COMS W4111: Database Systems
Homework 1

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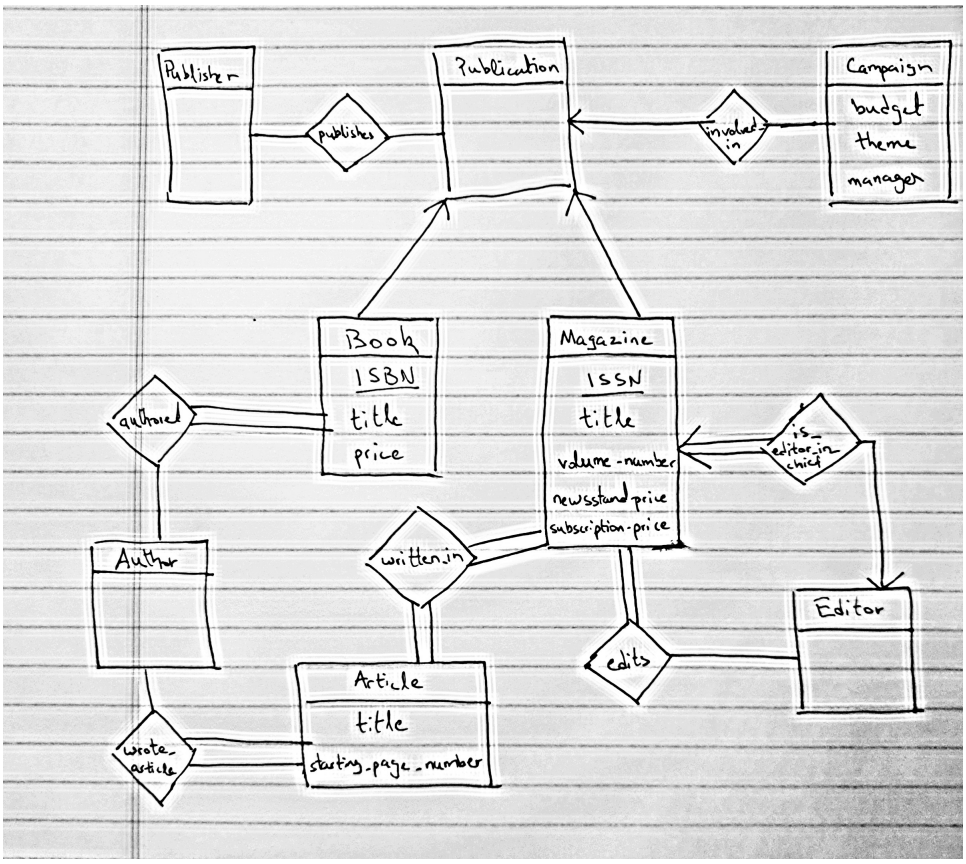
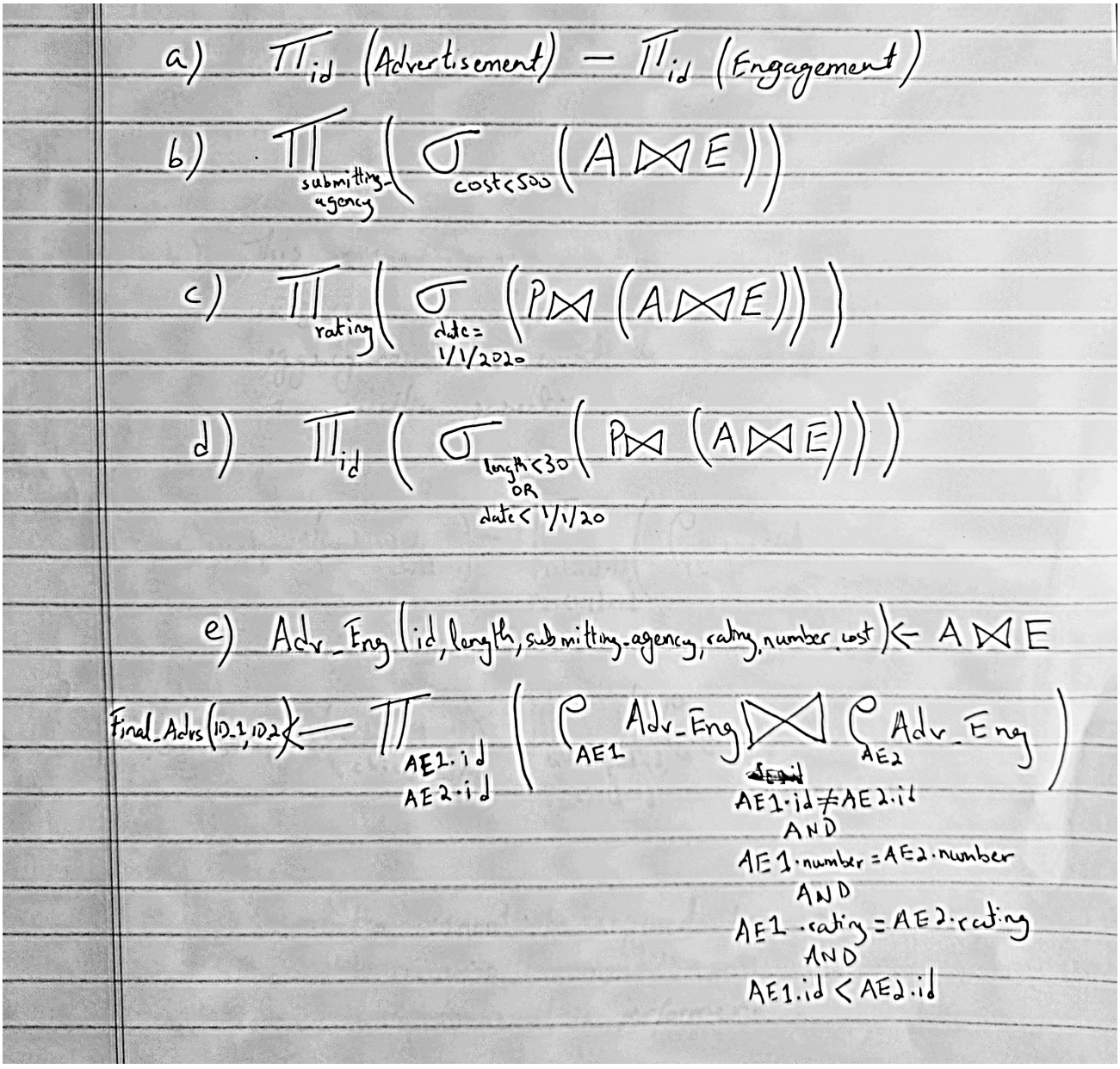
1. Creating such a model would have tremendous problems with scaling. The number of attributes E will end up having is probably very large. For each entity, most attributes will not be valid. This will lead to a large number of null values and, therefore, a lot of wasted storage.
   As for relationships, B and T will not be sufficient. There might be relationships in the database model which involve more than three relationships. Therefore we would need a relationship table with 4, 5, 6 entities and so on.
   As tables will grow so large, performing even simple operations on them will become very expensive. Given the non-intuitive nature of this model, writing queries will also become a much harder task for programmers.
   I do not think that the proposed design is simpler. Even though it seems to be so at first glance, it introduces a lot more complexities than it eliminates.

