An animal can have only one death date
    d. An animal can have only one name
    e. An animal can have only one habitat (current location)
    f. An animal should be able to be reassigned another habitat
    g. An animal can be managed by many veterinarians
    h. An animal should have recorded health and diet information
    i. An animal should have total food amount saved in its profile
    j. An animal on medicine should have its dosage saved in its profile
18. Diet
    a. A diet can consist of many foods
    b. A diet should contain ratios when more than one food type is used
    c. A diet can be assigned to many animals
    d. A diet should be editable by veterinarians
    e. A diet should contain at least one time slot for feeding
19. Medicine
    a. A medicine can have many names
    b. A medicine can be assigned to many animals
    c. A medicine can have many dosage sizes

   d. A medicine shall only be added to animal profiles via veterinarians

20. Habitat
    a. A habitat shall have only one identification number
    b. A habitat can have many animals
    c. A habitat can be managed by many veterinarians
    d. A habitat can be assigned many animal trainers
    e. A habitat can be maintained by many zookeepers
21. Area
    a. An area can have only one name
    b. An area can contain many habitats
    c. An area shall have only one manager
    d. An area can have many veterinarians assigned to it
    e. An area can have many zookeepers assigned to it
22. Annual member
    a. A member is a user
    b. A member shall have only one name
    c. A member shall have at least one payment account on file
    d. A member shall have only one date of birth
    e. A member can have many addresses
    f. A member should be able to update personal information
    g. A member can reserve only one VIP tour at a time
23. Visitor
    a. A visitor shall have a unique ID
    b. A visitor shall have only one name
    c. A visitor can have only one age bracket
    d. A visitor can be a child, adult, or senior
    e. A visitor can have many zip codes
    f. A visitor can have many party sizes
    g. A visitor can have a member ID
24. Show
    a. A show can have many trainers
    b. A show can have many animals
    c. A show can have many time slots
    d. A show can have only one area
    e. A show can have many attendance counts
25. Tour
    a. A tour can be led by many veterinarians
    b. A tour can have many visitors
    c. A tour can have many time slots
    d. A tour should list habitats to visit
26. Shops

a. A shop can have only one name
b. A shop can have many employees
c. A shop can be assigned on only one area
d. A shop can have many items

27. Inventory
    a. An inventory shall have a ID number
    b. An inventory can have many items in it
    c. An inventory shall have number of each item in stock
28. Item
    a. An item shall have a unique ID number
    b. An item can have only role
    c. An item can be animal food, animal medicine, or shop supply
    d. An item should have a description
    e. An item should have a vendor name
    f. An item should have a contract price
29. Vendor
    a. A vendor shall have a unique ID number
    b. A vendor can have many names
    c. A vendor can supply many items
    d. A vendor can have many addresses
    e. A vendor can have many points of contact (POC)
30. Shipment
    a. A shipment shall have only one order number
    b. A shipment can have many tracking numbers
    c. A shipment can consist of many items
    d. A shipment can have many delivery dates
    e. A shipment shall have a total cost
    f. A shipment can have many departments

Section 4: Detailed List of Main Entities, Attributes, and Keys

1. User (Strong)
    a. user_id: key, numeric, unique
    b. f_name: alphabetic
    c. l_name: alphabetic
    d. age: derived, numeric
    e. DOB: date, composite
    f. email: alphanumeric, unique
2. Address (Strong)
    a. address_id: key, numeric, unique
    b. house_number: alphanumeric
    c. street_name: alphanumeric
    d. city: alphabetic
    e. state: alphabetic
    f. zipcode: numeric
3. Phone Number (Strong)
    a. phone_id: key, unique, alphanumeric
    b. country code: numeric
    c. area_code: numeric
    d. phone number: numeric, multivalue
4. Company (Strong)
    a. company_id: key, numeric, unique
    b. company_name: alphanumeric
    c. num_employees: numeric
5. Account (Weak)
    a. account_id; key, unique, numeric
    b. password: alphanumeric
    c. username: foreign key, numeric
6. Employee (Weak)
    a. employee_id: key, unique, numeric
    b. user_id: numeric
    c. dept_id: multivalue, alphanumeric
    d. role: alphabetic, multivalue
    e. managed_by: numeric
7. Hourly Employee (Weak)
    a. hours_current: numeric
    b. hours_total: numeric
    c. hourly_rate: numeric
8. Salary Employee (Weak)

