ER Problem

Draw ER diagrams for each of the following:

1. **Doctor-patient**: Patients are identified by an SSN, and their names, addresses, and ages must be recorded. Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded. Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs (identified by trade name and formula) for several patients, and a patient could obtain prescriptions from several doctors. Each prescription has a date and a quantity associated with it. You can assume that, if a doctor prescribes the same drug for the same patient more than once, only the last such prescription needs to be stored. Every patient has a primary physician. Every doctor has at least one patient.

2. **Drug-pharma company**: Each pharmaceutical company is identified by name and has a phone number. For each drug, the trade name and formula must be recorded. Each drug is sold by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. If a pharmaceutical company is deleted, you need not keep track of its products any longer.

3. **Pharmacy-drug**: Each pharmacy has a name, address, and phone number. Each pharmacy sells several drugs and has a price for each. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another.

4. **Pharmacy-pharma company**: Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each contract, you have to store a start date, an end date, and the text of the contract. Pharmacies appoint a supervisor for each contract. There must always be a supervisor for each contract, but the contract supervisor can change over the lifetime of the contract.

(only major attributes are shown)
1. Consider a relation $R$ with five attributes ABCDE. You are given the following dependencies: $A \rightarrow B$, $BC \rightarrow E$, and $ED \rightarrow A$.

   (a) List all keys for $R$.
      i. $CDE$, $ACD$, $BCD$

   (b) Is $R$ in 3NF?
      i. $R$ is in 3NF because $B$, $E$ and $A$ are all parts of keys

   (c) Is $R$ in BCNF?
      i. $R$ is not in BCNF because none of $A$, $BC$ and $ED$ contain a key

2. Consider the relation schema $R(A,B,C)$, which has the FD $B \rightarrow C$. If $A$ is a candidate key for $R$, is it possible for $R$ to be in BCNF? If so, under what conditions? If not, explain why not.

   (a) The only way $R$ could be in BCNF is if $B$ is a key for $R$

3. Consider the relation schema $R(A,B,C,D,E)$, which has FDs $A \rightarrow B$, $C \rightarrow D$. Check if $R$ is in BCNF? If not, decompose it into BCNF?

   (a) BCNF decomposition: $AB$, $CD$, $ACE$. 