NASA Database Management Systems

Group ID :- 5.7

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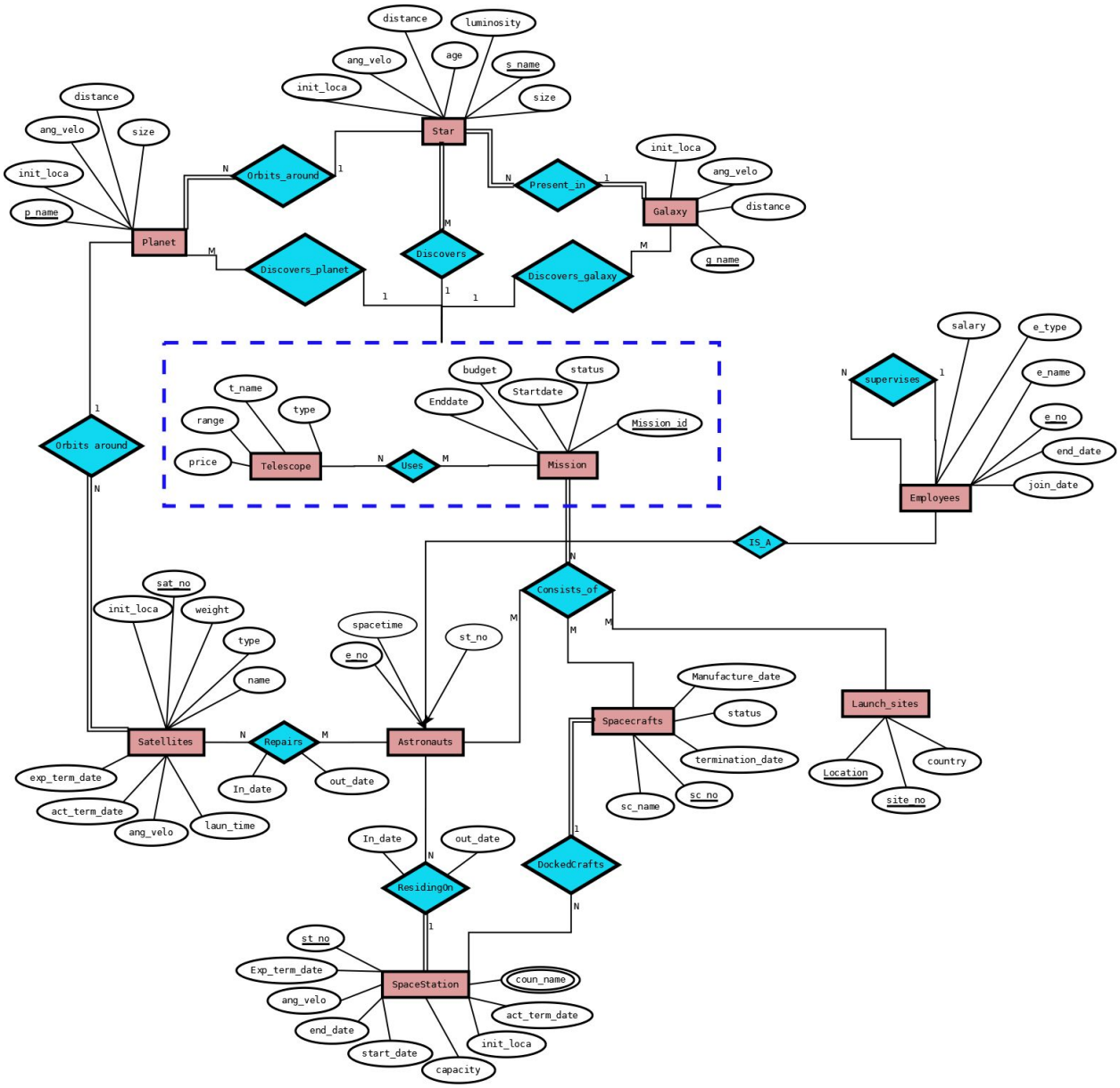
Nasa Database Description

The **National Aeronautics and Space Administration (NASA)** is an independent agency of the executive branch of the United States federal government responsible for the civilian space program, as well as aeronautics and aerospace research.
The project consists of describing the important components NASA adheres to and the relationship these show via formulation of a database consisting of tables for Missions initiate, Employees working etc.
It also demonstrates the aspect of research and development NASA undertakes and has data for astronomical objects that have been discovered thus far. Further these are implemented based on some certain constraints which are important rules to abide by.

The steps which need to be undertaken for successfully completing the project consists of

1: Entity - Relationship Diagram

ER diagram is a type of structural representation of the database and is a stepping stone for any complex database design as it describes the entities within the system scope and the relationship between these entities.