   a. annual_salary: numeric
   b. monthly_wage: numeric
   c. hours_total: numeric
9. Department (Strong)
   a. dept_id: key, unique, alphanumeric
   b. dept_head: alphabetic
   c. dept_name: alphabetic
10. Executive (Strong)
   a. exec_id: key, unique, alphanumeric
   b. employee_id: foreign key
   c. dept_id: foreign key
11. Manager (Weak)
   a. manager_id: key, unique, alphanumeric
   b. dept_id: foreign key
   c. budget_id: foreign key
12. Budget (Strong)
   a. budget_id: key, unique, alphanumeric
   b. dept_id: numeric, foreign key
   c. amount: numeric, multivalue
13. Revenue (Weak)
   a. transaction_id: key, unique, alphanumeric
   b. payment_source: alphanumeric, multivalue
   c. date: numeric, non-null
   d. amount: numeric, non-null
   e. revenue_source: alphabetic, multivalue
14. Expense (Weak)
   a. expense_id: key, unique, alphanumeric
   b. budget_dept: alphabetic, multivalue
   c. amount: numeric, multivalue
   d. date: numeric, non-null
   e. vendor: alphanumeric, multivalue
15. Payment (Weak)
   a. payment_id: key, unique, alphanumeric
   b. payment_type: alphabetic, multivalue
   c. card_number: numeric, multivalue
   d. routing_number: numeric, multivalue
   e. bank_account_number: numeric, multivalue
   f. member_id: foreign key
16. Accountant (Strong)
   a. accountant_id: key, unique, alphanumeric
   b. dept_managed: alphabetic, multivalue

    c. total_control_amount: numeric
17. Veterinarian (Weak)
    a. vet_id: key, unique, alphanumeric
    b. habitats: alphanumeric, multivalue
    c. animals: alphabetic, multivalue
18. Trainer (Weak)
    a. trainer_id: key, unique, alphanumeric
    b. habitats: alphanumeric, multivalue
    c. animals: alphanumeric, multivalue
19. Zookeeper (Weak)
    a. keeper_id: key, unique, alphanumeric
    b. area: alphabetic, multivalue
    c. habitat: alphanumeric, multivalue
    d. animals: alphanumeric, multivalue
    e. role: alphabetic, multivalue
20. Radio (Strong)
    a. radio_id: key, unique, alphanumeric
    b. serial_numer: alphanumeric, unique
    c. owner: alphabetic
    d. current_user: alphabetic, unique
21. Animal (Strong)
    a. animal_id: key, unique, alphanumeric
    b. DOB: date, composite
    c. age: numeric, derived
    d. DOD: date, composite
    e. name: alphanumeric
22. Diet (Strong)
    a. diet_id: key, unique, alphanumeric
    b. animal: alphanumeric, multivalue
    c. food: alphabetic, multivalue
    d. daily_amount: numeric
    e. feeding_times: numeric, multivalue
23. Medicine (Strong)
    a. rx_id: key, unique, alphanumeric
    b. otc_name: alphabetic, multivalue
    c. animal: alphanumeric, multivalue
    d. dosage: numeric, multivalue
    e. dosage_times: numeric, multivalue
24. Habitat (Weak)
    a. habitat_id: key, unique, alphanumeric
    b. size: numeric, multivalue

