Problem 1.

Consider the following schemas for a Facebook-like social network. Note this is a simplified, and slightly different version from your last assignment.

User(user_id, first_name, last_name, year_of_birth, gender)
Education(institution, major, degree)
HasEdu(user_id, institution, major, degree, year)
Friendship(user_id, friend_id)
Photo(photo_id, caption, creation_time, album_id)
Album(album_id, title, privacy, cover_photo_id, owner_id)
Tags(photo_id, user_id, x, y, creation_time)

For each relation, the attribute(s) of the primary key is(are) underlined. In addition the following foreign key constraints hold:

In HasEdu, user_id is a foreign key that references User(user_id), and (institution, major, degree) are foreign keys that reference Education(institution), Education(major), Education(degree), respectively.

In Friendship, both user_id and friend_id are foreign keys that reference User(user_id)

In Photo, album_id is a foreign key that references Album(album_id)

In Album, cover_photo_id is a foreign key that references Photo(photo_id), and owner_id is a foreign key that references User(user_id)

In Tags, user_id is a foreign key that references User(user_id), and photo_id is a foreign key that references Photo(photo_id)

Write the following queries in Relational Algebra. Note “dsmith” is a unique user ID.

1. Print dsmith’s education history (institution, major, degree, year).
2. Print the names (first name, last name) of all dsmith’s friends.
3. Print all IDs of photos in which dsmith is tagged.
4. Print the owners (names) of photos in which dsmith is tagged.
5. Print the names of users who have no friends in the network.
6. Print the name of the oldest user.
7. Print the names of users who studied different subjects for their BS and MS degrees, and there is at least 10-year gap between the degrees.
8. Print the ID(s) of user(s), if any, who is(are) tagged in all dsmith’s photos.
9. Print the names of the institutions that no user in the network has attended.
10. Find the names of dsmith’s friends who attended the same college as him (for BS degree).