2: Relational Schema

Relational diagram is the formal representation of all the tables present in the database containing the information of Primary key and Foreign key as well as keeping in mind the participation and cardinality constraints. The relational diagram for NASA database is given below

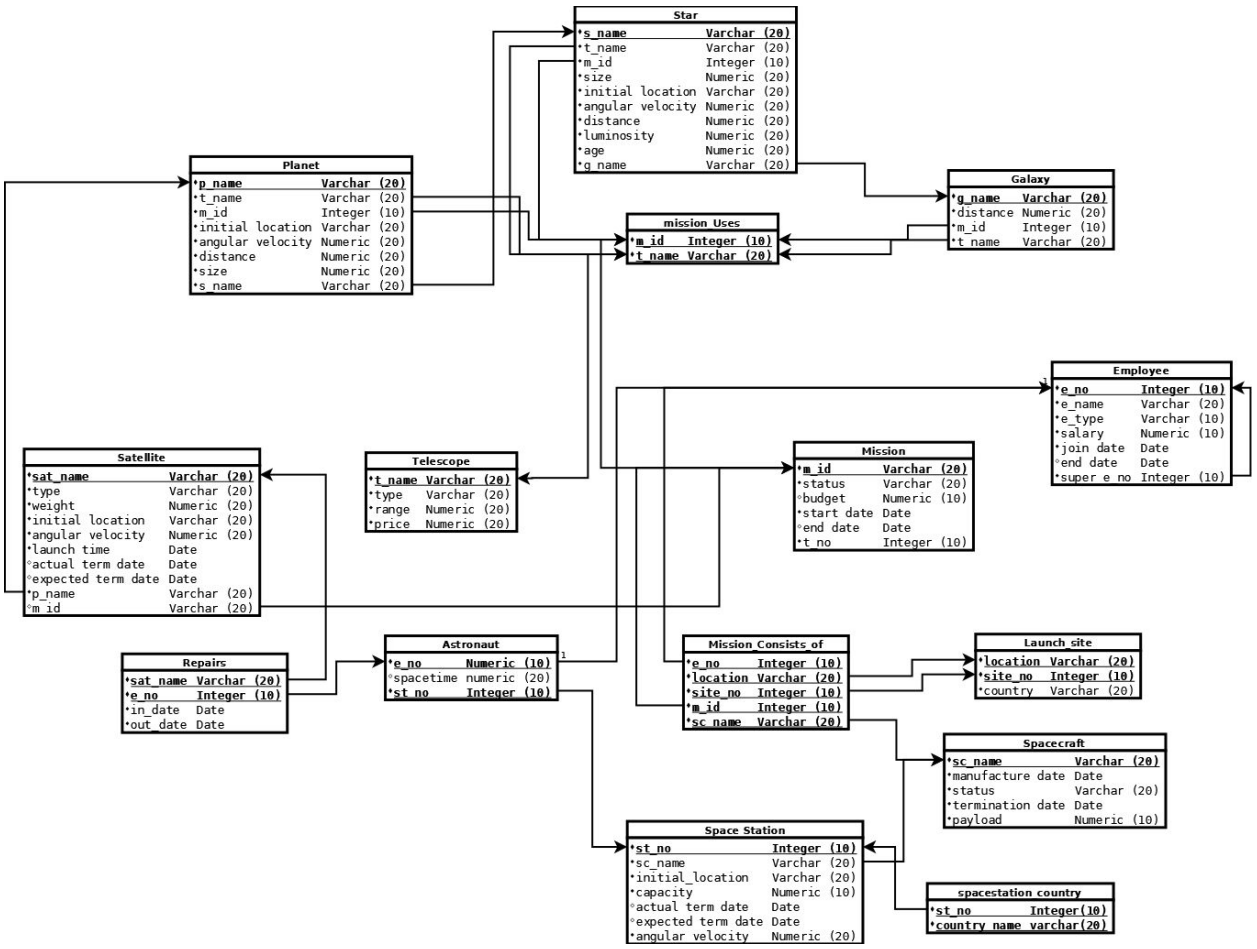


Table Description and Normalization Proofs

Normal Forms

Normal forms measures the goodness of a relation by assigning Normal Forms to each table. Higher the normal form better is the table as it follows stricter constraints.
NASA database that we have implemented has the following tables.

1: Mission

This relation determines the missions NASA has undertaken within a self-described span and the duration associated with each of the Mission. It is one of the most important relations as it will have connection with most of the relations discussed further. The attributes are
1: m_id : Gives the mission id of the mission.
2: status : Shows whether the mission is in progress or is completed.
3: start_date : Gives the starting date of the mission.
4: end_date : Gives the termination date of mission.
5: t_no : Gives the telescope name associated with the mission.
6: budget : Gives the total investment associated with each mission.
Functional Dependencies of the table

$$m\_id \rightarrow \{status, budget, start\_date, end\_date, t\_no\}$$

The above table has m_id or mision id as the primary key and so the following table **satisfies the BCNF rule.**

2: Telescope

This relation describes the name and specification of the telescopes owned by NASA and their usefulness in the discovery of number of celestial object.

The attributes are
1: t_name : Gives the name of telescope names.
2: type : Gives the type of telescope like Infrared, Visual etc.
3: range : Gives how far it can see the objects.
4: price : Gives the cost of telescope.
FD's are

t_name → {type,range,price}

The above table is in **BCNF** as t_name is Primary Key.