    c. land_type: alphabetic, multivalue
    d. capacity: numeric

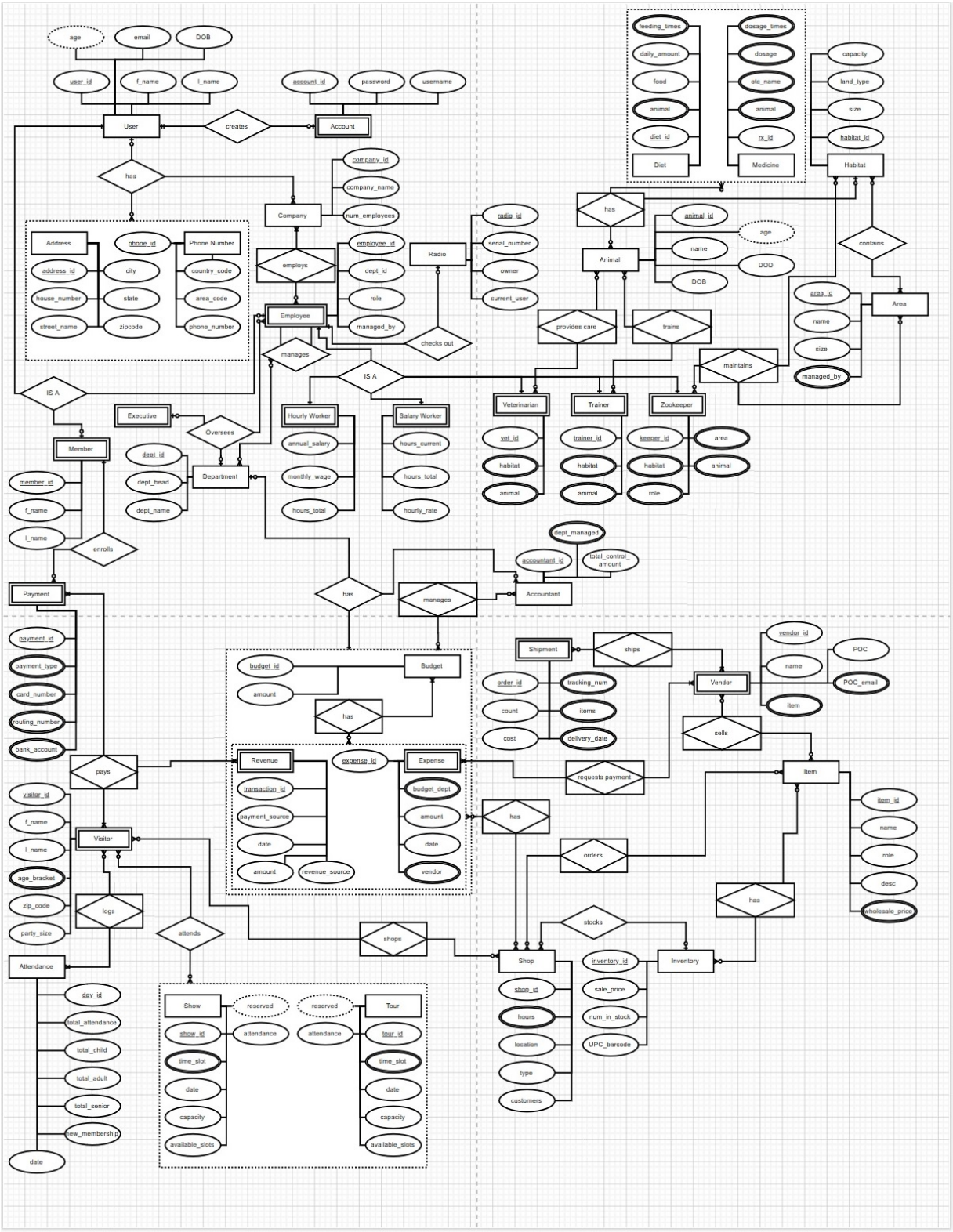
25. Area (Strong)
    a. area_id: key, unique, alphanumeric
    b. name: alphanumeric, unique
    c. size: numeric
    d. managed_by: alphanumeric, multivalue
26. Member (Weak)
    a. member_id: key, unique, alphanumeric
    b. f_name: alphabetic
    c. l_name: alphabetic
27. Attendance (Strong)
    a. day_id: key, unique, numeric
    b. date: date, unique
    c. total_attendance: numeric
    d. total_child: numeric
    e. total_adult: numeric
    f. total_senior: numeric
    g. new_membership: numeric
28. Visitor (Weak)
    a. visitor_id: key, unique, alphanumeric
    b. f_name: alphabetic
    c. l_name: alphabetic
    d. age_bracket: alphabetic
    e. zip_code: numeric
    f. party_size: numeric
29. Show (Strong)
    a. show_id: key, unique, alphanumeric
    b. time_slot: numeric, multivalue
    c. date: numeric
    d. capacity: numeric
    e. available_slots: numeric
    f. reserved: numeric, derived
    g. attendance: numeric

