CS 5200 Homework 1
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Q1) A runway has an airport name, a runway number, a latitude value, a longitude value, a length and a width. The combination of latitude and longitude uniquely identifies a runway. The combination of airport name and runway number is also guaranteed to be unique for each runway. (10 points)

Ans) Below are the entities' descriptions:

- **Airport**:
  - Attributes: airport_name (PK).
- **Runway**:
  - Attributes: runway_number, latitude, longitude, length, width.
  - Composite PK: {latitude, longitude}.
  - **Alternate Key:** {airport_name, runway_number}.

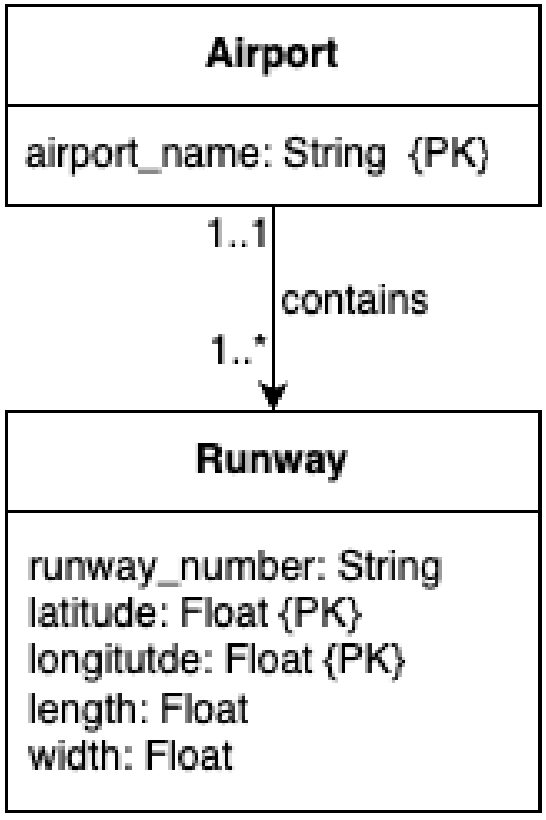


Image - 1

Q2) An airport has an airport name, an airport abbreviation, a city name, and a country name. The airport name as well as the airport abbreviation is guaranteed to be unique for each airport. An airport has many runways but a runway can be found at only one airport. A runway has a runway number, a latitude value, a longitude value, a length and a width. The combination of latitude and longitude uniquely identifies a runway. The combination of airport name and runway number is also guaranteed to be unique for each runway. (10 points)

Ans) Below are the entities' descriptions:

- **Airport**:
    - Attributes: airport_name (PK), abbreviation (AK), city, country.
- **Runway**:
    - Attributes: runway_number, latitude, longitude, length, width.
    - Composite PK: {latitude, longitude}.
    - Alternate Key: {airport_name, runway_number}.