3: Mission_uses

This relation is used to describe a relation among mission and telescope with the celestial objects.
Has attributes m_id and t_name and both are primary key so we have the trivial FD's
{m_id,t_name} → m_id
{m_id,t_name} → t_name
So the above table is in **BCNF**.

4: Galaxy

Table contains data related to the galaxies discovered thus far and details associated with it.
The attributes are
1: g_name : Name of the galaxy
2: distance : Distance from earth.
3: m_id : Associated with which mission id.
4: t_name : Discovered by which telescope.

FD's are

g_name → {distance, m_id, t_name}

So the above relation is in BCNF as g_name is the primary key.

5: Star

It is another celestial object whose data is present in the database and these objects revolve around planets.

The new attributes are

1: s_name : Gives the name of the star.
2: size : Gives the size of star in kilometres.
3: initial_location : Gives initial location with respect to earth.
4: anguar_velocity : Gives the velocity with which it is revolving
5: distance : It is the distance from earth.
6: Luminosity : Gives the brightness of the star
7: age : Gives the time elapsed after it is discovered.
8: g_name : Gives the name of galaxy around which it revolves.

FD'S are

s_name → {t_name, m_id, size, initial_location, angular velocity, distance, luminosity, age, g_name}

As the name of star is primary key so the above table is in BCNF.

6: Planet

The table also corresponds to the celestial body and gives the data of planets that revolve around a particular star.

The attributes are almost same as that of star relation and the table is in BCNF.

7: Employee

This table is important for analysis as it contains the information regarding the types of workers in NASA.

The attributes are

1: e_no : Gives the employee id.
2: e_name : Gives the name of employee in consideration
3: e_type : Gives the job type like engineer, non-technical etc.
4: salary : Gives the annual income of each employee.
5: join_date : Gives the join date
6: end_date : Gives the end date of the tenure.
7: supere_no : Gives the id of the employee's supervisor.

The FD's are

e_no → { e_name, e_type, salary, join date, end date, super e_no} The table is in BCNF as the employee id is the primary key of the table.

8: Spacecraft

The table consists of spacecrafts owned by NASA and details of it.

The important attributes are

1: sc_name : The name of spacecrafts present.
2: status : Shows whether the spacecraft is in working condition or not.
3: payload ; Gives the amount of weight a spacecraft can carry in space.

The FD's are

sc_name → {manufacture date, status, termination date, payload}

The spacecraft name is the primary key so the above table is in BCNF.

9: Spacestation

The table gives the information regarding the space station and the specifications associated with it.

The new attributes are

1: st_no : The number associated with the number of spacestation

2: sc_no : Gives the space-crafts which have visited the space station.

3: capacity: Denotes the amount of weight it can hold.

The FD's are

st_no → {sc_name, initial_location, capacity, actual term date, expected term date, angular velocity}

As space station number is the primary key, the table is in BCNF.

10: spacestation_country

This table is used to link the space station to the number of countries that have contributed to produce it.

The attributes are

1: st_no : Gives the id of space station

2: country_name: Gives the country which have invested in that particular space station.

The table has both the attributes as the key so the table is BCNF.

11: Astronaut

This relation is a subclass of the table Employee which has e_no and references the employee. It is an important relation as they travel in space.

The attributes are

1: e_no : Employee number which have type astronaut.

2: spacetime : Amount of time spent in space.

3: st_no : Gives the space station astronaut has stayed.

The FD's are

E_no → {spacetime,st_no}

The table is in BCNF because the astronaut number is key.

12: Launch sites

Is an Independent table which has the location of all the launch sites.
The attributes are
Location : Gives the city of launch site
Site_no : uniquely identifies the launch site
Country : Gives the Country in which launch site is located
FD's are

site_no → {Location , Country}

The site_no is primary key so the above relation is in BCNF.

13: Mission_Consits_of

This is used as a relating table to connect astronaut to space station and also Employees to mission. This relation has all the attributes as the key so it is in BCNF.
The attributes are
e_no, location, site_no, m_id, sc_name
The set of {e_no, location, site_no, m_id, sc_name} is primary key so the above relation is in BCNF.

14: Satellite

This is an important relation as it gives the information of the number of satellites revolving around the planets and also connects the astronauts which have repaired a particular satellite.
The new attributes are
1: sat_name : The name of satellite in principle.

2: type: The type including GEO,HEO etc.
weight,initial_location,launch_time,actual_term_date,
expected_term_date
4: p_name: The planet around which the satellite is revolving.
5: m_id: The mission with which the satellite is associated.
The FD's are

sat_name → {type, weight, initial location, angular velocity, launch time, actual term date, expected term date, p_name,m_id}

The satellite name is primary key so the above relation is in BCNF.

15: Repairs

This is a connecting table which determines the astronaut id who have repaired which satellites.
The attributes are
Sat_name, e_no , in_date, out_date
The FD's are
{sat_name,e_no} → {in_date, out_date}
So the table is clearly in BCNF.