30. Tour (Strong)
    a. tour_id: key, unique, alphanumeric
    b. time_slot: numeric, multivalue
    c. date: numeric
    d. capacity: numeric
    e. available_slots: numeric

    f. reserved: numeric, derived
    g. attendance: numeric
31. Shop (Strong)
    a. shop_id: key, unique, alphanumeric
    b. hours: numeric, multivalue
    c. location: alphabetic
    d. type: alphabetic
    e. customers: numeric
32. Inventory (Strong)
    a. inventory_id: key, alphanumeric
    b. item_id: foreign_key
    c. sale_price: numeric
    d. num_in_stock: numeric
    e. upc_barcode: numeric, unique
33. Item (Strong)
    a. item_id: key, unique, alphanumeric
    b. name: alphanumeric, multivalue
    c. role: alphabetic
    d. desc: alphanumeric
    e. wholesale_price: numeric, multivalue
34. Vendor (Weak)
    a. vendor_id: key, unique, alphanumeric
    b. name: alphanumeric
    c. item: alphanumeric, multivalue
    d. POC: alphabetic
    e. POC_email: alphanumeric, multivalue
35. Shipment (Weak)
    a. order_id: key, unique, alphanumeric
    b. tracking_num: alphanumeric, multivalue
    c. items: alphanumeric, multivalue
    d. count: numeric, multivalue
    e. delivery_date: date, multivalue
    f. cost: numeric

Section 5: Entity Relationship Diagram (ERD)

Overview (expanded view on following pages):



ERD images will be labeled in grid notation with [0,0] representing top left, [0,1] being below and [1,0] being to the right, and [1,1] being diagonal from the origin.

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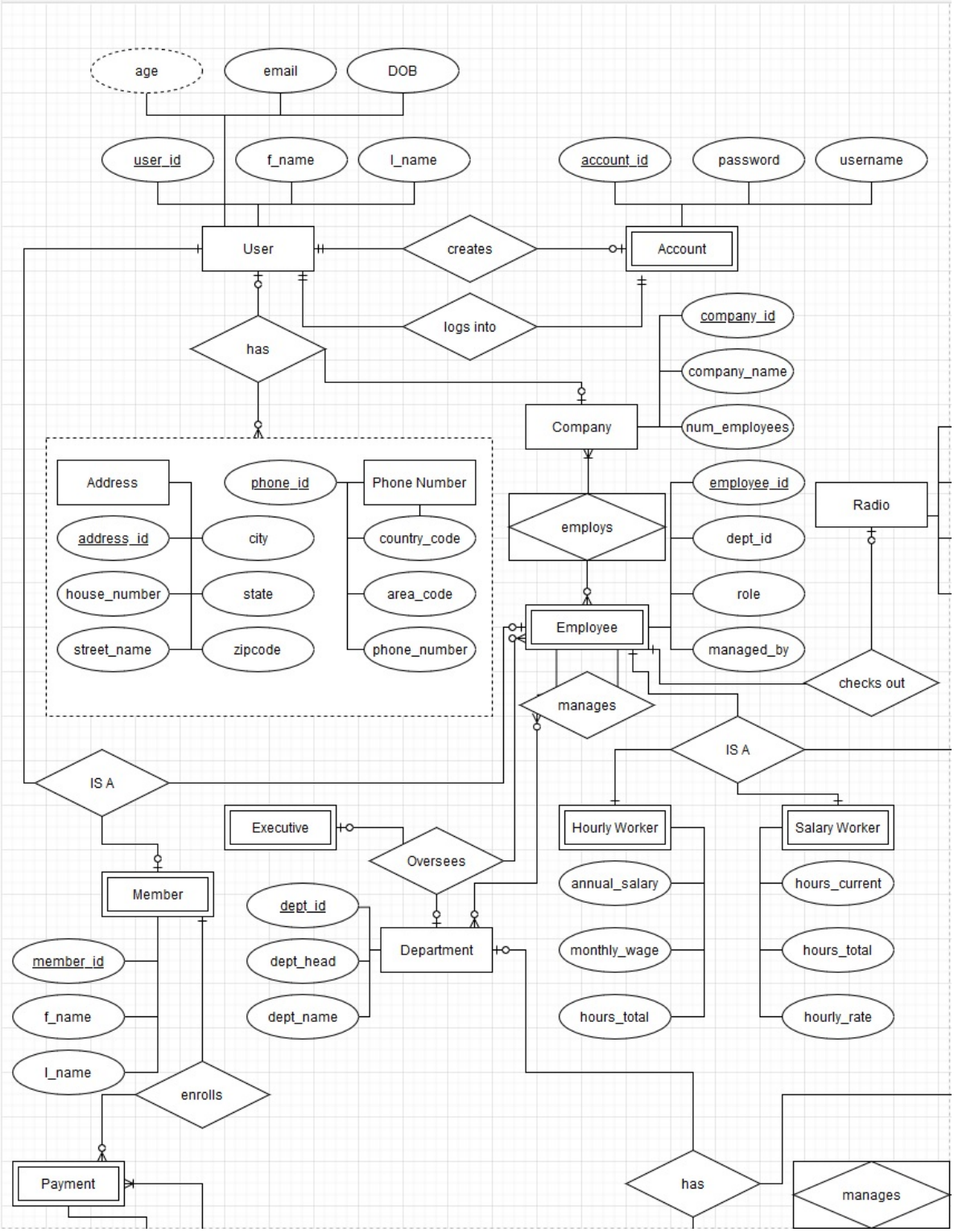