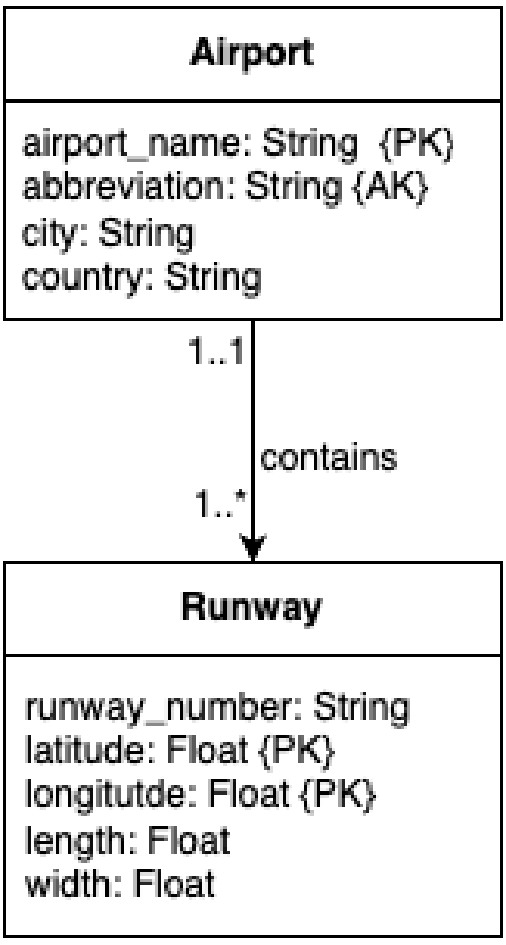


Image - 2

Q3) An airport has an airport name, an airport abbreviation, a city name, and a country name. The airport name as well as the airport abbreviation is guaranteed to be unique for each airport. An airport has many runways but a runway can be found at only one airport. An airport must have at least 1 runway. A runway has a runway number, a latitude value, a longitude value, a length and a width. An airplane lands on a runway on a specific date and time. An airplane can land on many runways, however at any point in time it can be on at most 1 runway. A runway can have many airplanes that land on it. For each airplane we track the unique airplane id, its model name and its last service date. (15 points)

Ans) Below are the entities' descriptions:

- **Airport**:
  - Attributes: airport_name (PK), abbreviation (AK), city, country.
- **Runway**:
  - Attributes: runway_number, latitude, longitude, length, width.
  - Composite PK: {latitude, longitude}.
  - Alternate Key: {airport_name, runway_number}.
- **Airplane**:
  - Attributes: airplane_id (PK), model_name, last_service_date.

