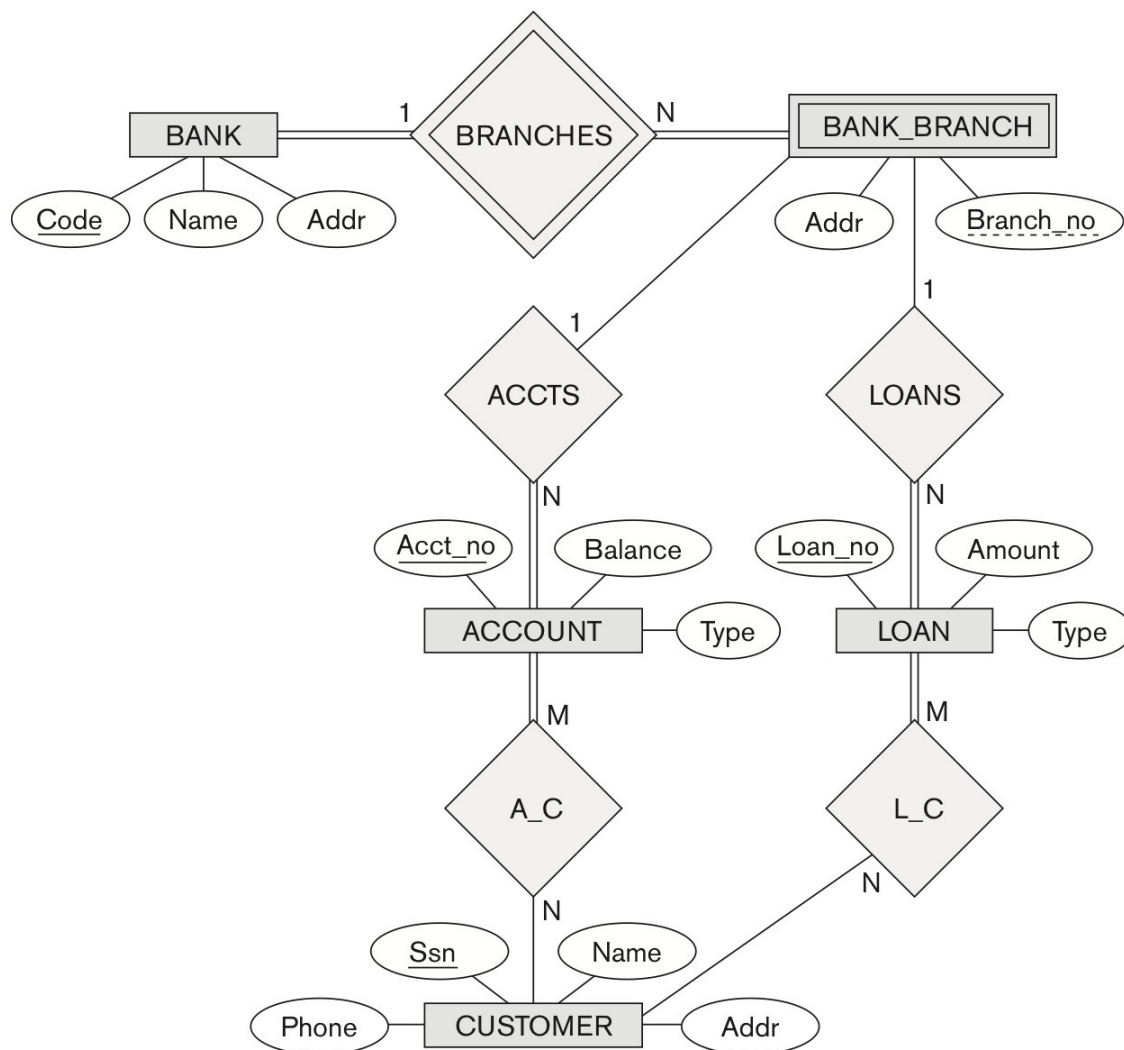**LECTURE 3 TUTORIAL (ER MODELING AND MAPPING ER SCHEMAS TO A RELATIONAL DESIGN)**

THREE QUESTIONS

QUESTION 1:

Consider the ER schema of a Bank Database:

1A. Answer the following questions for this ER Schema:

a. List the strong entity types in the schema
   ANSWER: BANK, ACCOUNT, LOAN, CUSTOMER

b. Is there a weak entity type in the schema? If so, name it, name the identifying relationship that identifies it and state the partial identifier and complete identifier of this entity type.
   ANSWER: BANK_BRANCH is the Weak Entity type. The identifying relationship type is BRANCHES . The partial identifier for BANK_BRANCH is Branch_no and the full identifier is (Bank_Code,Branch_no).

c. Can a LOAN be assigned to multiple customers
   ANSWER: YES

d. Can there be customers in the database that have multiple accounts?
   ANSWER: YES

e. Can there be customers in the database that have neither an account, nor a loan?
   ANSWER: YES

f. What constraints did you use to give the above answer in (e) ?
   ANSWER: THE MINIMUM CARDINALITY CONSTRAINTS FOR CUSTOMER ENTITY IN RELATIONSHIPS A_C AND L_C ARE ZERO. IN OTHER WORDS, THE PARTICIPATION OF A Customer (entity) in the relationship type A_C and L_C IS OPTIONAL.

1B. Questions about mapping to a set of relations:

a. Show the mapping of the weak entity type from this schema into a relation.
   ANSWER: BANK_BRANCH (Bank_code, Branch_no, Addr)

b. Consider the mapping of the ACCOUNT entity type into the following relation:
   ACCOUNT (Account#, ..., Balance, Account-type, Customer_SSN).
   What attribute is missing from the key?
   ANSWER: Bank_code, Branch_no.
   What attribute is incorrect in this relation? Why?
   ANSWER: Customer_SSN included here is incorrect. It cannot be included here because an account may be owned by multiple customers and therefore a separate relation is needed to capture the many-to-many relationship between CUSTOMER and ACCOUNT.

c. If we map the L_C relationship type into a relation, what will that relation look like?
   ANSWER: L_C (Loan#, Customer_SSN)

d. How is the LOANS relationship type taken into consideration while mapping to the relational schema?
   ANSWER: By incorporating the foreign key (Branch_no, Bank_code) into the relation for LOAN.

e. The A_C relationship type is mapped into the relation:
   CUSTOMER_ACCOUNT (Acct#, SSN, Opening_date).
   What is the primary key of this relation?
   ANSWER: {Acct#, SSN}
   Opening_date should have been in the ER schema if this relation was correct. Where would this attribute be placed in the ER schema?
   ANSWER: As an attribute of the relationship type A_C.