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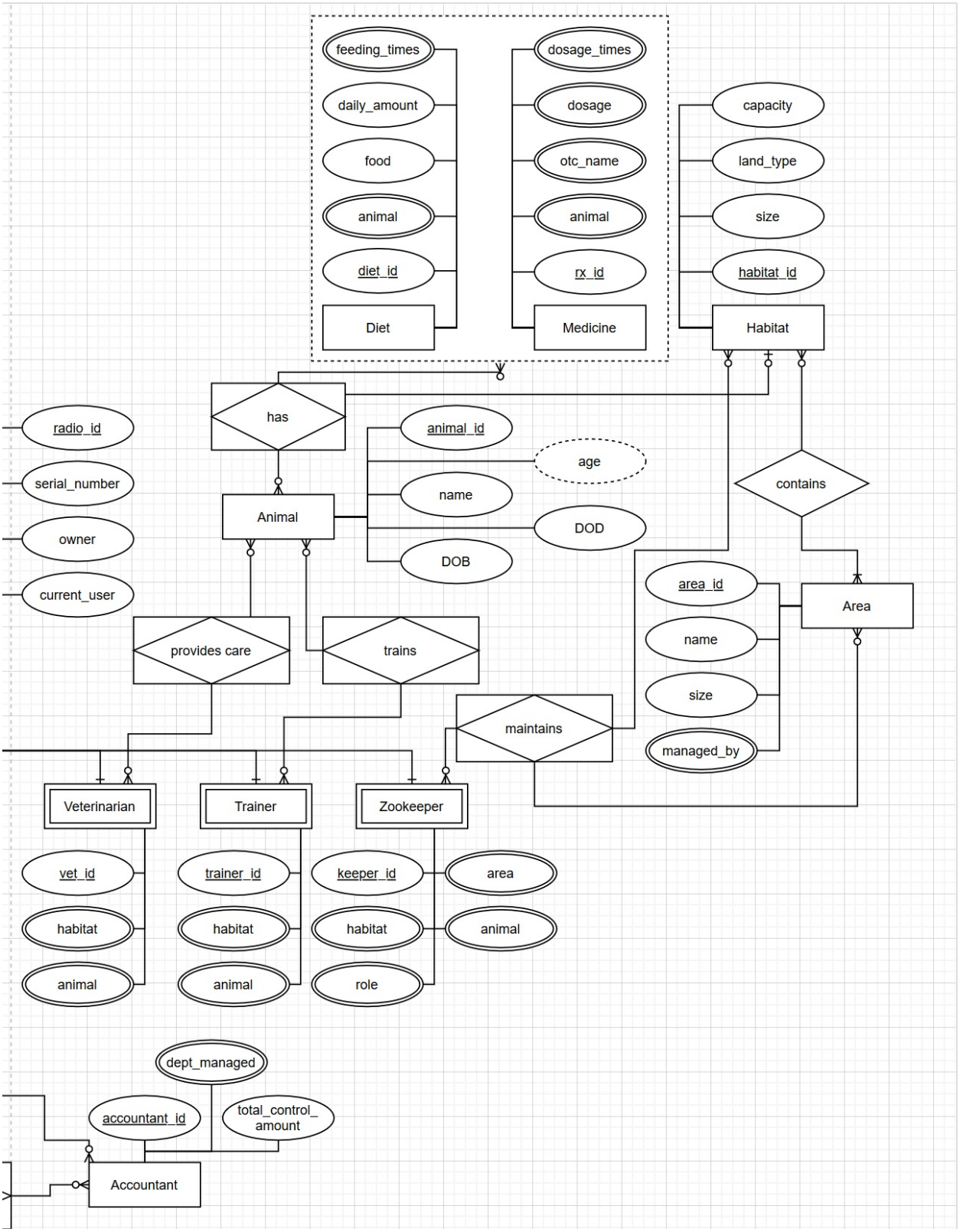
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owner
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name
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DOB
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name
size
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Area
