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Assignemnt02 Normalization

1. **Pharmacy**(patient_id, patient_name, address, (Rx_num, trademark_name, generic_name, (filldate, num_refills_left), num_refills))

Functional Dependencies:

- patient_id ⟶ patient_name, address
- patient_id, Rx_num ⟶ trademark_name, generic_name
- Rx_num ⟶ num_refills
- Rx_num, filldate ⟶ num_refills_left

a. Is this relation in 1NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
No, this relation is not in 1NF. There are multiple non atomic attributes. One patient has multiple *Rx_num*, and one *Rx_num* has multiple *filldate.*

Schema(First Normal Form):
Pharmacy (Patient_id, patient_name, address, Rx_num, trademark_name, generic_name, Filldate, num_refills)

b. Is this relation in 2NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
Not quite, for the relation to be in 2NF all the non-prime attributes of the relation have to fully depend upon the entire primary key which there not.

Schema(Second Normal Form):
Patient (Patient_id, patient_name, address)
Recipe (Patient_id, Rx_num, trademark_name, generic_name)
Refill (Rx_num, num_refills)
RefDate (Rx_num, filldate, num_refills)

c. Is this relation in 3NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
Doing the 2NF was enough, as there is no transitive dependency

2. **Company**(EmpID, EmpName, EmpAddr, (ProjID, ProjName, MgrID, MgrName, HoursWorked))

Functional Dependencies:

- EmpID ⟶ EmpName, EmpAddr
- ProjID ⟶ ProjName, MgrID, MgrName
- EmpID, ProjID ⟶ HoursWorked
- MgrID ⟶ MgrName

a. Is this relation in 1NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
No, this relation is not in 1NF. There are multiple non atomic attributes. One employee can have multiple projects and have different managers for different projects.

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Schema (First Normal Form):
Company (EmpID, EmpName, EmpAddr, ProjID, ProjName, MgrID, MgrName, HoursWorked)

b. Is this relation in 2NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
No, to make this relation to be in 2NF all the non-prime attributes must fully depend upon the entire primary key, which in our relation they do not.

Schema (Second Normal Form):
Employee (EmpID, EmpName, EmpAddr, ProjID)
Projects (ProjID, ProjName, MgrName, MgrID)
Time (EmpID, ProjID, HoursWorked)
Supervisor (MgrID, MgrName)

c. Is this relation in 3NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
Doing the 2NF was enough, as there is no transitive dependency

3. **Property**(id, county, lotNum, lotArea, price, taxRate, (datePaid, amount))
Functional Dependencies:

- id ⟶ county, lotNum, lotArea, price, taxRate
- lotArea ⟶ price
- county ⟶ taxRate
- id, datePaid ⟶ amount

a. Is this relation in 1NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
No, in order to be in 1NF we need remove any repeating cell. We have many different datePaid for one property, which is a violation of 1NF. We need to find an appropriate primary key that will functionally determine all the other attributes.

Schema (First Normal Form):
Property (ID, country, lotNum, lotArea, price, taxRate, datePaid, amount)

b. Is this relation in 2NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
No, not yet. We need to create the attribute to depend upon the entire primary key ID not only a part. We can fix that by doing decomposition.

Schema (Second Normal Form):
Location(ID, country, lotNum, lotArea, price, taxRate)
Payment (ID, datePaid, amount,)

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c. Is this relation in 3NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
No, this relation is not in 3NF due to having non-prime (lotArea, country) attribute that are functionally dependent upon the primary key. To fix this, I looked at the functional dependencies and looked on the LHS for the attributes that are non-prime in the context of the correct relation. In this attribute -> lotArea, country

Schema (Third Normal Form):
Location (ID, country, lotNum, lotArea)
Payment (ID, datePaid, amount)
AreaPrice (lotArea, price)
TaxRate (country taxRate)

4. **StockExchange**(Company, Symbol, HQ, Date, ClosePrice)
Functional Dependencies:
   - Symbol, Date ⟶ Company, HQ, ClosePrice
   - Symbol ⟶ Company, HQ
   - Symbol ⟶ HQ

a. Is this relation in 1NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
Yes, the table looks right without multiple values in a single cell. One stock exchange per company. But, there isn't any keys available yet.

StockExchange (Company, Symbol, HQ, Date, ClosePrice)

b. Is this relation in 2NF? If not, write an explanation of why it isn't, then make the necessary change to fix it. But WITHOUT keys
No, the attributes need to depend upon the entire primary key not just part of the primary key. Need to identify keys!

Schema (Second Normal Form):
StockExchange (Company, Symbol, HQ, Date, ClosePrice)

c. Is this relation in 3NF? If not, write an explanation of why it isn't, then make the necessary change to fix it.
No, the relation is not in 3NF due to existing transitive dependencies. We need to use composition in order to address this violation.

Schema (Third Normal Form):
Info (Symbol, Date, Company, HQ, ClosePrice)
Logo (Company, HQ)
MainOffices (Symbol, HQ)

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