Q2. ER TO RELATIONAL SCHEMA MAPPING

Consider a database kept by a shipping company HONG_KONG_LINES. They use it to keep track of the movement of ships and track ships periodically as they move. They do this to log data on all ships in their possession for reporting to maritime authorities. Your task is to map this schema into a set of relations. Identify Primary and Foreign keys appropriately.
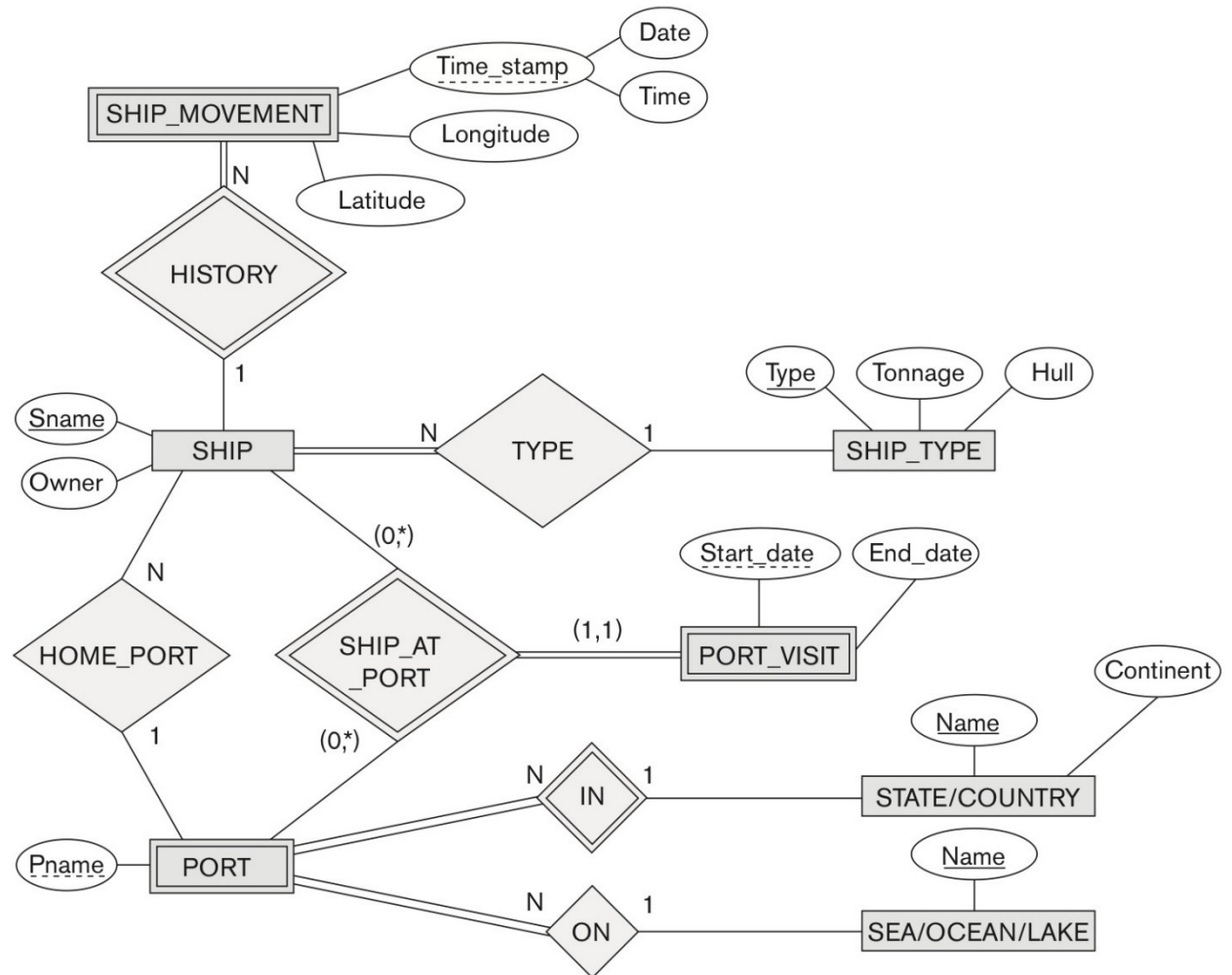
We get 4 relations for the 4 strong entity types and 3 more relations for the three weak entity types. There are no many-to-may relationships; hence no additional relations are required. All 1:N relationships are handled by incorporating the key of the entity on N side of the relationship into the relation on the 1 side as a foreign key.

SHIP (Sname, Owner, Ship_type, Home_portname, Home_countryname)
SHIP_TYPE (Ship_type,Tonnage, Hull)
STATE_COUNTRY (Country_name, Continent)
SEA_OCEAN (Sea_name)

Weak Entity types:
SHIP_MOVEMENT (Sname, Date, Time, Latitude, Longitude)
PORT (Portname, Countryname, Seaname)
PORT_VISIT (Portname, Countryname, Sname, Start_date, Enddate)