provides care
trains
maintains
Veterinarian
Trainer
Zookeeper
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habitat
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habitat
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area
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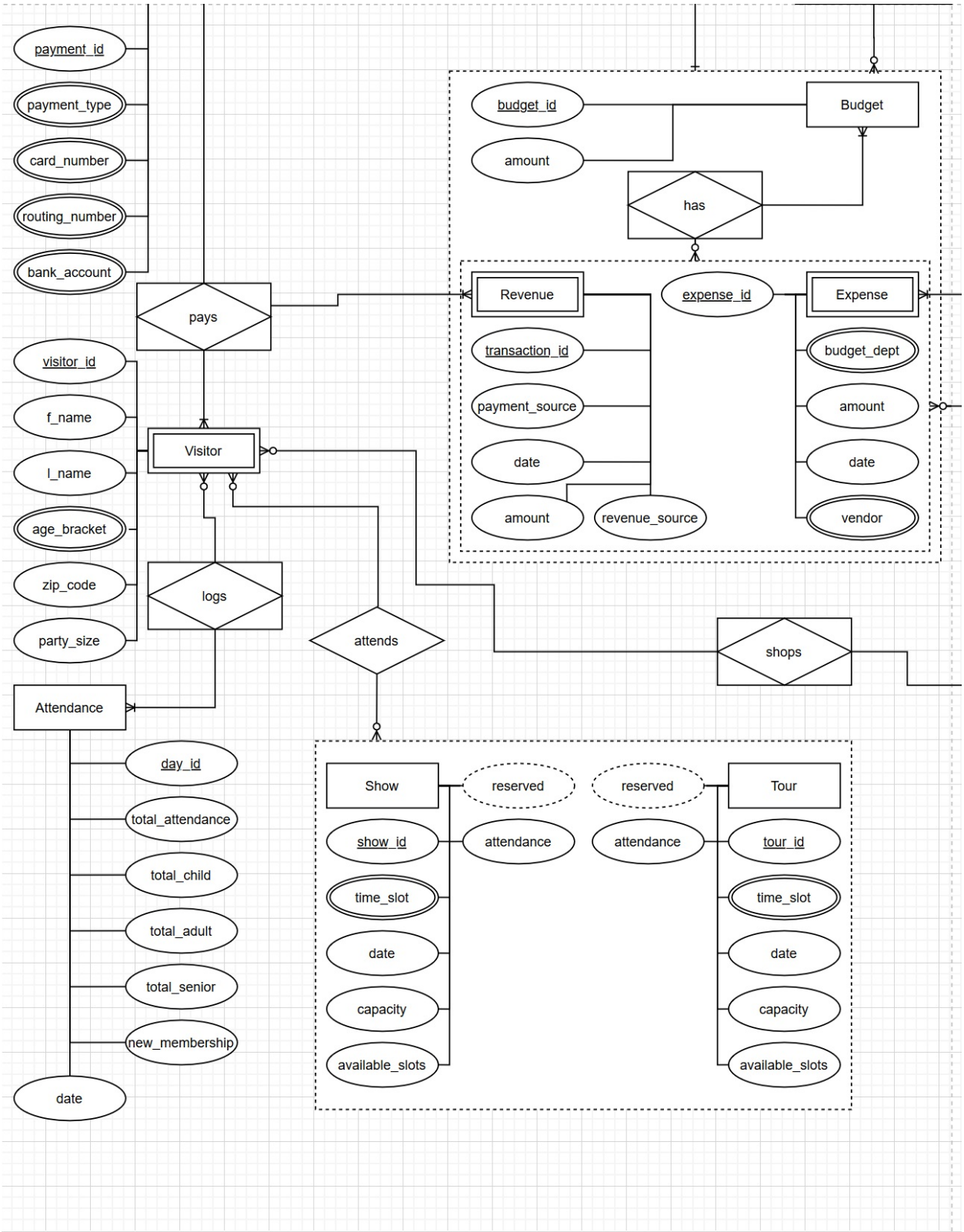
Accountant