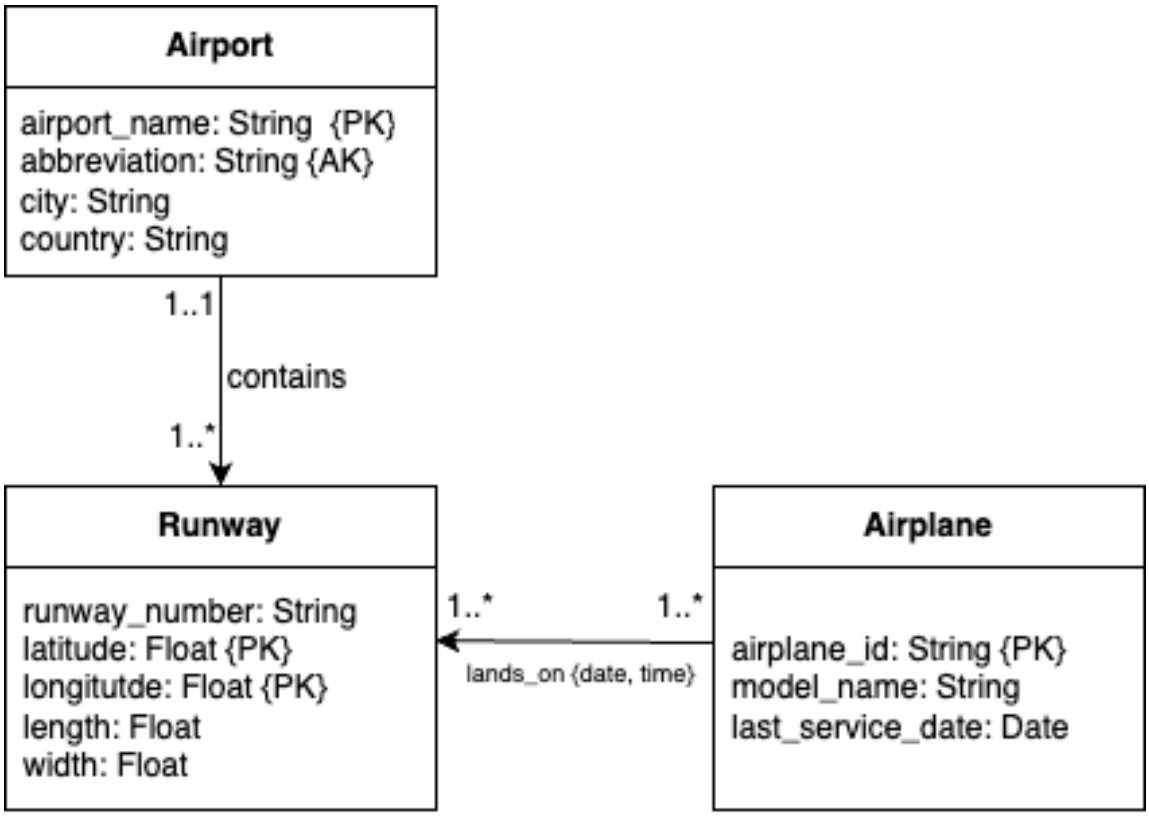


Image - 3

Q4) An airport has an airport name, an airport abbreviation, a city name, and a country name. The airport name as well as the airport abbreviation is guaranteed to be unique for each airport. An airport has many runways but a runway can be found at only one airport. An airport must have at least 1 runway. A runway has a runway number, a latitude value, a longitude value, a length and a width. An airplane lands on a runway on a specific date and time. An airplane can land on many runways, however at any point in time it can be on at most 1 runway. A runway can have many airplanes that land on it. For each airplane we track the unique airplane id, its model name and its last service date. An airplane belongs to an airline. An airline has a unique airline name, a unique airline abbreviation, a hub city and a hub country. (15 points)

Ans) Below are the entities' descriptions:

- **Airport**:
    - Attributes: airport_name (PK), abbreviation (AK), city, country.
- **Runway**:
    - Attributes: runway_number, latitude, longitude, length, width.
    - Composite PK: {latitude, longitude}.
    - Alternate Key: {airport_name, runway_number}.
- **Airplane**:
    - Attributes: airplane_id (PK), model_name, last_service_date.
- **Airline**:
    - Attributes: airline_name (PK), abbreviation (AK), hub_city, hub_country.

