Project Name: Countries and International Affairs

1. **Functional Dependencies**
   1. Countries(countryCode, countryNumber, name, region, subregion, capital, factbookCode, generalInfo, climate, govType, economy)

*Minimal set of FD's is {countryCode → countryNumber,*

*countryCode → name,*

*countryCode → region,*

*countryCode → subregion,*

*countryCode → capital,*

*countryCode → factbookCode,*

*countryCode → generalInfo,*

*countryCode → climate,*

*countryCode → govType,*

*countryCode → economy,*

*countryNumber → countryCode,*

*countryNumber → name,*

*countryNumber → region,*

*countryNumber → subregion,*

*countryNumber → capital,*

*countryNumber → factbookCode,*

*countryNumber → generalInfo,*

*countryNumber → climate,*

*countryNumber → govType,*

*countryNumber → economy,*

*subregion → region,*

*factbookCode → countryCode,*

*factbookCode → countryNumber,*

*factbookCode → name,*

*factbookCode → region,*

*factbookCode → subregion,*

*factbookCode → capital,*

*factbookCode → generalInfo,*

*factbookCode → climate,*

*factbookCode → govType,*

*factbookCode → economy,*

*name → countryCode,*

*name → countryNumber,*

*name → factbookCode,*

*name → region,*

*name → subregion,*

*name → capital,*

*name → generalInfo,*

*name → climate,*

*name → govType,*

*name → economy}*

*name, countryCode, countryNumber, factbookCode are all keys. We included these because indifferent data resources(UN, Worldbank, CIA) use different key. They are not BCNF violations. The only BCNF violation is subregion→region. We will break it.*

* 1. Borders(countryCode, borderingCountryCode)

*No non-trivial functional dependencies.*

* 1. LanguagesSpoken(countryCode, language, percentPop)

*Minimal set of FD's is {countryCode, language → percentPop}*

* 1. WorldBankStats(countryCode, statType, year2005, year2006, year2007, year2008, year2009, year2010, year2011, year2012, year2013, year2014)

*Minimal set of FD's is {countryCode, statType → year2005,*

*countryCode, statType → year2006,*

*countryCode, statType → year2007,*

*countryCode, statType → year2008,*

*countryCode, statType → year2009,*

*countryCode, statType → year2010,*

*countryCode, statType → year2011,*

*countryCode, statType → year2012,*

*countryCode, statType → year2013,*

*countryCode, statType → year2014}*

* 1. Leaders(name, type, termStart, termEnd)

*Minimal set of FD's is {name, type → termStart, termEnd}*

* 1. LeaderOf(countryCode, leaderName)

*No non-trivial functional dependencies.*

* 1. Conflicts(conflictId, location, start, end)

*Minimal set of FD's is {conflictId → location, start, end}*

* 1. ConflictParties(conflictId, partyName, side, isCountry)

*Minimal set of FD's is {conflictId, partyName → side,*

*conflictId, partyName → isCountry,*

*PartyName → isCountry}*

* 1. TradesWith(countryCode, partnerCountryCode, type, total)

*Minimal set of FD's is {countryCode, partnerCountryCode → type,*

*countryCode, partnerCountryCode → total}*

* 1. Treaties(treatyNumber, name, dateEnforced, description, wikipage)

*Minimal set of FD's is {treatyNumber → name,*

*treatyNumber → dateEnforced,*

*treatyNumber → description,*

*treatyNumber → wikipage}*

* 1. TreatyParties(treatyNumber, treatyNumber)

*No non-trivial functional dependencies.*

* 1. Migrations(destCountry, origCountry, inYear, totalAmount)

*Minimal set of FD's is {destCountry, origCountry, inYear → totalAmount}*

1. **Normalize to BCNF**
   1. Countries can be normalized to 2 relations:

*a.1. Countries(countryCode, countryNumber, name, subregion, capital,*

*factbookCode, generalInfo, climate, govType, economy)*

*a.2. Regions(subregion, region)*

* 1. Borders is a*lready in BCNF.*
  2. LanguagesSpoken is *already in BCNF.*
  3. WorldBankStats is a*lready in BCNF.*
  4. Leaders is a*lready in BCNF.*
  5. LeaderOf is a*lready in BCNF.*
  6. Conflicts is a*lready in BCNF.*
  7. ConflictParties can be normalized to 2 relations:

*h.1. ConflictParties(conflictId, partyName,side)*

*h.2. Subregions(PartyName,isCountry)*

* 1. TradesWith is a*lready in BCNF.*
  2. Treaties is a*lready in BCNF.*
  3. TreatyParties is a*lready in BCNF.*
  4. Migrations is *already in BCNF.*

1. **Multivalued Dependencies**

There are no non-trivial MVD's. All the relations above are already in 4NF.