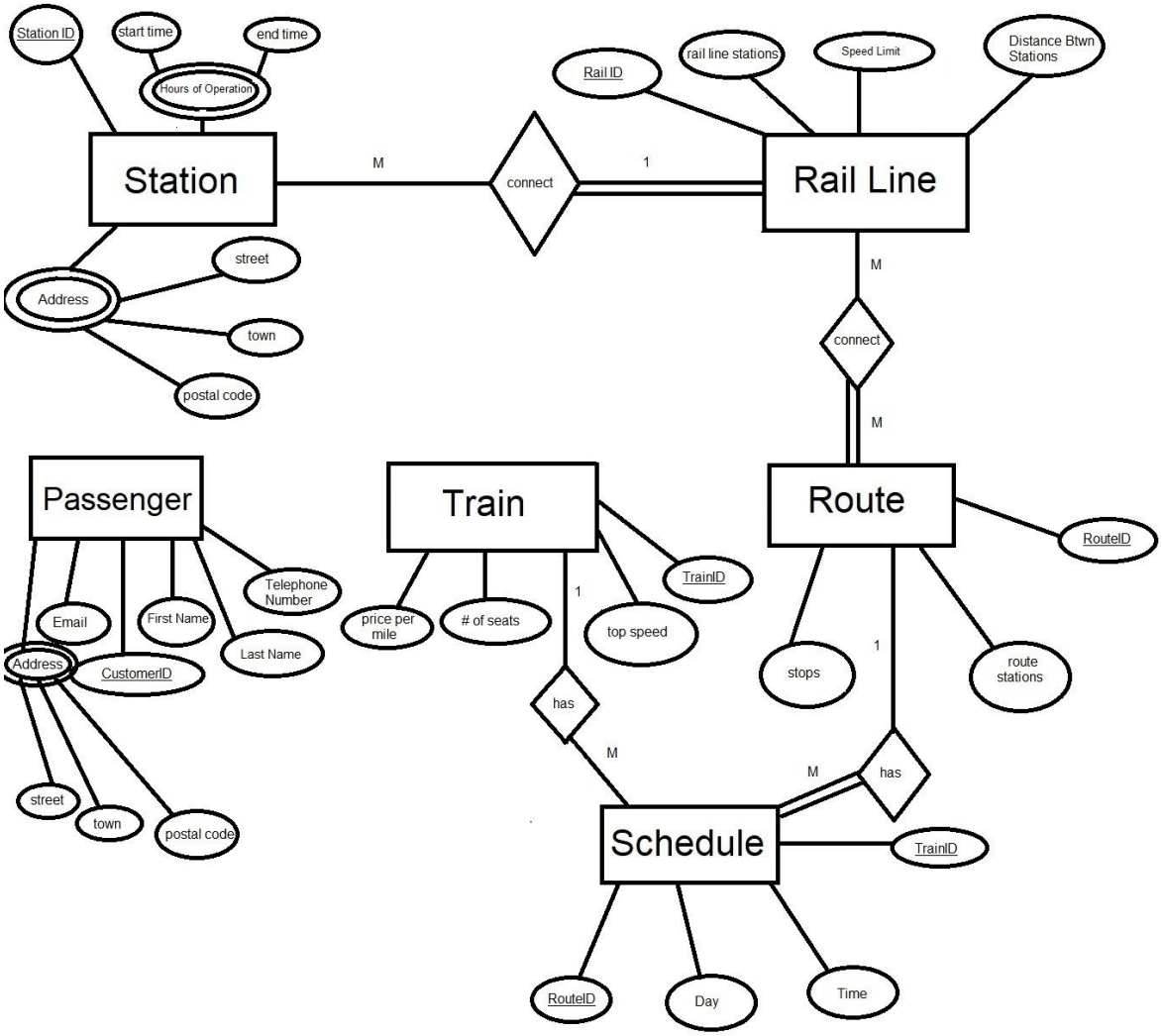
1. Refer to the ER diagram in ExpressRailwayERDiagram.jpeg if this image is unclear:



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

Entities

Station(StationID, Start Time, End Time, Street, Town, Postal Code)

Rail Line(RailID, Speed Limit)

Route(RouteID)

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

Schedule(RouteID, Day, Time, TrainID)

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

Additional Tables:

Route_Stations(RouteID, StationID)

Rail_Line_Stations(RailID, StationID, distance_between_stations)
Route_Stops(RouteID, StationID, Order)

***PLEASE NOTE: The **Route_Stations, Rail_Line_Stations, and Route_Stops** tables were added to maintain foreign key relationships for a list of stations. This may not be clear on the ER diagram; **distance_between_stations** is now stored in the **rail_line_stations** table. **Order** is stored in the route_stops table. *******The “stops”, “route stations”, and “rail line stations” circles on the ER diagram are now tables containing the above information.

Relationships:

1. stations <connect> rail lines M:1, PARTIAL/TOTAL
2. route <connect> rail lines M:M, TOTAL/PARTIAL (many routes can connect many rail lines)
3. trains<has> schedule 1:M, PARTIAL/PARTIAL
4. schedule<has>route M:1, TOTAL/PARTIAL

Relational Schema:

STATION(StationID, Address, Hours of Operation)

RAIL_LINE(RailID, Speed Limit)

ROUTE(RouteID)

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

SCHEDULE(RouteID, Day, Time, TrainID)
FK(TrainID)->TRAIN(TrainID)
FK(RouteID)->ROUTE(RouteID)

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

ROUTE_STATIONS(RouteID, StationID)
FK(StationID)->STATION(StationID)
FK(RouteID)->ROUTE(RouteID)

RAIL_LINE_STATIONS(RailID, StationID, distance_between_stations)
FK(RailID)->ROUTE(RailID)
FK(StationID)->STATION(StationID)

ROUTE_STOPS(RouteID, StationID, Order)

FK(StationID)->STATION(StationID)
FK(RouteID)->ROUTE(RouteID)

Assumptions:

- Customer does not interact directly with the system; therefore, it is a stand-alone entity/table.
- A route can connect any rail line (M:M). This is resolved through the addition of new tables Route_Stations, Rail_Line_Stations, and Route_Stops so that the stops and distance between stations can be easily queried and foreign references maintained. **We were unsure if this is the best way to do this; please let me know if this needs changed.**
- IDs are unique for each entity and assigned when inserted into the tables . A customer gets assigned a randomized, unique ID.