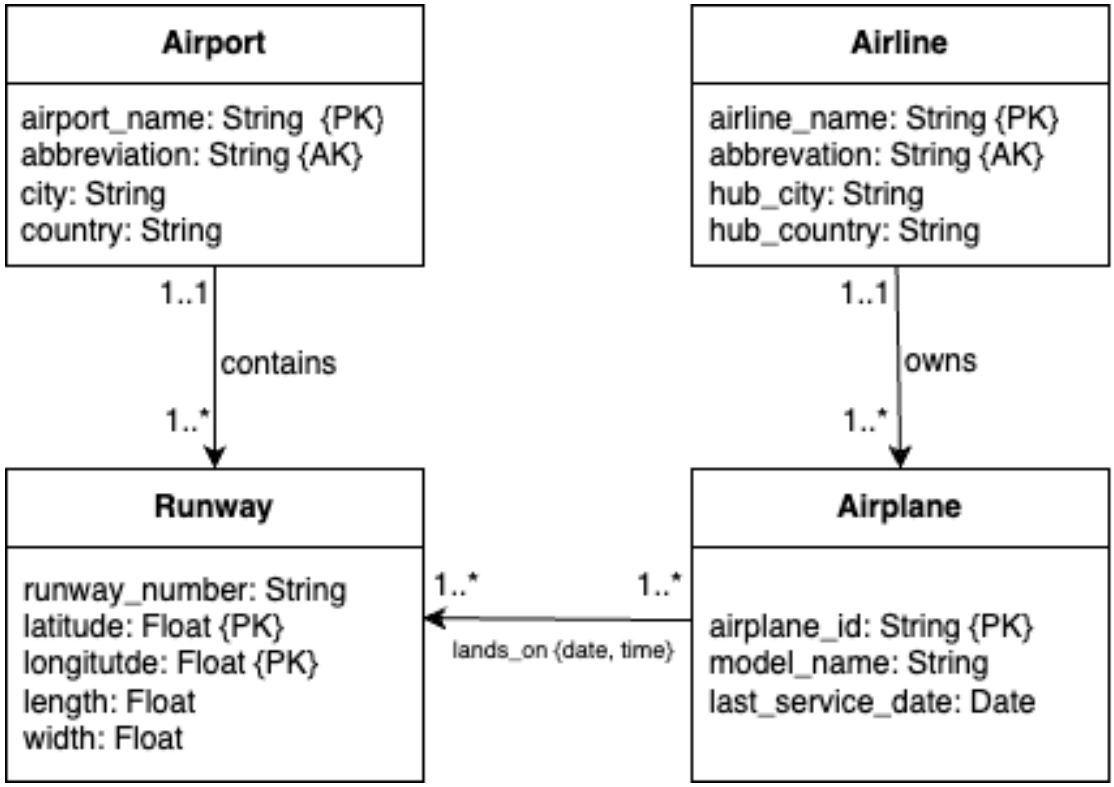


Image - 4

Q5) A website has a URL, a title, a last updated date and the creator's name of the website. A website is associated with 1 company and a company is associated with 1 to many websites. A company has a unique name, a business genre (such as financial, commercial, non-profit etc.), and an address that is composed of a street number, street name, town, state, zip code. For each company, we track the number of websites they have created. Each website has a collection of valid users. For each user, we track their user name, their password, their full name (first and last name) and their country of origin. A user is associated with 1 and only 1 website, the user name is only unique for that specific website. A website can have 0 to many users that are currently logged in. When a user logs into a website we track the date and time of the login. Since a user is associated with only 1 website, a user can be logged into 0 or 1 website. (15 points)

Ans) Below are the entities' descriptions:

- **Company**:
  - Attributes: name (PK), business_genre, address (composite).
- **Website**:
  - Attributes: url (PK), title, last_updated, creator_name.
- **User**:
  - Attributes: user_name (PK), password, full_name (composite), country_of_origin.
  - Composite PK: {url, username}