Q3. ADDITIONAL Question for ER Modeling. Consider the MOVIES ER Schema that represents a database that has been populated with appropriate data consistent with this schema. ACTOR is used as a generic term and includes both males and female actresses. Attributes are not shown to keep the schema simple.
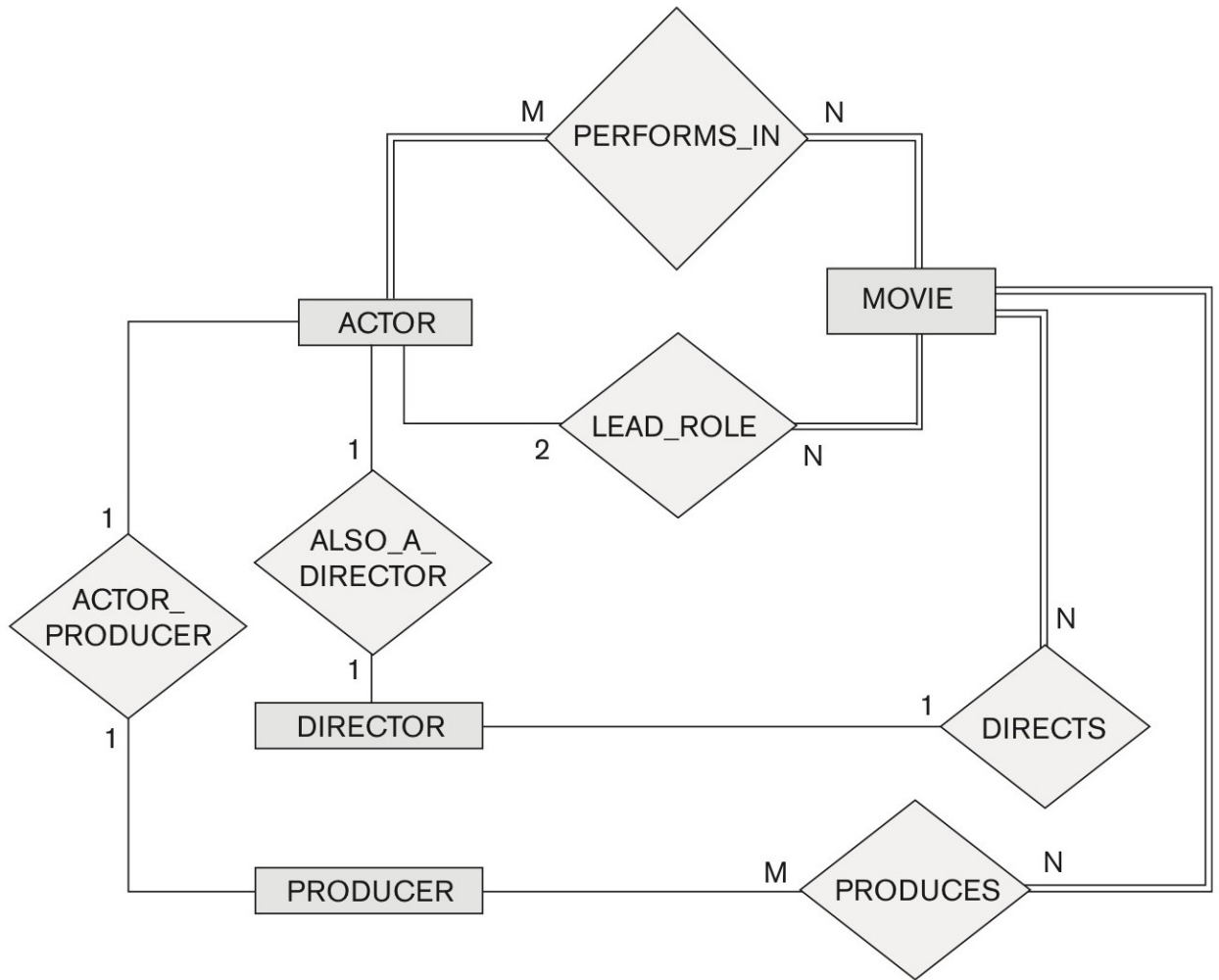
Assume that MOVIES is a populated database. Given the constraints shown in the ER schema, respond to the following statements with True, False, or Maybe. Your answer should be based on what populated database will be consistent with the given schema. Assign a response of Maybe to statements that, although not explicitly shown to be True, cannot be proven False based on the schema as shown. Justify each answer.

a. There are no actors in this database that have been in no movies. NO
b. There are some actors who have acted in more than ten movies. YES
c. Some actors have done a lead role in multiple movies. YES
d. A movie can have only a maximum of two lead actors. YES
e. Every director has been an actor in some movie. NO
f. No producer has ever been an actor. MAYBE (POSSIBLE, BUT CANNOT BE GURANTEED)
g. There are movies with more than a dozen actors. YES.
h. There are some producers who have also been a director. MAYBE (POSSIBLE, BUT CANNOT BE GURANTEED)
I. All movies have one director and one producer. NO
J. Some movies have one director but several producers. YES.
k. There are some actors who have done a lead role, directed a movie, and produced a movie. YES