2. 

3. A product has a Model-Number and a category. A manufacturer has a name and an address. A product must be made by a single manufacturer. A manufacturer must make at least one product. Manufacturers can be owned by other manufacturers. In such a case, the subsidiary can have only one owner, while an owner can have multiple subsidiaries. A retailer has a name and an address. A product is sold by a retailer. A retailer must be selling at least one product. The product being sold by the retailer will have a price.

4.



5.

a) $\text{two-or-more-children}(\text{Parent-id}) \leftarrow \Pi_{P1.\text{Parent-id}}\left(\rho_{P1}\,\text{parent} \bowtie_{P1.\text{Parent-id} = P2.\text{Parent-id} \text{ AND } P1.\text{child-id} \neq P2.\text{child-id}} \rho_{P2}\,\text{parent}\right)$

b) This ~~expression~~ can relation cannot be expressed using relational algebra because we cannot use an aggregator to count the number of children for a specific parent.

c) $\text{grandparent}(\text{grandparent-id}, \text{child-id}) \leftarrow \Pi_{P1.\text{Parent-id}, P2.\text{Child-id}}\left(\rho_{P1}\,\text{parent} \bowtie_{P1.\text{child-id} = P2.\text{Parent-id}} \rho_{P2}\,\text{parent}\right)$

d) $\text{great-grandparent}(\text{Grandparent-id}, \text{child-id}) \leftarrow \Pi_{G.\text{Grandparent-id}, P.\text{child-id}}\left(\rho_{G}\,\text{grandparent} \bowtie_{G.\text{child-id} = P.\text{Parent-id}} \rho_{P}\,\text{parent}\right)$

e) This relation cannot be expressed because it would require a recursive computation with no bound on how many times it is performed.