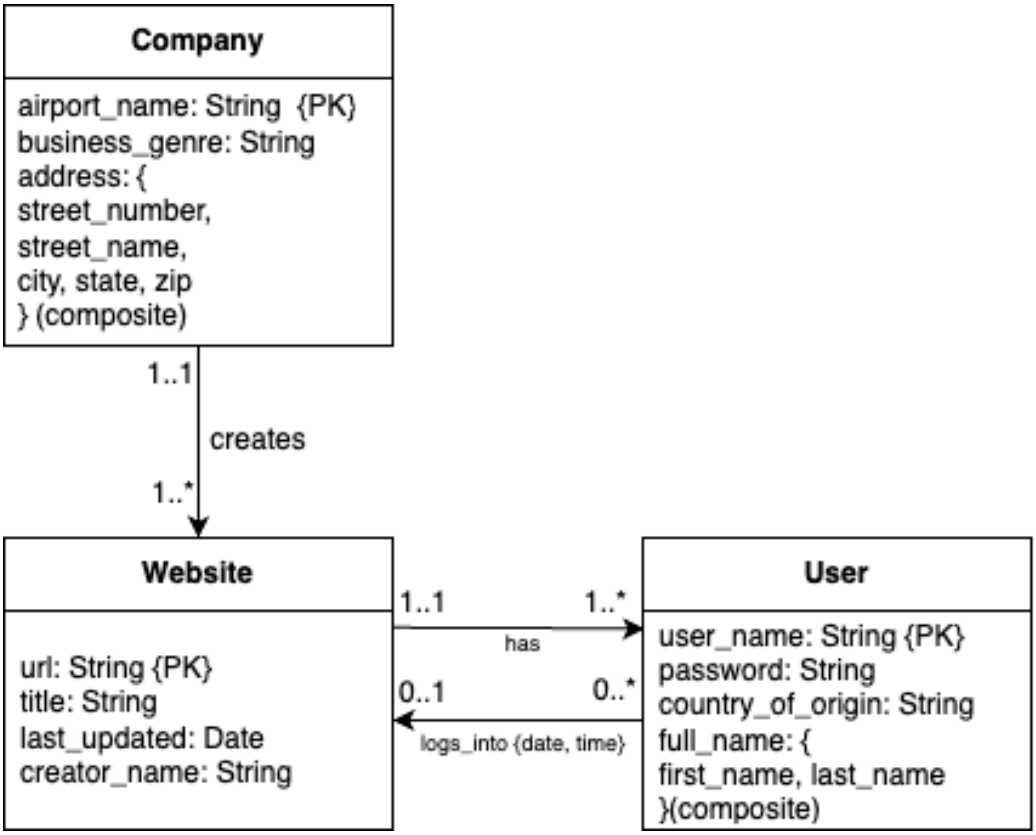


Image - 5

Q6) Create a conceptual design for the processes completed at ATM machines for a bank. For each ATM machine we track a unique ATM machine identifier, an address that is composed of a street number, street name, town, state, zip code and the date the ATM machine was last serviced. Customers of the bank have bank cards that can be used in ATM machines for completing transactions. For each customer we track the customer name (first and last), the customer's email address, the customer's address, that is composed of a street number, street name, town, state, zip code as well as the customer's telephone number. The customer's email is guaranteed to be unique for each customer, a customer's telephone number will also be unique. A customer may have 1 to many accounts and an account is associated with 1 customer. For each account, the bank tracks a unique account number, the current balance, as well as the type of account it is (checking or savings). The current balance is determined by the deposit, and withdrawal transactions on the account. A bank card has a unique id associated with it as well as a name. The name on the bank card may be different from the customer's name associated with the account. Each bank card is associated with 1 bank account. A bank account has 1 to many bank cards.

