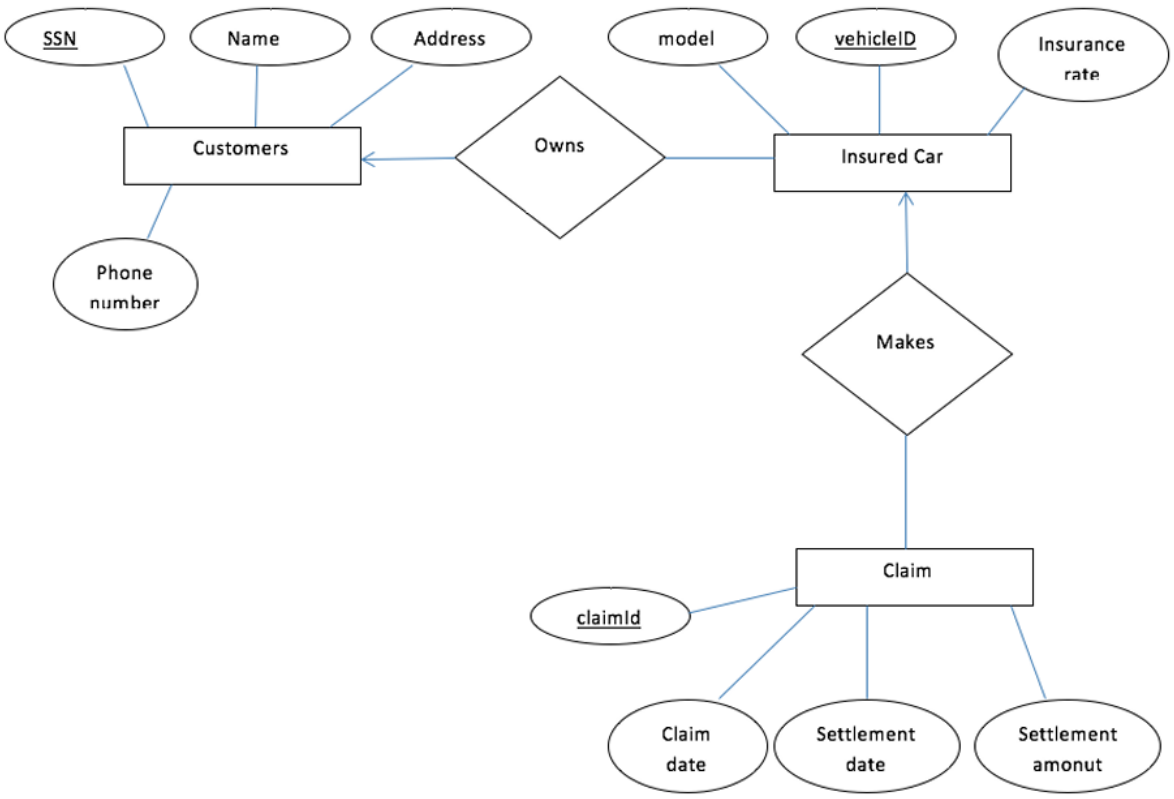
Tutorial 3.1 Solution

1. You are to design a database for an insurance company. The data will include:

   - Information about customers (SSN, name, address and phone number)
   - Information about insured cars (model, vehicleID and insurance rate)
   - Information about claims made on insured cars (claimID, claim date, settlement date and amount of settlement)
   - An insured car can have multiple insurance claims
   - You may assume that all insured cars are owned by a single customer, but you should allow a customer to own several cars

   Specify an E/R design for your database. Please state any additional assumptions you make in your design. Don't forget to underline key attributes for entity sets and include arrowheads indicating the multiplicity of relationship sets. If there are weak entity sets or "is-a" relationships, make sure to notate them appropriately.



Armstrong's Axioms

Derive the following rules using Armstrong's axioms:

1. Combining rule: $X \to Y, X \to Z \implies X \to YZ$

$X \to Y \implies XZ \to YZ$ (augmentation rule)
$X \to Z \implies X \to XZ$ (augmentation rule)
$\therefore X \to YZ$ (transitivity rule)

2. Splitting rule: $X \to YZ \implies X \to Y$

$X \to YZ$
$YZ \to Y$ (reflexivity rule)
$\therefore X \to Y$ (transitivity rule)

Functional Dependencies

Consider a relation $R(A, B, C, D, E)$ with the following functional dependencies:

$AB \to C$ $(AB)^+ = ABCDE$ ∴ CK
$BC \to D$ $(BC)^+ = BCDEA$ ∴ CK
$CD \to E$ $(CD)^+ = CDEA$
$DE \to A$

1. Specify all minimal keys for R among the following: $\{AB, BC, CD, ED, \overline{ABD}, BDE, \overline{BCE}\}$.

$(ED)^+ = EDA$
$(ABD)^+ = ABDCE$

AB, BC, BDE

ABD, and BCE are not considered as minimal key as their subset AB, BC are already in the candidate key (CK) list