SpaceX Database Management System

Academic Mini Project

Batch - 09

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Computer Science and Engineering

Project Collaborators

Rohan Sai N - 121810303009,
Hari Priya - 121810303033,
Dheeraj A - 121810303023,
Nikhil P - 121810303032,
Kamala Sree - 121810303062,
Sri Charan - 121810303046;

Section - *B3*

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ABSTRACT

Observing the Latest advancements In the commercial spaceflight, **SpaceX** has travelled a long way through the line to be the first to get certified by **NASA** for statistically being the safest option to deliver a payload and Crew to the International Space Station. It is indeed intriguing to look through the timeline of SpaceX from the inception to the anticipation for future Launches. This Web Application administrates/simulates the **Database informatics**, holding the Historical data of SpaceX and also the information about any recent future launches.

USE CASES

Scenario -- 1:

A spaceX employee with admin credentials will be able to login to the site and has the eligibility of performing any of the Data Manipulative Operations on the database.

Scenario -- 2:

A Normal User/SpaceX enthusiast, with normal login procedure (Email input, to send him the notifications and schedules of any future launches). After the login he/she gets access to all the catalogues available, Information about the past launches like launchpad, launch vehicle used, payload delivered, Orbit level status, and overall launch status and also a Statistical analysis of the SpaceX over the time.

REQUIREMENT ANALYSIS

Database Composition

- **Entities**

  1. Rockets
  2. Payloads
  3. Missions
  4. Launch Pad
  5. Drone Ships
  6. Administrators

- **Relations**

  1. Launches (Launch Pad - Launches - Rocket)
  2. Assigned (Mission - Assigned to - Rocket)
  3. Delivers (Payload - Delivered by - Rocket)
  4. First stage Recovery (Rocket - First Stage Recovered by - Drone Ship)
  5. Updates Data (Administrators - Updates Data - Missions)

Attribute List

1. **Rocket**

    - Name
    - Type
    - Stages
    - Rocket_id
    - Active
    - Country
    - Company
    - Cost_per_launch

2. **Payloads**

    - payload_id
    - Name
    - Type
    - Reuse
    - Manufacturer
    - Mass (mass_kg, mass_lb)
    - Orbital status (reference System, orbit, regime)

3.   Missions

- launch_status
- launch_id
- Name
- Date
- rocket_id
- Launchpad_id
- Payload_id

4.   Launch Pad

- full_name
- name
- Status
- launchpad_id
- Coordinates (longitude, latitude)
- Location (region, TimeZone, locality)

5.   Drone Ship

- Home port
- Activity
- Mass
- Roles
- ship_id
- Name
- Type

6. Administrators

- Name
- Admin_id
- Password
- Access_level

Cardinalities

1. **Rockets** will have **one-to-one** cardinality/relationship with **Drone Ships**; i.e - only one rocket's first stage is recovered at one drone ship at a time.

2. **Launch Pad** will have **one-to-one** cardinality/relationship with **Rockets**; i.e - only one rocket is launched from one launch pad at a time considering the launch belonging to one manufacturer/company.

3. **Rockets** will have **one-to-many** cardinality/relationship with **payloads**; i.e - one rocket can carry and deliver multiple payloads at once.

4. **Missions** will have **one-to-one** cardinality/relationship with **Rockets**; i.e - one rocket can be assigned with one mission date at once according to the orbital mechanics.