Customers can withdraw money from an account or deposit money to an account or view the current balance of an account. A customer uses a bank card to deposit money at an ATM machine. The bank card can be used 0 to many times by the customer when making a deposit. For each deposit, the bank tracks the amount of money deposited and the transaction date. A customer can also use their bank card to withdraw money. The bank card can be used 0 to many times by the customer when making money withdrawals from the account. For each withdrawal, the bank tracks the amount of money withdrawn and the transaction date. A customer can also use their bank card to view their current balance of an account. The bank card can be used 0 to many times by the customer when viewing account balances. An account balance can only be viewed with a specific bank card, but the viewing can occur at any ATM. (15 points)

Ans) Below are the entities' descriptions:

- **ATM Machine**:
    - Attributes: atm_id (PK), address (composite), last_serviced_date.
- **Customer**:
    - Attributes: phone_number (PK), email(AK), customer_name(composite), address(composite).
- **Bank Account**:
    - Attributes: account_number(PK), current_balance, type.
- **Bank card**:
    - Attributes: card_id, card_name.
- **Deposit/Withdrawal**:
    - Attributes: amout, transaction_date.

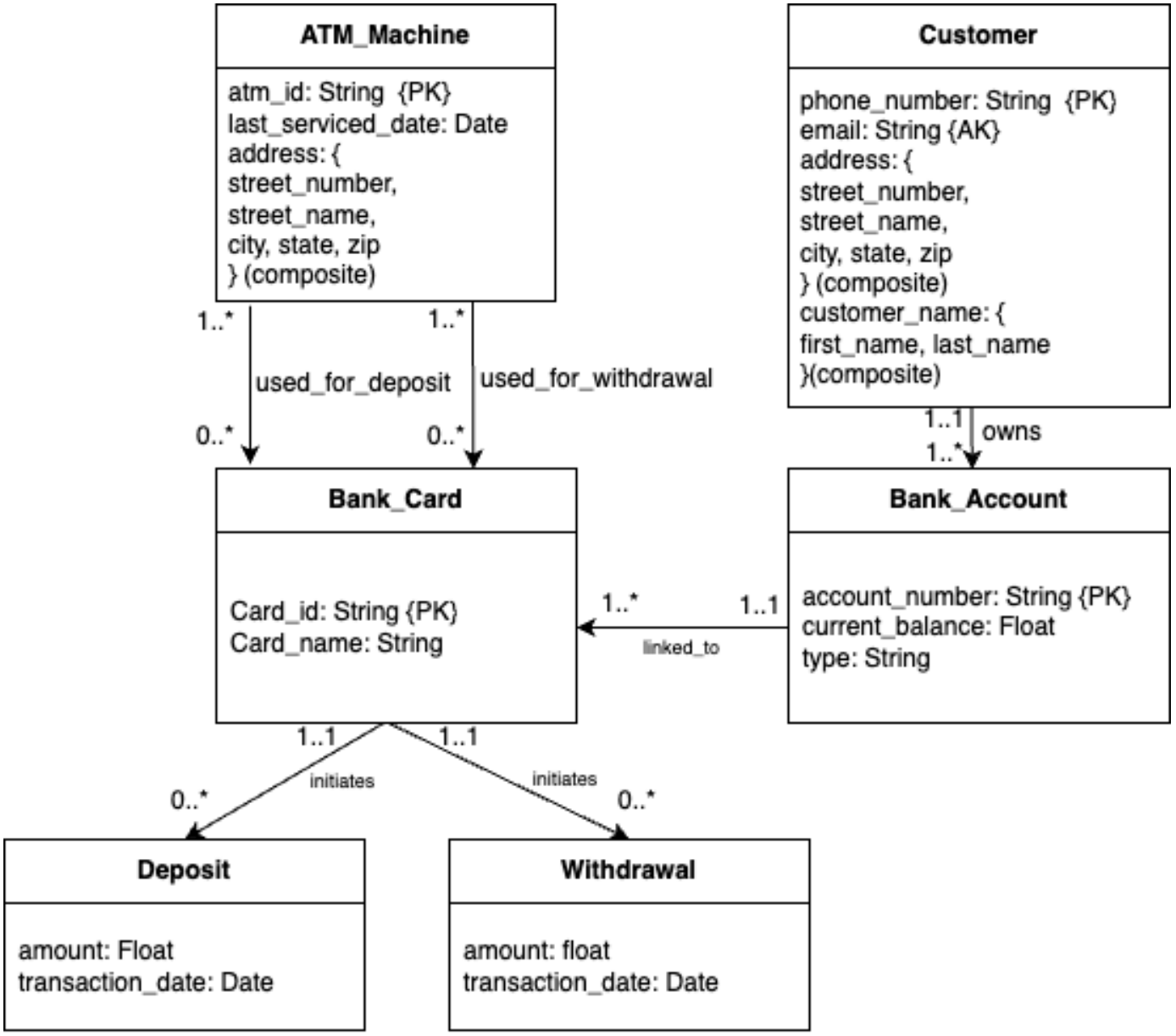

ATM_Machine
atm_id: String {PK}
last_serviced_date: Date
address: {
street_number,
street_name,
city, state, zip
} (composite)
Customer
phone_number: String {PK}
email: String {AK}
address: {
street_number,
street_name,
city, state, zip
} (composite)
customer_name: {
first_name, last_name
}(composite)
1..*
used_for_deposit
0..*
1..*
used_for_withdrawal
0..*
1..1
owns
1..*
Bank_Card
Card_id: String {PK}
Card_name: String
Bank_Account
account_number: String {PK}
current_balance: Float
type: String
1..*
linked_to
1..1
1..1
initiates
0..*
1..1
initiates
0..*
Deposit
amount: Float
transaction_date: Date
Withdrawal
amount: float
transaction_date: Date

