Student Name:_____

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CSCI3170 Introduction to Database Systems (Fall 2022) Assignment 2

Please answer the questions below and submit this sheet to the blackboard **_before 4 Nov 2022 23:59_**

Consider the following relation schema for a video sharing website:
User (<u>uID: integer</u>, uName: string, uAge: integer, uEmail: string)
Video (<u>vID: integer</u>, vTitle: string, vDuration: integer, vFormat: string)
Watch (<u>uID: integer, vID: integer</u>)
Company (<u>cID: integer</u>, cName: string)
Advertisement (<u>vID: integer, cID: integer,</u> aFee: integer)

The key fields are underlined, and the domain of each field is shown after the field name. In table _Advertisement_, the placement fee of each advertisement is represented by _aFee_ (in terms of million US dollars). Meanwhile, the _vDuration_ and _vFormat_ attributes in _Video_ refer to the length (in terms of minutes) and file format (in terms of file extension e.g. mp4, avi, mkv) of each video respectively.

Write the following queries in **relational algebra.**

1. Find the _uID(s)_ and _uName(s)_ of _User(s)_ who have watched at least one video longer than 30 minutes.
    Ans:
    $$\Pi_{uID,uName}(\sigma_{vDuration>30}(Video) \bowtie Watch \bowtie User)$$

2. Find the _uID(s)_ and _uName(s)_ of _User(s)_ who have watched at least one mp4 video with an advertisement from 'General Computer Inc'.
    Ans:
    $$\Pi_{uID,uName}\left(User \bowtie Watch \bowtie \sigma_{vFormat='mp4'}(Video) \bowtie Advertisement \right.$$
    $$\left. \bowtie \sigma_{cName='General\ Computer\ Inc'}(Company)\right)$$

3. Find the _uID(s)_ and _uName(s)_ of _User(s)_ who have watched at least one video entitled "Introduction to Java Programming" and at least one video entitled "Introduction to Oracle SQL Client".
    Ans:
    $$\rho\left(P1, \Pi_{uID,uName}\left(User \bowtie Watch \bowtie \sigma_{vTitle='Introduction\ to\ Java\ Programming'}(Video)\right)\right)$$
    $$\rho\left(P2, \Pi_{uID,uName}\left(User \bowtie Watch \bowtie \sigma_{vTitle='Introduction\ to\ Oracle\ SQL\ Client'}(Video)\right)\right)$$
    $$P1 - (P1 - P2) \text{ or } P2 - (P2 - P1) \text{ or } P1 \cap P2 \text{ or or } P2 \cap P1$$

4. Find the _vID(s)_ of non-mp4 _Video(s)_ which have advertisements with _aFee_ larger than 5 million dollars.
    Ans:
    $$\rho\left(R1, \Pi_{vID}(Video \bowtie \sigma_{aFee>5}(Advertisement))\right)$$
    $$\rho\left(R2, \Pi_{vID}\left(\sigma_{vFormat='mp4'}(Video)\right)\right)$$
    $$R1 - R2$$

5. Find the pair(s) of *uID(s)* of *User(s)* who have at least one watched-video in common and the first person is older than the second one.

   Ans:

   $\rho(P1, User \bowtie Watch)$

   $\rho(P2, User \bowtie Watch)$

   $\Pi_{P1.uID, P2.uID}(P1 \bowtie_{P1.vID=P2.vID \,\wedge\, P1.uAge>P2.uAge} P2)$

6. Find the *uID(s)* of the oldest *User(s)*.

   Ans:

   $\rho(R1, User)$

   $\rho(R2, User)$

   $\Pi_{uID}(User) - \Pi_{R2.uID}(R1 \bowtie_{R1.uAge>R2.uAge} R2)$

7. Find the *vID(s)* of *Video(s)* which have been watched by exactly two *Users*.

   Ans:

   $\rho(R1, Watch)$

   $\rho(R2, Watch)$

   $\rho(R3, Watch)$

   $\rho(R4, \sigma_{(R1.vID=R2.vID)\wedge(R1.uID \neq R2.uID)}(R1 \times R2))$

   $\rho(R5, \sigma_{(R1.vID=R2.vID)\wedge(R1.vID=R3.vID)\wedge(R2.vID=R3.vID)\wedge(R1.uID \neq R2.uID)\wedge(R1.uID \neq R3.uID)\wedge(R2.uID \neq R3.uID)}(R1 \times R2 \times R3))$

   $\Pi_{R1.vID}(R4) - \Pi_{R1.vID}(R5)$