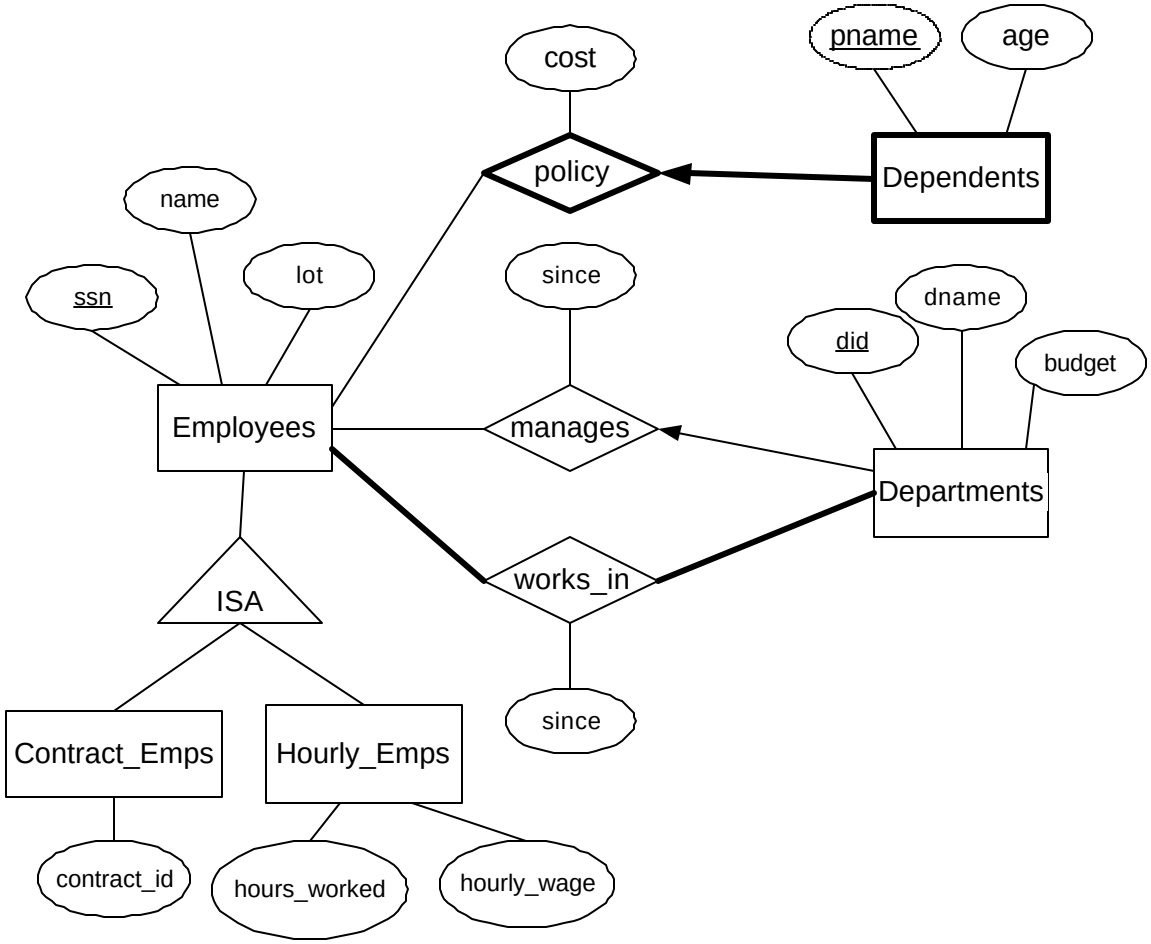
Sample Solution to Exercise

Disclaimer 1: This is only one possible solution. The solution provided intends to show as many features of ER diagram as possible and there may be other models.

Solution to Part 1:



Notes about sample solution:

- Since we are assuming that an employee works in at least one department and a department has at least one employee, the lines between the two entities are bold to indicate the participation constraints.
- The restriction that each department has at most one manager is indicated in the ER diagram by using an arrow from Departments to manages.
- The total participation of Dependents in Policy is indicated by linking them with a dark line. The arrow from Dependents to Policy indicates that each Dependents entity appears in at most one Policy relationship.

Disclaimer 2: There may be other restrictions and anomalies because of the modeling decisions made in the solution. Please feel free to find them and point them out.

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Solution to Part 2:

```
CREATE TALBE Employees ( ssn          CHAR(11),
                         name         CHAR(30),
                         lot          INTEGER,
                         PRIMARY KEY (ssn) )

CREATE TABLE Dept_Mgr ( did           INTEGER,
                        dname         CHAR(20),
                        budget        REAL,
                        ssn           CHAR(11),
                        since         DATE,
                        PRIMARY KEY (did),
                        FOREIGN KEY (ssn) REFERENCES Employees  )

CREATE TABLE Works_In ( ssn           CHAR(11),
                        did           INTEGER,
                        since,        DATE,
                        PRIMARY KEY (ssn, did),
                        FOREIGN KEY (ssn) REFERENCES Employees,
                        FOREIGN KEY (did) REFERENCES Dept_Mgr )

CREATE TABLE Dept_Policy ( pname      CHAR(20),
                           age        INTEGER,
                           cost       REAL,
                           ssn        CHAR(11),
                           PRIMARY KEY (pname, ssn),
                           FOREIGN KEY (ssn) REFERENCES Employees,
                           ON DELETE CASCADE  )
```

Notes about this solution:

- The foreign key in the referencing relation must match the primary key of the referred relation.
- Since Dependents is a weak entity associated with Employees, we can merge the entity Dependents and the relationship policy into a single table Dept_Policy. We use cascade deletes because Dependents is a weak entity of the Employees, and if the row of an Employees is removed from the database, the dependents of that employee should be removed as well.
- The table Dept_Mgr is an example of including the information about the relationship set in the table corresponding to the entity set with the key and taking advantage of the key constraint. Since a department has at most one manager, we can add the key fields of the Employees tuple denoting the manager and the *since* attribute to the Department tuple. The only drawback to this approach is that space could be wasted if several departments have no managers.