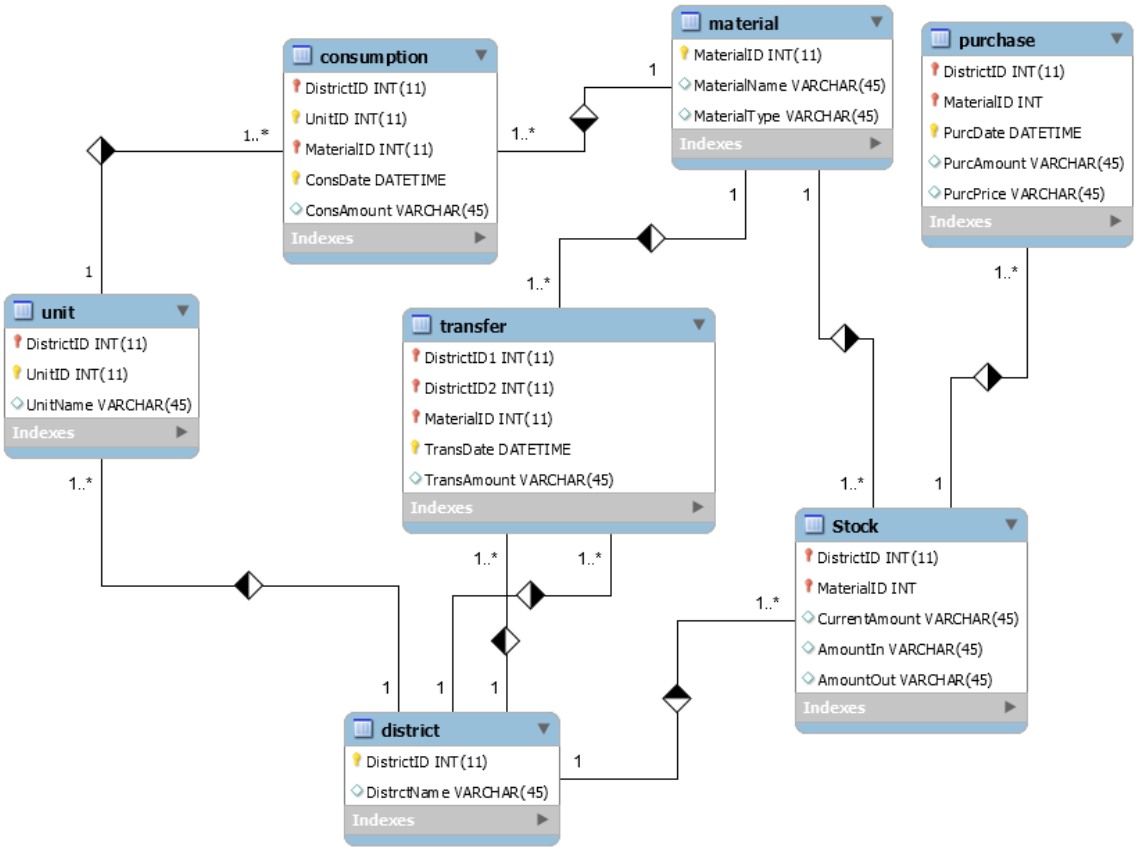
Quiz6 – Solutions

1. **Material(MaterialID, MaterialName, MaterialType)** (E / WE / R / DA)
   District(DistrictID, DistrictName) (E / WE / R / DA)
   Unit(DistrictID, UnitID, UnitName) (E / WE / R / DA)
   Stock(DistrictID, MaterialID, CurrentAmount, AmountIn, AmountOut) (E / WE / R / DA)
   Purchase(DistrictID, MaterialID, PurcDate, PurcAmount, UnitPrice) (E / WE / R / DA)
   Consumption(DistrictID, UnitID, MaterialID, ConsDate, ConsAmount) (E / WE / R / DA)
   Transfer(DistrictID1, DistrictID2, MaterialID, TransDate, TransAmount) (E / WE / R / DA)

a) Right answers are marked with red color.

b)



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2.

a) Write an appropriate question for the relational algebra below.

$$X1 \leftarrow \pi_{\text{DistrictID, MaterialID}} (\sigma_{(\text{TotalAmount}>0)}(\text{Stock}))$$

$$X2 \leftarrow \pi_{\text{MaterialID}} (\sigma_{(\text{MaterialType}=\text{“food”})}(\text{Material}))$$

$$X3 \leftarrow X1 \div X2$$

$$X4 \leftarrow \pi_{\text{DistrictName}} (\text{District} \bowtie X3)$$

Find Id and name of the materials whose current amount is zero in at least two different districts.

3. Using an SQL query, find the name of each district such that there exists at least one material (current amount of material is greater than zero) in its stock.

select DistrctName from District where DistrictID not in (select DistrictID from Stock where CurrentAmount=0)

4. Suppose you are given a relation R with four attributes ABCD. For each of the following sets of FDs, assuming those are the only dependencies that hold for R, do the following:

i. $A \rightarrow B, BC \rightarrow D, A \rightarrow C$
ii. $AB \rightarrow C, AB \rightarrow D, C \rightarrow A, D \rightarrow B$

a. Identify the candidate key(s) for R.

b. If R is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies.

a)

i. Candidate keys: A
ii. Candidate keys: AB, BC, CD, AD

b)

i. BC → D violates BCNF since BC does not contain a key. So we split up R as in: BCD, ABC.
ii. C → A and D → B both cause violations. So decompose into: AC, BCD but this does not preserve AB → C and AB → D, and BCD is still not BCNF because D → B. So we need to decompose further into: AC, BD, CD. However, when we attempt to revive the lost functional dependencies by adding ABC and ABD, we that these relations are not in BCNF form. Therefore, there is no BCNF decomposition.