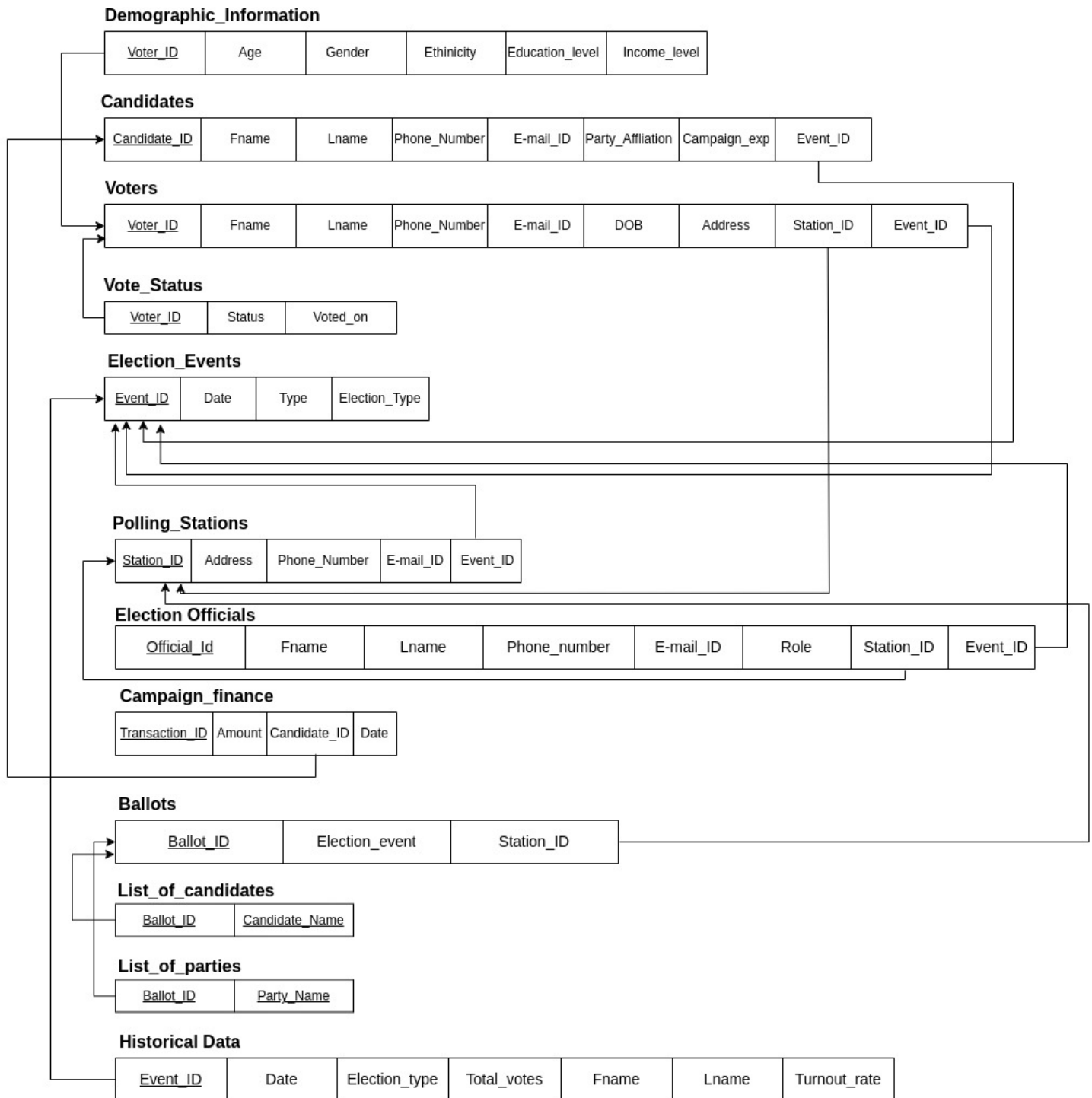


Relational Model:



Explanation for converting ER to Relational Model:

Strong Entities: We have created a relation R for each strong entity S and included all the simple attributes as is. For composite attributes, we have included each of the simple attributes in the composite attributes. We have chosen the primary key from one of the attributes and the one we chose is the one we mentioned in the requirements doc in phase 1.

Weak Entities: We have created a relation R for each weak entity W and included all the simple attributes as is. For composite attributes, we have included each of the simple attributes in the composite attributes. We have chosen the primary key and foreign key from the attributes itself and we tried to stick to the phase 1 doc in choosing these keys.

Multi-Valued Attributes: We have created a separate relation R for multi-valued attributes and included a foreign key to reference the entity which this attribute belongs to. Also, the attributes in these newly created tables are simple attributes. We have indicated the foreign and primary keys of these newly created relations in the relational model diagram.