ERD[0,1]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Visitor
logs
Attendance
day_id
total_attendance
total_child
total_adult
total_senior
new_membership
date
budget_id
amount
Budget
has
Revenue
transaction_id
payment_source
date
amount
revenue_source
expense_id
Expense
budget_dept
amount
date
vendor
attends
shops
Show
show_id
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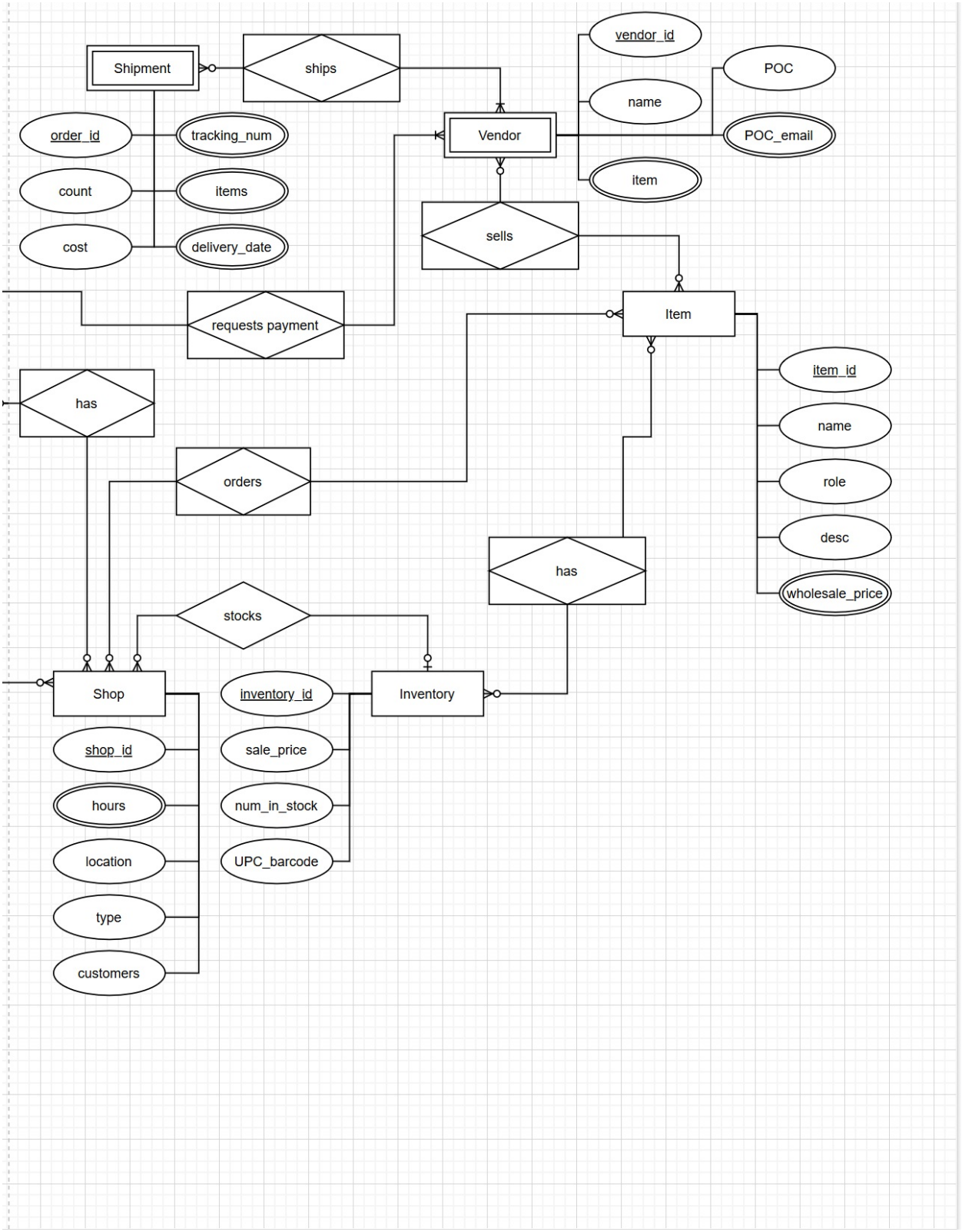
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name
order_id
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Vendor
POC_email
count
items
item
cost
delivery_date
sells
requests payment
Item
item_id
has
name
role
orders
desc
has
wholesale_price
stocks
Shop
inventory_id
Inventory
shop_id
sale_price
hours
num_in_stock
location
UPC_barcode
type
customers