ENTITY RELATIONSHIP DIAGRAM
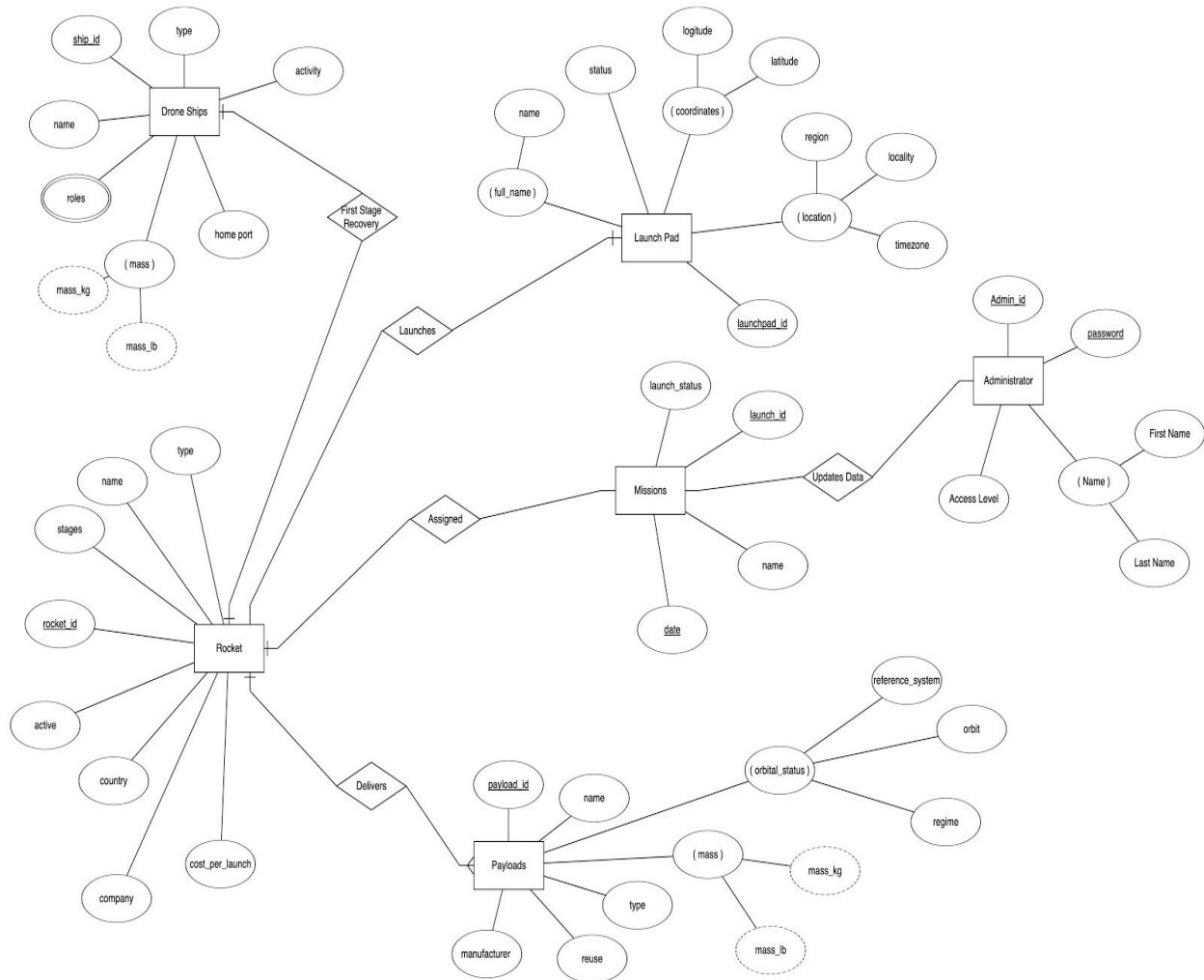
CONCEPTUAL SCHEMA

1. Rocket (name: **VARCHAR(20)**, type: **VARCHAR(10)**, stages: **INTEGER**, <u>rocket_id:</u> <u>**VARCHAR(24)**</u>, active: **VARCHAR(10)**, country: **VARCHAR(40**), company : **VARCHAR(20)**, cost_per_launch: **INTEGER**);

2. Payloads (<u>payload_id: **VARCHAR(24)**</u>, name: **VARCHAR(35)**, type: **VARCHAR(20)**, reuse: **VARCHAR(10)**, manufacturer: **VARCHAR(40)**, mass_kg: **FLOAT**, mass_lb: **FLOAT**, orbit: **VARCHAR(10)**, reference_system: **VARCHAR(30)**, regime: **VARCHAR(30)**);

3. Missions (launch_status: **VARCHAR(10)**, <u>launch_id: **VARCHAR(24)**</u>, name: **VARCHAR(50)**, date: **DATETIME**);

4. Launch Pad (<u>launchpad_id: **VARCHAR(24)**</u>, name: **VARCHAR(50)**, full_name: **VARCHAR(80)**, status: **VARCHAR(20)**, locality: **VARCHAR(50)**, region: **VARCHAR(20)**, timezone: **VARCHAR(40)**, latitude: **FLOAT**, longitude: **FLOAT**);

5. Drone Ship (<u> ship_id: **VARCHAR(24)**,</u> home_port: **VARCHAR(30)**, name: **VARCHAR(35)**, type: **VARCHAR(20)**, roles: **VARCHAR(45)**, activity: **VARCHAR(10)**, mass_kg: **FLOAT**, mass_lb: **FLOAT**);