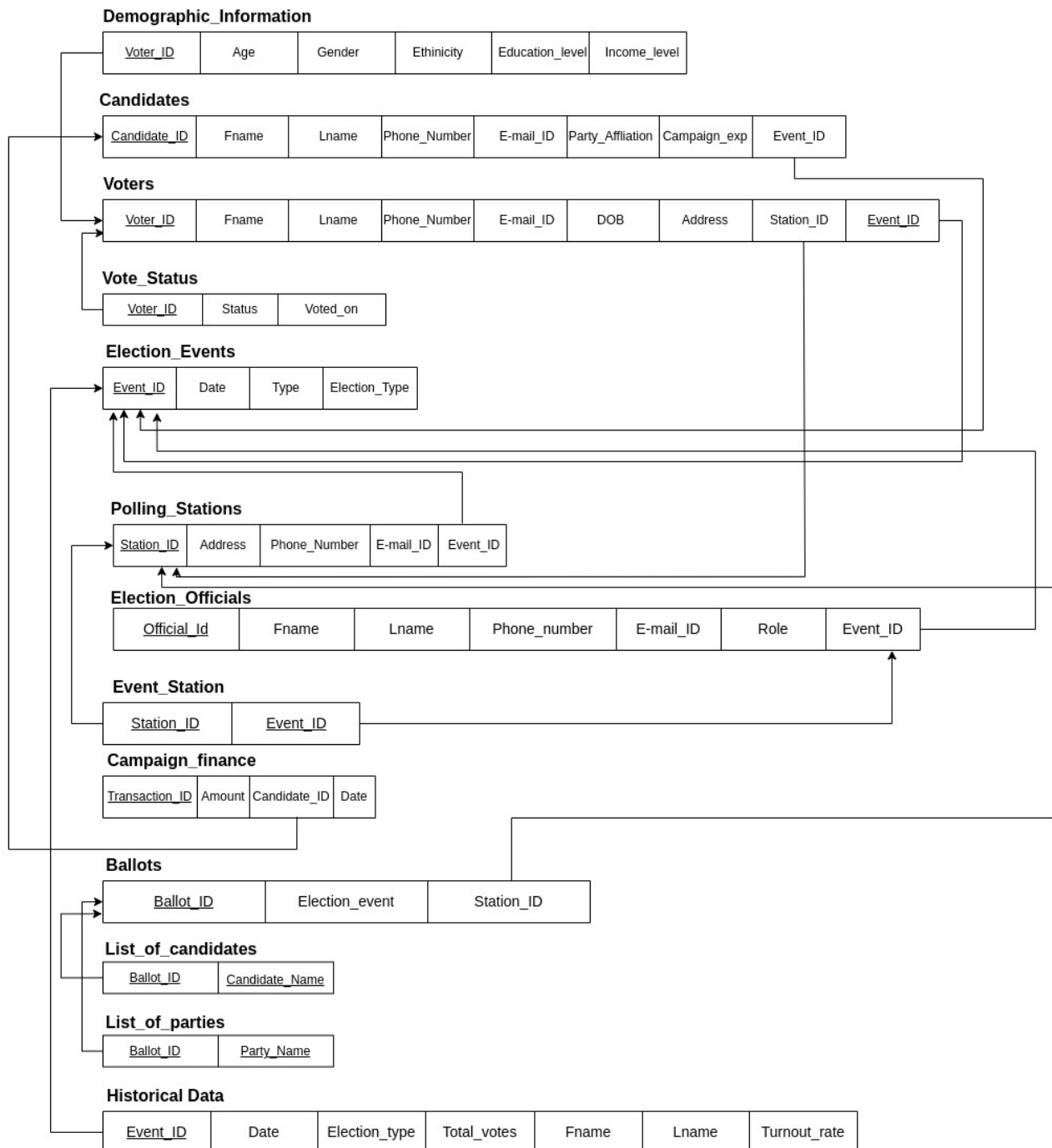
Mapping of relationships:

- **1:1 Relationships:** We have included a foreign key in one of the two entities which are in relationship to reference the other.
- **1:N Relationships:** We have included a foreign key in the entity which has cardinality N in 1:N relationship and referenced the other entity using this key.
- **N:M Relationships:** We have created a separate relation R for these kinds of relationships, and these contain the two foreign keys in which one refers to one entity and other refers to another entity.
- **Degree >2 relationships:** We have converted these to multiple binary relationships and applied the same above rules for each of them.

Normalization:

1NF: Our model is already in 1NF as we have eliminated the attributes to be multi-valued following the explanation mentioned above. And hence all our attributes are atomic.

2NF:



In our relational model, there is only one partial dependency. This one is in the *Election_Officials* relation. The partial dependency is between *Event_ID* and *Station_ID*, as there can be up to 4 officers in the same station for an election event. Hence, we overcame this dependency by creating a separate relation having attributes as *Station_ID* and *Event_ID* and removed the *Station_ID* attribute from the *Election_Officials* relation. A Pair of *Election_ID* and *Sation_ID* are always distinct, and both together act as primary key.

3NF: Our 3NF is same as 2NF as there are no transitive functional dependencies in our 2NF. And hence, our 2NF and our 3NF are the same.

Normalized Model:

