Q1. Consider the following database schema:

\[ \text{Neighbors}(\text{name1}, \text{name2}, \text{duration}) \]
\[ \text{Colleagues}(\text{name1}, \text{name2}, \text{duration}) \]

Write a Relational Algebra Plan for the SQL query below.

\[
\begin{align*}
\text{SELECT DISTINCT } & \text{C1.name1, C2.name2} \\
\text{FROM Colleagues C1, Neighbors N, Colleagues C2} \\
\text{WHERE } & \text{C1.name2 = N.name1} \\
\text{AND } & \text{N.name2 = C2.name1} \\
\text{AND } & \text{C1.duration < 10} \\
\text{AND } & \text{C2.duration < 10} \\
\text{AND } & \text{N.duration > 100}
\end{align*}
\]

Q2. Consider the following relational schema:

\[ \text{R(A,B)} \]
\[ \text{S(C,D,E)} \]
\[ \text{T(F, H, G)} \]

Write a Relational Algebra Plan for the SQL query below.
Q3. Consider the following relational schema:

Users(uid, name)
Comment(uid, pid, score, txt)
Picture(pid, author, img)

(1) Write a Relational Algebra expression that is equivalent to the SQL query below:

SELECT distinct u.uid
FROM Users u, Picture x, Comment y
WHERE u.uid = x.author and x.pid = y.pid and y.score > 8
GROUP BY u.uid, x.pid
HAVING count(*) > 10

Solution: \( \Pi_{u.uid}(\sigma_{\text{cnt}>10}(\gamma_{u.uid=\text{cnt}(x)}(\sigma_{\text{score}>8}(\text{Users} \bowtie \text{Picture} \bowtie \text{Comment}))) ) \)
(2) Write a Relational Algebra expression that is equivalent to the SQL query below:

```sql
SELECT x.pid
FROM picture x
WHERE NOT EXISTS
(SELECT *
FROM comment y
WHERE x.pid = y.pid and y.score <5)
```

Solution: \(\Pi_{pid}(Picture) - \Pi_{pid}(\sigma_{score<5}(Comment))\)

(3) Consider the Relational Algebra expression below:

Write an equivalent SQL query without using any subqueries.

Solution:
```sql
select x.uid
from Users x, Comment y
where x.uid = y.uid and y.score < 3
  group by x.uid
having count(*) > 20
```