Warmup #1

Given that the average seek time on a hard disk is 45 ms and rotates at the rate of 12000 rpm with 200 tracks, calculate the time needed to access all the data.

*Note:* Take average rotational latency into consideration and assume one entire track is read during one disk rotation

Warmup #2

Consider the following set of functional dependencies $F$ for schema $R = (A, B, C, D, E)$:

$$
F = \{ \\
AD \rightarrow BC \\
AC \rightarrow E \\
B \rightarrow D \\
E \rightarrow D \\
\}
$$

Write a schema in BCNF for relation $R$ if one such exists. State whether your schema is dependency preserving. If not, explain why it is not.
Problem 3 (To Be Graded)

Consider the following sample database for a retailer:

- regions(id, zip_code_served)
- customers(id, status, street, city, region_id, cc_number)
- orders(id, customer_id, total, qty)
- order_items(order_id, item_id, qty)
- items(id, price)

Where:

- cc_number is a credit card number, which is used by the customer for payments.
- region_id is a region that serves the customer.

Let’s assume that the database was set up using where the architect was aware of BCNF and ensured the relationship was in BCNF.

1. List all of the nontrivial functional dependencies that you can infer from these relations.

Now assume that they want to change some of the requirements to give their customers greater flexibility. They decide that they want to allow for multiple credit cards and addresses per customer.

2. Does this requirement change any functional dependencies? Is the schema above still in BCNF? You do not have to prove it, but if it is not then provide a decomposition that is.

Assume the following new requirement: every region serves different zip areas, but a zip area may be served only by a single region.

3. Does this requirement bring any new functional dependencies? Is the schema still in BCNF? You do not have to prove it, but if it is not then provide a decomposition that is.
Problem 4 (To Be Graded)

Intel has been stating that a new technology is coming around called "Non volatile memory". The main idea of this technology is that it would have the speed of main memory but will not be volatile. Said another way it will not lose its value when power is turned off. In the wake of this arrival, write 1-2 sentences about how the database memory stack would change with the following properties of non volatile memory.
1) Price per bit is the same as cache, but has the same speed as main memory.
2) Price per bit is the same as flash storage, and has the same speed as main memory.