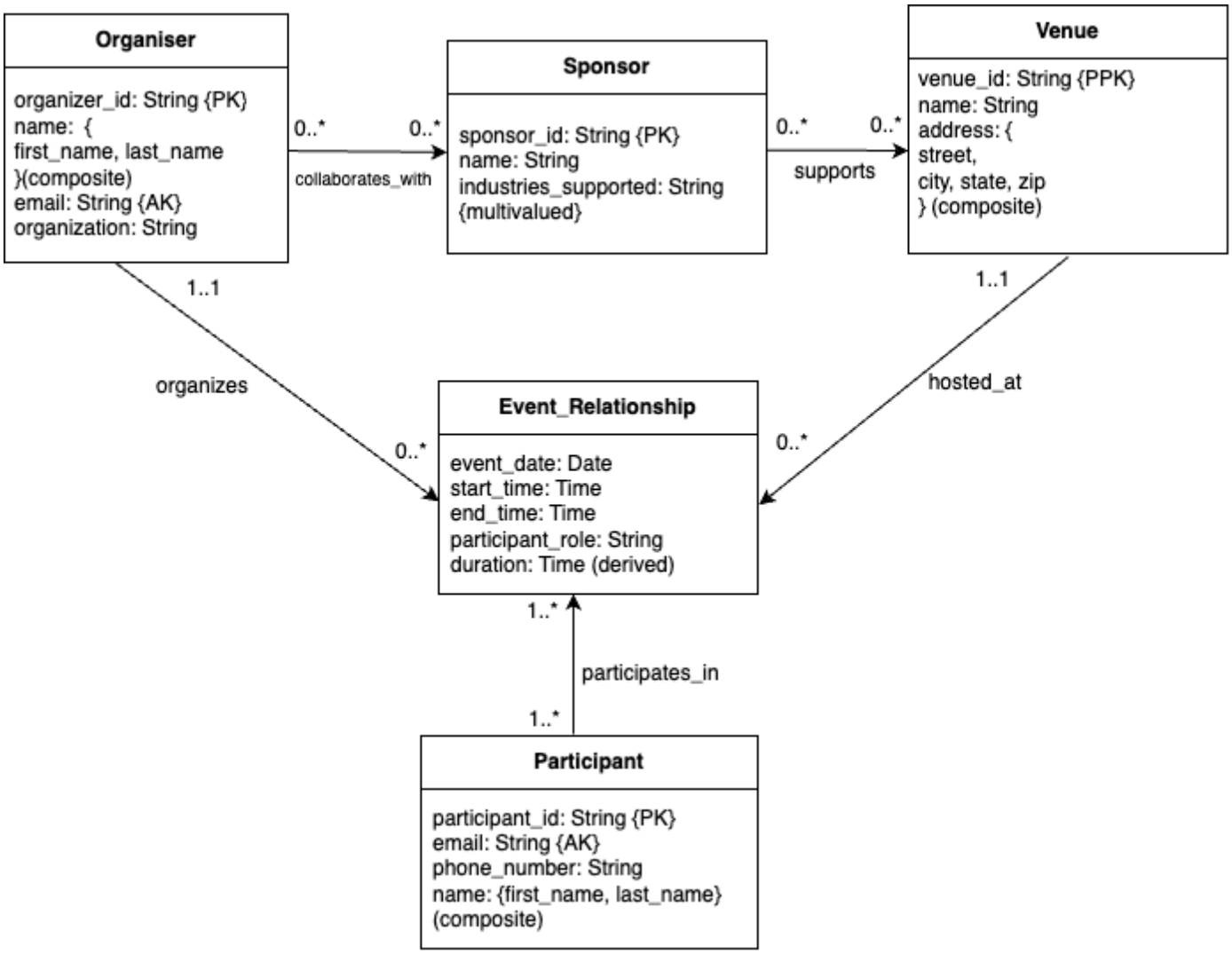
Image - 6

Q7) Create a conceptual design that requires at least 5 entities that each have at least 3 attributes. There should also be at least one ternary relationship and 3 binary relationships. Provide at least one weak entity, as well as a strong entity with an alternate key. There should be an example of a multivalued attribute, a composite attribute and a derived attribute as well. Provide a detailed textual description as well as a UML diagram. Your textual description must provide all of the necessary details to create your UML diagram, such as a description of the entities and attributes, as well as statements supporting the multiplicities for the relationships' entities. Your problem description must be different from the provided homework problems. (20 points)

Ans) This UML diagram is of an Event Management System where organizers plans an events at specific venues, participants attend these events, and sponsors provide funding. Each event is linked to a venue, involves multiple participants. Sponsors may collaborate with organizers or support venues. It includes a ternary relationship named as Event_Relationship linking Organizer, Participant, and Venue. Attributes include Participant.name as composite attribute, Sponsor.industries_supported as multivalued attribute, and Event_Relationship.duration as derived attirbute(end_time - start_time). The Venue entity is weak, relying on Event for identification.

Below are the entities' and attribute's descriptions:

- **Organizer**:
    - Attributes: oragnizer_id (PK), email (AK), name (composite), organization.
- **Participant**:
    - Attributes: participant_id (PK), email (AK), name (composite), phone_number.
- **Sponsor**:
    - Attributes: sponsor_id (PK), name, industries_supported (multivalued).
- **Event_Relationship (Ternary Relationship)**:
    - Attributes: event_date, start_time, end_time, duration(derived), participant_role.
- **Venue (Weak Entity)**:
    - Attributes: venue_id(ppk), name, address (composite).
    - Composite PK: (event_id, venue_id)


Organiser
organizer_id: String {PK}
name: {
first_name, last_name
}(composite)
email: String {AK}
organization: String
0..*
0..*
collaborates_with
Sponsor
sponsor_id: String {PK}
name: String
industries_supported: String
{multivalued}
0..*
0..*
supports
Venue
venue_id: String {PPK}
name: String
address: {
street,
city, state, zip
} (composite)
1..1
organizes
0..*
Event_Relationship
event_date: Date
start_time: Time
end_time: Time
participant_role: String
duration: Time (derived)
1..1
hosted_at
0..*
1..*
participates_in
1..*
Participant
participant_id: String {PK}
email: String {AK}
phone_number: String
name: {first_name, last_name}
(composite)

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