6. Administrators (name: **VARCHAR(25)**, <u>admin_id: **VARCHAR(12)**,</u> <u>password:</u> <u>**VARCHAR(20)**</u> **CHECK** (**LENGTH**(password) > 8), access_level: **VARCHAR(10)**);

Conceptual Schema for Relations

1. Delivers (_payload_id: **VARCHAR(24)**, rocket_id: **VARCHAR(24)**, name: **VARCHAR(50)**);

2. Assigned (date: **DATETIME**, name: **VARCHAR(50)**, rocket_id: **VARCHAR(24)**, launch_id: **VARCHAR(24)**);

3. First_stage_recovery (rocket_id: **VARCHAR(24)**, ship_id: **VARCHAR(24)**, roles: **VARCHAR(50)**);

4. Updates_Data (admin_id: **VARCHAR(12)**, launch_id: **VARCHAR(24)**, name: **VARCHAR(50)**, launch_status: **VARCHAR(10)**);

5. Launches (launchpad_id: **VARCHAR(24)**, rocket_id: **VARCHAR(24)**, name: **VARCHAR(50)**, status: **VARCHAR(30)**);

LOGICAL DATABASE DESIGN

Logical database design is the process of transforming (or mapping) a conceptual schema of the application domain into a schema for the data model underlying a particular DBMS, such as the relational or object-oriented data model.

Tables

1. Rockets
2. Payloads
3. Launchpads
4. Drone Ships
5. Missions
6. Administrators
7. First Stage Recovery
8. Launches
9. Assigned
10. Updates Data
11. Delivers

- **MYSQL** is the Domain Specific Language used to Create and Establish Relational Databases to manage the data for this Application;

Link for all the MYSQL scripts which are used to create and populate the tables.

MYSQL Syntax to CREATE TABLES and INSERT VALUES

```
CREATE TABLE <table_name> (
  <attribute1>  <type1>(size1) <constraint1>,
  <attribute2>  <type2>(size2) <constraint2>,
  ...
);



INSERT INTO <table_name>
 VALUES (value1, value2, value3 ...);
```

Creating and Populating Tables

Note, To make the Document as concise as possible, major portions of MYSQL Scripts are reduced down; the reduced part is **denoted** as `**Three dots**` -- "..." **and** the Data also represents the HEAD portion of it.

- Rockets

```
USE `SpaceX-DB`;


CREATE TABLE Rockets (rocket_id VARCHAR(24) NOT NULL PRIMARY KEY,name
VARCHAR(20),type VARCHAR(10),active VARCHAR(10),country VARCHAR(40),
company VARCHAR(20), cost_per_launch INTEGER);


INSERT INTO Rockets VALUES ('5e9d0d95eda69955f709d1eb','Falcon
1','rocket','False','Republic of the Marshall
Islands','SpaceX',6700000);
INSERT INTO Rockets VALUES ('5e9d0d95eda69973a809d1ec','Falcon
9','rocket','True','United States','SpaceX', 50000000);
INSERT INTO Rockets VALUES ('5e9d0d95eda69974db09d1ed','Falcon
Heavy','rocket','True','United States','SpaceX', 90000000);
```

```
INSERT INTO Rockets VALUES
('5e9d0d96eda699382d09d1ee','Starship','rocket','False','United
States','SpaceX', 7000000);

SELECT * FROM Rockets
```

Data

- Payloads

```
USE `SpaceX-DB`;


CREATE TABLE Payloads(payload_id VARCHAR(24) NOT NULL PRIMARY
KEY,name VARCHAR(35), type VARCHAR(20), reuse VARCHAR(10),
manufacture VARCHAR(40), mass_kg FLOAT, mass_lb FLOAT, orbit
VARCHAR(10), reference_system VARCHAR(30),regime VARCHAR(30));

INSERT INTO payloads
VALUES('5eb0e4b5b6c3bb0006eeb1e1','FalconSAT-2','Satellite','Fa
lse','SSTL',20.0,43.0,'LEO','geocentric','low-earth');
INSERT INTO payloads
VALUES('5eb0e4b7b6c3bb0006eeb1e5','RatSat','Satellite','False',
'SpaceX',165.0,363.0,'LEO','geocentric','low-earth');
INSERT INTO payloads
VALUES('5eb0e4b7b6c3bb0006eeb1e6','RazakSAT','Satellite','False
','Satrec',200.0,440.0,'LEO','geocentric','low-earth');
INSERT INTO payloads
VALUES('5eb0e4bab6c3bb0006eeb1eb','CRS-1','Dragon
```

```
1.0','False','SpaceX',400.0,881.0,'ISS','geocentric','low-earth
');
INSERT INTO payloads
VALUES('5eb0e4bab6c3bb0006eeb1ec','Orbcomm-OG2','Dragon
1.0','False','Not
Disclosed',400.0,881.0,'LEO','geocentric','low-earth');
...
SELECT * FROM Payloads;
```

