Data Base and Big Data Analytics – Data Base module

We want to create and query a database for managing mobile telephone companies, containing the following relations with corresponding information:

- Company: name, country.
- Plan: name, monthly cost, minutes included, GBs included. If minutes or GB is a negative number, it means “unlimited”. Phone numbers of different companies can have the same plan.
- User: name, surname, country.
- Phone number: number, number activation date. Each phone number is associated to a company, a user and a plan. Each phone number stores date plan activation date.

The resulting database schema can be structured as follows:

- Company (id, name, country)
- Plan (id, name, cost, minutes, gbs)
- User (id, name, surname, country)
- Phone (id, number, company_id, user_id, plan_id, number_activation_date, plan_activation_date)
  - FK: company_id → Company (id)
  - FK: user_id → User (id)
  - FK: plan_id → Plan (id)

Questions:

All queries must be implemented in SQL. Queries 2 and 3 must also be implemented in relational algebra. You can use as many views as you want.

1. Create the database schema, with referential integrity constraints. Fill the database with the provided data file.

2. Show users (name, surname) who have phone numbers with British companies. Each user should appear only once in the result.

3. Show Italian users (name, surname) who activated a phone number before 2015 (included) with companies whose country starts with “U”. Each user should appear only once in the result.

4. For each and all Italian companies, show their name and average number of phone numbers per user. You can count the sum of phone numbers of each company and the sum of users of each company, and divide the two amounts.

5. For each and all companies, compute the number of phones of that company that have plans with unlimited minutes or unlimited GBs.

6. Compute, for each and all companies (show the name), the average number of years for which a phone number has been active and the average number of years for which numbers have activated their current plan. The two results must be shown in the same row.