

Fiora Xu

Given the entities:

1. **Driver** (driver_id, name, contactInfo, basepay_id)
2. **Stops** (stop_id, route_id, stop_type)
3. **TimeTaken** (timeTaken_id, route_id, driver_id, date, totalTime)
4. **Route** (route_id, difficulty)
5. **AmountOfPackages** (stop_id, date, total_packages)
6. **BasePay** (basepay_id, base_rate, package_threshold, extra_rate_per_package)
7. **Performance**(performance_id, driver_id, date, stops_completed, packages_delivered, time_efficiency)
8. **Bonuses**(bonus_id, driver_id, date, reason, amount)

Functional Dependencies (FDs)

FDs for each entity:

1. Driver: driver_id \rightarrow name, contactInfo, basepay_id
2. Stops: stop_id \rightarrow route_id, stop_type
3. TimeTaken: timeTaken_id \rightarrow route_id, driver_id, date, totalTime
4. Route: route_id \rightarrow difficulty
5. AmountOfPackages: packages_id \rightarrow stop_id, date, total_packages
6. BasePay: basepay_id \rightarrow base_rate, package_threshold, extra_rate_per_package
7. Performance: performance_id \rightarrow driver_id, date, route_id, stops_completed, packages_delivered, time_efficiency
8. Bonuses: bonus_id \rightarrow driver_id, date, reason, amount

Relational Schema in BCNF

1. Driver(driver_id PK, name, contactInfo, basepay_id FK)
 - FD: driver_id \rightarrow name, contactInfo, basepay_id
 - All attributes are functionally dependent on the primary key, so it's in BCNF.
2. Stops(stop_id PK, route_id FK, stop_type)
 - FD: stop_id \rightarrow route_id, stop_type
 - In BCNF as stop_id is a superkey.
3. TimeTaken(timeTaken_id PK, route_id FK, driver_id FK, date, totalTime)
 - FD: timeTaken_id \rightarrow route_id, driver_id, date, totalTime

- timeTaken_id is a superkey, satisfying BCNF.
4. Route(route_id PK, difficulty)
 - FD: route_id \rightarrow difficulty
 - route_id is a superkey, so it's in BCNF.
 5. AmountOfPackages(packages_id PK, stop_id FK, date, total_packages)
 - FD: packages_id \rightarrow stop_id, date, total_packages
 - packages_id is a superkey, in BCNF.
 6. BasePay(basepay_id PK, base_rate, package_threshold, extra_rate_per_package)
 - FD: basepay_id \rightarrow base_rate, package_threshold, extra_rate_per_package
 - basepay_id is a superkey, so it's in BCNF.
 7. Performance(performance_id PK, driver_id FK, date, route_id FK, stops_completed, packages_delivered, time_efficiency)
 - FD: performance_id \rightarrow driver_id, date, route_id, stops_completed, packages_delivered, time_efficiency
 - performance_id is a superkey, in BCNF.
 8. Bonuses(bonus_id PK, driver_id FK, date, reason, amount)
 - FD: bonus_id \rightarrow driver_id, date, reason, amount
 - bonus_id is a superkey, in BCNF.

Relationships

Based on the relational schema and the functional dependencies provided, here are the relationships between the entities:

1. Driver to BasePay: One-to-One (1:1)
 - Each 'Driver' is assigned exactly one 'BasePay' through 'basepay_id'. Since 'basepay_id' is unique for each 'Driver', this forms a one-to-one relationship.
2. Driver to Performance: One-to-Many (1:N)
 - A 'Driver' can have multiple 'Performance' records over time, indicated by 'performance_id'. Each 'Performance' record is unique to a 'Driver' on a specific date, route, etc.
3. Driver to Bonuses: One-to-Many (1:N)

- A `Driver` can receive multiple `Bonuses`, as each `bonus_id` is unique and can be awarded to the `Driver` for various reasons on different dates.

4. Driver to TimeTaken: One-to-Many (1:N)

- A `Driver` can have multiple `TimeTaken` records, each representing the time taken for different routes on different dates.

5. Route to Stops: One-to-Many (1:N)

- A `Route` can have multiple `Stops`, as stops are parts of a route. Each `Stop` is uniquely identified and associated with a `Route`.

6. Route to TimeTaken: One-to-Many (1:N)

- A single `Route` can be associated with multiple `TimeTaken` records, as different drivers might take the same route on different dates.

7. Stop to AmountOfPackages: One-to-Many (1:N)

- A `Stop` can have multiple `AmountOfPackages` records, as the number of packages delivered can vary by date.

8. Route to Performance: One-to-Many (1:N)

- A `Route` can be associated with multiple `Performance` records through different drivers and dates.