Section 6: Testing Table

	Entity A	Relation	Entity B	Cardinality	Pass/Fail	Description
1.	User	Creates	Account	1 to 1	Pass	None
2.	User	Logs into	Account	1 to 1	Pass	None
3.	User	Has	Address/Phone No.	Aggregation	Pass	None
4.	Company	Has	Address/Phone No.	Aggregation	Fail	Needed to change company side of relationship to 0 or 1
5.	User	Has	Company	1 to 1	Fail	A user can be associated with 0 to many companies
6.	User	ISA	Member	1 to 1	Pass	None
7.	User	ISA	Employee	1 to 1	Pass	None
8.	Company	Employs	Employee	M to M	Pass	None
9.	Employee	Manages	Employee	Recursion	Pass	Employee is managed by another employee
10	Employee	ISA	Hourly Worker	1 to 1	Pass	None
11	Employee	ISA	Salary Worker	1 to 1	Pass	None
12	Employee	ISA	Veterinarian	1 to 1	Fail	Had 0 or 1 for relation but being a veterinarian relies on the existence of the employee
13	Employee	ISA	Trainer	1 to 1	Fail	Same as veterinarian
14	Employee	ISA	Zookeeper	1 to 1	Fail	Same as veterinarian
15	Employee	Checks out	Radio	1 to 1	Pass	None
16	Employee	Manages	Department	1 to M	Fail	Employee can manage more than one department, but a department can also have many managers
17	Executive	Oversees	Employee	1 to M	Pass	None
18	Executive	Oversees	Department	1 to 1	Pass	None
19	Member	Enrolls	Payment	M to M	Fail	Member payments should only pertain

						to a singular member not many
20	Payment	Pays	Revenue	M to M	Fail	Needed to change type of relation because of M to M relationship
21	Visitor	Pays	Revenue	M to M	Pass	Edited by last test
22	Attendance	Logs	Visitor	M to M	Fail	Needed to change relationship type
23	Visitor	Attends	Show/Tour	Aggregation	Pass	None
24	Visitor	Shops	Shop	M to M	Fail	Update relationship type to reflect M to M
25	Department	Has	Budget	1 to 1	Pass	None
26	Department	Has	Accountant	1 to M	Pass	None
27	Budget	Has	Rev./Exp.	Aggregation	Pass	None
28	Shop	Has	Rev./Exp.	Aggregation	Pass	None
29	Shop	Stocks	Inventory	M to 1	Pass	None
30	Shop	Orders	Item	M to M	Pass	None
31	Inventory	Has	Item	M to M	Pass	None
32	Vendor	Sells	Item	M to M	Pass	None
33	Vendor	Request Payment	Expense	M to M	Pass	None
34	Vendor	Ships	Shipment	M to M	Pass	None
35	Veterinarian	Cares	Animal	M to M	Pass	None
36	Trainer	Trains	Animal	M to M	Pass	None
37	Zookeeper	Maintain	Habitat	M to M	Fail	Needed to change both sides to 0 to M, the existence of the entity is not dependent on assignment by staff or vice versa

38	Zookeeper	Maintain	Area	M to M	Pass	Issue rectified during last test check
39	Animal	Has	Diet/Medicine	M to M	Pass	None
40	Animal	Has	Habitat	M to 1	Pass	None
41	Area	Contains	Habitat	M to M	Pass	None
42	Accountant	Manages	Budget	Aggregation	Fail	Needed to add forgotten relationship