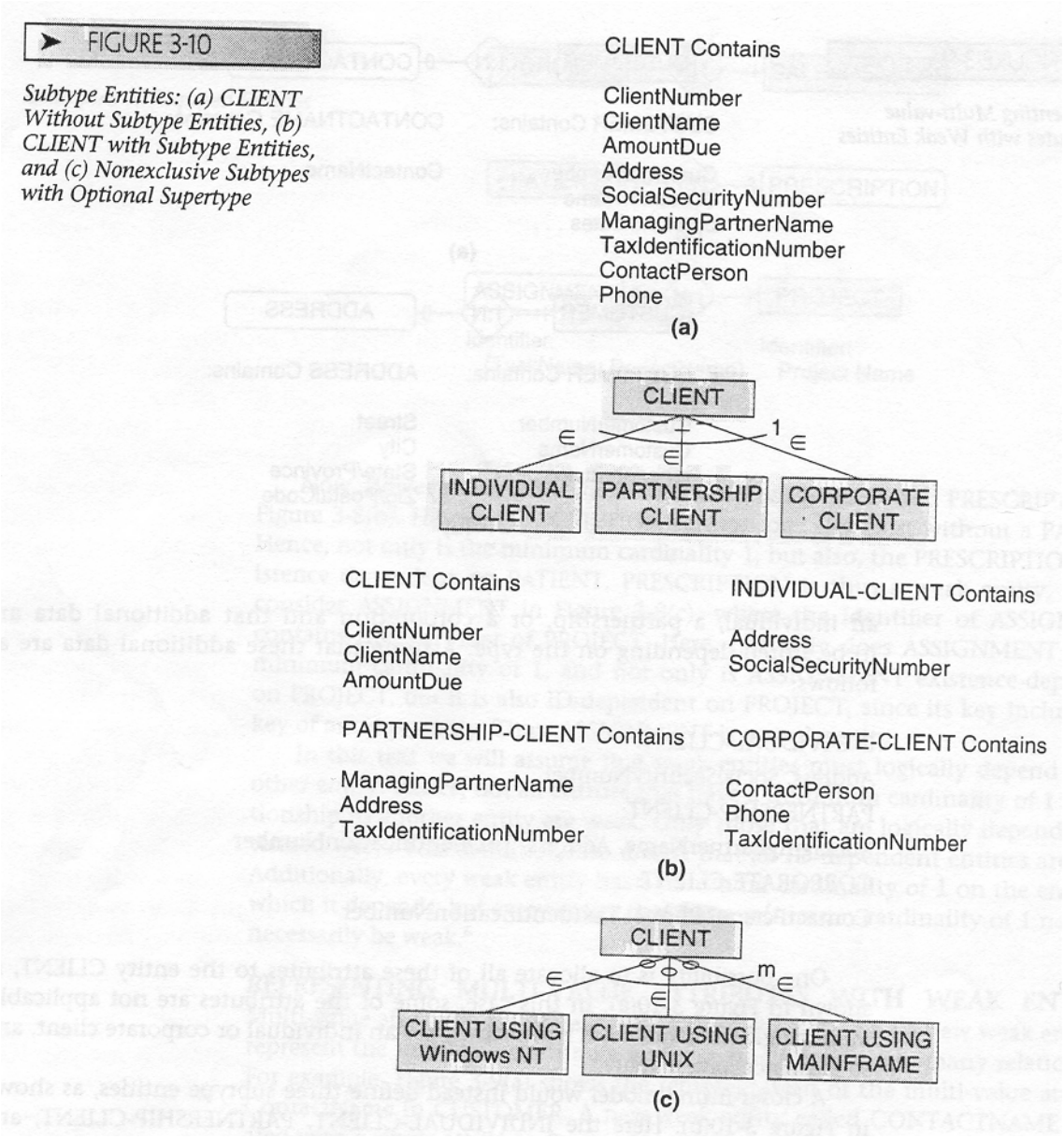
Some entities contain optional sets of attributes; these entities are often representes using **subtypes**. Consider, for example, CLIENT, with attributes ClientNumber, ClientName, and AmountDue. Suppose that a CLIENT can be an individual, a partnership, or a corporation and that additional data are to be stored depending on the type. Assume that these additional data are as follows:

INDIVIDUAL-CLIENT:
Address, SocialSecurityNumber
PARTNERSHIP-CLIENT:
ManagingPartnerName, Address, TaxIdentificationNumber
CORPORATE-CLIENT:
ContactPerson, Phone, TaxIdentificationNUmber

➤ FIGURE 3-10

Subtype Entities: (a) CLIENT Without Subtype Entities, (b) CLIENT with Subtype Entities, and (c) Nonexclusive Subtypes with Optional Supertype



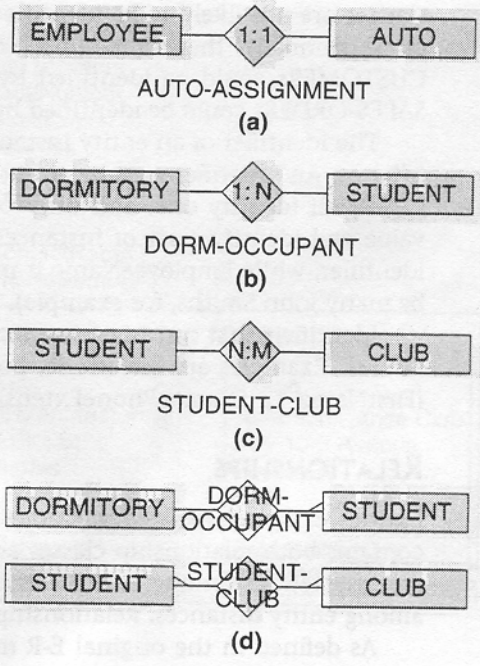
One possibility is to allocate all these attributes to the entity CLIENT, as shown in **Figure 3-10(a)** . In this case some of the attributes are not applicable. ManagingPartnerName has no meaning for an individual or corporate client, and so it cannot have a value.
A closer-fitting model would instead define three subtype entities, as shown in **Figure 3-10(b)**. Here the INDIVIDUAL-CLIENT, PARTNERSHIP-CLIENT, and CORPORATE-CLIENT entities are shown as **subtypes** of CLIENT. CLIENT, in turn, is a **subtype** of the INDIVIDUAL-CLIENT, PARTNERSHIP-CLIENT, and CORPORATE-CLIENT entities.

The ∈ next to the relationship lines indicates that INDIVIDUAL-CLIENT, PARTNERSHIP-CLIENT, and CORPORATE-CLIENT are subtypes of CLIENT. Each subtype entity must belong to the supertype CLIENT. The curved line with a 1 next to it indicates that a CLIENT entity must belong to one, and only one, subtype. It means that the subtypes are exclusive and that one of them is reqired.
Subtypes are not always mutually exclusive, however, nor are they always required. **Figure 3-10©** shows the CLIENT-USING subtypes within CLIENT. The *m* indicates that CLIENT may belong to from zero to many CLIENT_USING subtypes.

Structures of subtypes and subtypes are sometimes called **generalization hierarchies** because CLIENT is a generalization of the three subtypes. Sometimes, too, this relationship type is called an **IS-A relationship,** since, in **Figure3-10(b)** INDIVIDUAL-CLIENT *is a* CLIENT, just as PARTNERSHIP-CLIENT and CORPORATE-CLIENT also are CLIENTs.
Entities with an *IS-A* relationship should have the same identifier since they represent different aspects of the same thing. In this case, that identifier is Client Number. Contrast this situation with the HAS-A relationships shown in the following **figure**.

➤ FIGURE 3-3

Three Types of Binary Relationships: (a) 1:1 Binary Relationship, (b) 1:N Binary Relationship, (c) N:M Binary Relationship, and (d) Relationship Representation with Crow's Feet



Generalization hierarchies have a special characteristic called **inheritence,** which means that the entities in subtypes inherit attributes of the subtype entity class. PARTNERSHIP-CLIENT, for example, inherits ClientName and AmountDue from CLIENT.