Data

- Drone Ships

```sql
USE `SpaceX-DB`;

CREATE TABLE DroneShip(ship_id VARCHAR(24) NOT NULL PRIMARY
KEY,home_port VARCHAR(30),name VARCHAR(35),type VARCHAR(20),roles
VARCHAR(45),activity VARCHAR(10),mass_kg FLOAT,mass_lb FLOAT);

INSERT INTO DroneShip VALUES ('5ea6ed2d080df4000697c901','Port of Los
Angeles','American Champion','Tug','Support
Ship','False',266712.0,588000.0);
INSERT INTO DroneShip VALUES ('5ea6ed2e080df4000697c905','Port of Los
Angeles','Betty R Gambarella','Tug','ASDS
Tug','False',202302.0,446000.0);
INSERT INTO DroneShip VALUES ('5ea6ed2e080df4000697c906','Port
Canaveral','Elsbeth III','Tug','ASDS Tug','False',273063.0,602000.0);
INSERT INTO DroneShip VALUES ('5ea6ed2d080df4000697c907','Port
Canaveral','GO Ms Chief','High Speed Craft','Fairing
Recovery','True',449964.0,992000.0);
INSERT INTO DroneShip VALUES ('5ea6ed2e080df4000697c908','Port
Canaveral','GO Ms Tree','High Speed Craft','Fairing
Recovery','True',449964.0,992000.0);
INSERT INTO DroneShip VALUES ('5ea6ed2d080df4000697c909','Port
Canaveral','GO Navigator','Cargo','Support Ship','True',
451778.0,996000.0);

. . .

INSERT INTO DroneShip VALUES ('5ea6ed30080df4000697c916','Port
Canaveral','RACHEL','Tug','ASDS Tug','False',312072.0,688000.0);
INSERT INTO DroneShip VALUES ('5ee68c683c228f36bd5809b5','Port
Canaveral','Finn Falgout','Tug','Support
Ship','True',843682.0,1860000.0);

SELECT * FROM DroneShip
```

Data

	ship_id	home_port	name	type	roles	activity	mass_kg	mass_lb
0	5ea6ed2d086d4000597c801	Port of Los Angeles	American Champion	Tug	Support Ship	False	266712	588000
1	5ea6ed2d086d4000597c807	Port Canaveral	GO Ms Chief	High Speed Craft	Faring Recovery	True	448864	882000
2	5ea6ed2d086d4000597c808	Port Canaveral	GO Navigator	Cargo	Support Ship	True	451749	885000
3	5ea6ed2d090d4000597c905	Port of Los Angeles	Betty R Gambarella	Tug	ASDS Tug	False	203282	448000
4	5ea6ed2d090d4000597c906	Port Canaveral	Elsbeth III	Tug	ASDS Tug	False	273063	602000
5	5ea6ed2d090d4000597c909	Port Canaveral	GO Ms Tree	High Speed Craft	Faring Recovery	True	448864	882000
6	5ea6ed2d090d4000597c90a	Port Canaveral	GO Pursuit	Cargo	Support Ship	False	502999	1108920
7	5ea6ed21080d4000597c90b	Port Canaveral	GO Searcher	Cargo	Support Ship	True	450870	994000
8	5ea6ed21080d4000597c90d	Port Canaveral	HAWK	Tug	ASDS Tug	False	508023	1120000
9	5ea6ed21090d4000597c90e	Fort Lauderdale	Hollywood	Tug	ASDS Tug	True	320206	706000
10	5ea6ed3d090d4000597c912	Port of Los Angeles	NRC Quest	Cargo	Support Ship	True	440082	872000
11	5ea6ed3d090d4000597c914	Port of Los Angeles	Pacific Freedom	Tug	ASDS Tug	True	6980	149000
12	5ea6ed3d090d4000597c915	Port of Los Angeles	Pacific Warrior	Tug	ASDS Tug	False	351089	774000
13	5ea6ed3d090d4000597c916	Port Canaveral	RACHEL	Tug	ASDS Tug	False	312072	688000
14	5eef6d5c5e220103bafa3f4b5	Port Canaveral	Fins Edgout	Tug	Support Ship	True	040802	1080000

