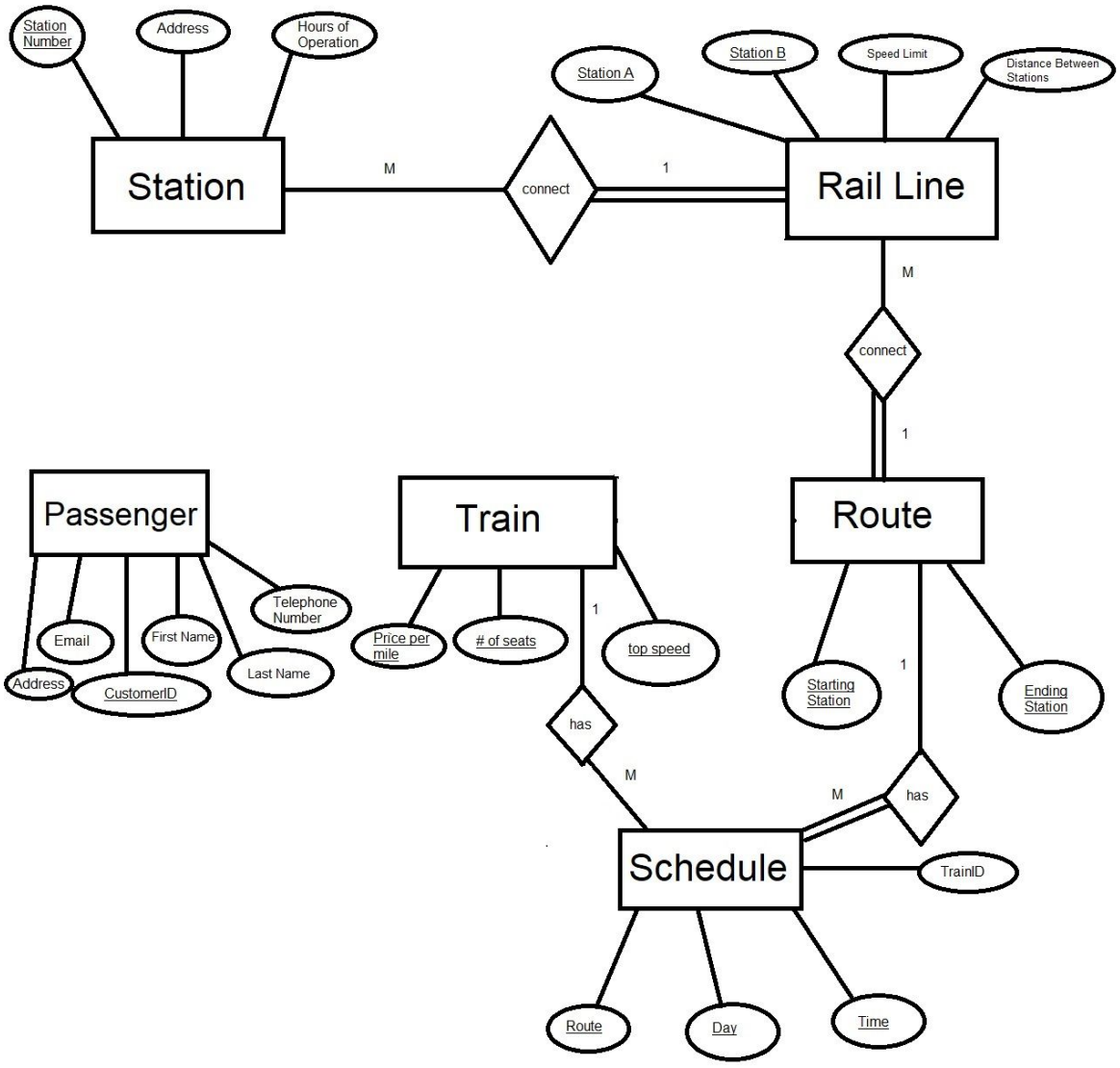
1. Refer to the ER diagram in ExpressRailwayERDiagram.jpeg if this image is unclear:



2. Transform the ER diagram from part 1 into relational schemas

Entities

Station(Station Number, Address, Hours of Operation)

Rail Line(Station A, Station B, Speed Limit, Distance Between Stations)

Route(Starting Rail Line, Ending Rail Line)

Train(Price Per Mile, # of seats, Top Speed)

Schedule(Route, Day, Time, TrainID)

Customer(CustomerID, First Name, Last Name, Email Address, Address, Telephone Number)

Relationships:

1. stations <connect> rail lines M:1, PARTIAL/TOTAL
2. route <connect> rail lines 1:M, TOTAL/PARTIAL (a route can use one or more rail lines)
3. trains<has> schedule 1:M, PARTIAL/PARTIAL
4. schedule<has>route M:1, TOTAL/PARTIAL

Relational Schema:

STATION(Station Number, Address, Hours of Operation)

RAIL_LINE(Station A, Station B, Speed Limit, Distance Between Stations, Station Number)
FK(Station A) -> STATION(Station Number)
FK(Station B) -> STATION(Station Number)

ROUTE(Starting Station, Ending Station)
FK(Starting Station) -> STATION(Station Number)
FK(Ending Station) -> STATION(Station Number)

TRAIN(Price Per Mile, # of seats, Top Speed)

SCHEDULE(Route, Day, Time, TrainID)
FK(TrainID)->TRAIN(Price Per Mile, # of seats, Top Speed)
FK(Route)->ROUTE(Starting Station, Ending Station)

CUSTOMER(CustomerID, First Name, Last Name, Email Address, Address, Telephone Number)

Assumptions:

- None of train's attributes are unique, so all 3 must be used as a key. Same goes for Schedule. We were considering making train a weak entity that refers to schedule as its primary key, but was unsure how this relation would hold
- Route is able to state the stations on the path and those station numbers included in its Path
- Customer does not interact directly with the system; therefore, it is a stand-alone entity/table. Maybe we will need another field for ticket if they are not interacting with the system because how we will know if they ordered a ticket?
- A route can use one or more rail lines (1:M) and any train can run on any route (M:N)

- Route only needs to track starting rail A and ending rail B. We could use code or a complex query to check if a train on a route would breach the “Each rail line can only be used by 1 train at a time.“ rule
- “TrainID” includes the primary key characteristics of a train: price per mile, # of seats, top speed. This potentially means we would need 3 fields total instead of just 1 (as I have shown in the diagram above) to store the train primary key
- Similarly, “Route” in Schedule’s entity includes the primary key characteristics of a route; starting rail line station, ending rail line station