Step 1: mapping of regular entities: SHIP, SHIP\_TYPE, STATE/COUNTRY AND SEA/OCEAN/LAKE.

* Regular entity SHIP mapped as SHIP relation. All simple attributes are included. Attribute “Sname” is chosen as a primary key.
* Regular entity SHIP\_TYPE mapped as SHIP\_TYPE relation. All simple attributes are included. Attribute “Type” is chosen as a primary key.
* Regular entity STATE/COUNTRY mapped as STATE/COUNTRY relation. All simple attributes are included. Attribute “Name” is chosen as a primary key.
* Regular entity SEA/OCEAN/LAKE mapped as SEA/OCEAN/LAKE relation. Attribute “Name” is chosen as a primary key.

Step 2: mapping of weak entities: SHIP\_MOVEMENT, PORT AND PORT\_VISIT.

* Weak entity SHIP\_MOVEMENT mapped as SHIP\_MOVEMENT relation. All simple attributes are included. Primary key “Sname” from SHIP relation is added as Foreign Key. The primary key the combination of “Sname” and “Time\_Stamp”.
* Weak entity PORT mapped as PORT relation. Attribute “Name” is added as Foreign key from “STATE/COUNTRY” and “SEA/OCEAN/LAKE” relations. The primary key is the combination of “Name” and “Pname”.
* Weak entity PORT\_VISIT mapped as PORT\_VISIT relation. All simple attributes are included. Attribute “Sname” is added as foreign key from “SHIP” relation. The primary key is the combination of attribute “Sname” and “Start\_date”.

Step 3: mapping of binary 1:1 relationship: PORT\_VISIT

- 1:1 relationship TYPE is mapped as a foreign key attribute “Start\_Date” in SHIP relation that corresponds to “Start\_Date” partial key attribute in PORT\_VISIT relation.

Step 4: mapping of binary 1:N relationship: TYPE, ON, IN, and HOME\_PORT.

- 1:N relationship TYPE is mapped as a foreign key attribute “Type” in SHIP relation (“N” side) that corresponds to “Type” primary key attribute in SHIP\_TYPE relation (“1” side)

- 1:N relationship IN is mapped as a foreign key attribute “Name” in PORT relation (“N” side) that corresponds to “Name” primary key attribute in STATE/COUNTRY relation (“1” side)

- 1:N relationship ON is mapped as a foreign key attribute “Name” in PORT relation (“N” side) that corresponds to “Name” primary key attribute in SEA/OCEAN/LAKE relation (“1” side)

- 1:N relationship HOME\_PORT is mapped as a foreign key attribute “Pname” in SHIP relation (“N” side) that corresponds to “Pname” primary key attribute in PORT relation (“1” side)

Step 5: mapping of binary M:N relationship: no relationship

Step 6: mapping of multivalued attributes: no multivalued attribute.

Step 7: mapping of n-ary relationship: no n-ary relationship