Task 2 (3 marks)
An objective of this task is to write implementation of the queries as the relational algebra expressions

Consider the following queries related to the relational tables included in `tpchr` sample database.

(1) Find the names of customers (`C_NAME`) who submitted at least one order in `2020` (`year(O_ORDERDATE)`).

(2) Find the keys of orders (`L_ORDERKEY`), that included both at least one `bolt` and at least one `screw` (`P_NAME`).

(3) Find the names of customers (`C_NAME`) who submitted no orders yet.

Write the implementations of the queries listed above as expressions of the relational algebra.

Save the relational algebra expressions implanting the queries listed above in a file `solution2.pdf`.

Deliverables
A file `solution2.pdf` that contains implementation of the queries listed above as the expressions of the relational algebra. The handwritten and scanned/photographed implementations of the queries are acceptable.

Solutions

(1) Find the names of customers (`C_NAME`) who submitted at least one order in `2020` (`year(O_ORDERDATE)`).

$$\pi_{c\_name}(\sigma_{year(o\_orderdate)\ =\ 2020}(CUSTOMER \bowtie_{c\_custkey\ =o\_custkey} ORDER))$$

(2) Find the keys of orders (`L_ORDERKEY`), that included both at least one `bolt` and at least one `screw` (`P_NAME`).

$$\pi_{l\_orderkey}(LINEITEM \bowtie_{l\_partkey\ =\ p\_partkey}(\sigma_{p\_name\ =\ 'bolt'}(PART))) \cap \pi_{l\_orderkey}(LINEITEM \bowtie_{l\_partkey\ =\ p\_partkey}(\sigma_{p\_name\ =\ 'screw'}(PART)))$$

(3) Find the names of customers (`C_NAME`) who submitted no orders yet.

$$\pi_{c\_name}((CUSTOMER\ ~_{c\_custkey\ =\ o\_custkey}\ ORDERS)$$

End of sample solution