First 14 samples of Data

- ## Launch Pads

```
USE `SpaceX-DB`;

CREATE TABLE LaunchPads (launchpad_id VARCHAR(24) NOT NULL PRIMARY
KEY,name VARCHAR(50),full_name VARCHAR(80),status
VARCHAR(30),locality VARCHAR(50),region VARCHAR(30),TimeZone
VARCHAR(40),Latitude FLOAT, Longitude FLOAT);

INSERT INTO LaunchPads VALUES('5e9e4501f5090910d4566f83','VAFB SLC
3W','Vandenberg Air Force Base Space Launch Complex


3W','retired','Vandenberg Air Force
```

```
Base','California','America/Los_Angeles',34.6440904,-120.5931438);

INSERT INTO LaunchPads VALUES('5e9e4501f509094ba4566f84','CCAFS SLC




40','Cape Canaveral Air Force Station Space Launch Complex
40','active','Cape
Canaveral','Florida','America/New_York',28.5618571,-80.577366);

INSERT INTO LaunchPads
VALUES('5e9e4502f5090927f8566f85','STLS','SpaceX South Texas Launch
Site','under construction','Boca Chica
Village','Texas','America/Chicago',25.9972641,-97.1560845);

INSERT INTO LaunchPads VALUES('5e9e4502f5090995de566f86','Kwajalein
Atoll','Kwajalein Atoll Omelek Island','retired','Omelek
Island','Marshall
Islands','Pacific/Kwajalein',9.0477206,167.7431292);

INSERT INTO LaunchPads VALUES('5e9e4502f509092b78566f87','VAFB SLC
4E','Vandenberg Air Force Base Space Launch Complex
4E','active','Vandenberg Air Force
Base','California','America/Los_Angeles',34.632093,-120.610829);

INSERT INTO LaunchPads VALUES('5e9e4502f509094188566f88','KSC LC
39A','Kennedy Space Center Historic Launch Complex
39A','active','Cape
Canaveral','Florida','America/New_York',28.6080585,-80.6039558);




SELECT * FROM LaunchPads;
```

Data

- Missions

```
USE `SpaceX-DB`;

CREATE TABLE Missions (date DATETIME, name VARCHAR(50), rocket_id
VARCHAR(24),launchpad_id VARCHAR(24), launch_id VARCHAR(24) NOT NULL
PRIMARY KEY, payload_id VARCHAR(24) ,FOREIGN KEY (rocket_id)
REFERENCES Rockets(rocket_id), FOREIGN KEY (launchpad_id) REFERENCES
LaunchPads(launchpad_id), FOREIGN KEY (payload_id) REFERENCES
Payloads(payload_id), launch_status VARCHAR(10));


INSERT INTO Missions VALUES ('2006-03-24T22:30:00.000',
```

```sql
'FalconSat','5e9d0d95eda69955f709d1eb','5e9e4502f5090995de566f86','5e
b87cd9ffd86e000604b32a','5eb0e4b5b6c3bb0006eeb1e1','False');
INSERT INTO Missions VALUES ('2007-03-21T01:10:00.000',
'DemoSat','5e9d0d95eda69955f709d1eb','5e9e4502f5090995de566f86','5eb8
7cdaffd86e000604b32b','5eb0e4b7b6c3bb0006eeb1e5','False');
INSERT INTO Missions VALUES ('2008-08-03T03:34:00.000',
'Trailblazer','5e9d0d95eda69955f709d1eb','5e9e4502f5090995de566f86','
5eb87cdbffd86e000604b32c','5eb0e4b7b6c3bb0006eeb1e6','False');
INSERT INTO Missions VALUES ('2008-09-28T23:15:00.000',
'RatSat','5e9d0d95eda69955f709d1eb','5e9e4502f5090995de566f86','5eb87
cdbffd86e000604b32d','5eb0e4bab6c3bb0006eeb1ea','True');
INSERT INTO Missions VALUES ('2009-07-13T03:35:00.000',
'RazakSat','5e9d0d95eda69955f709d1eb','5e9e4502f5090995de566f86','5eb
87cdcffd86e000604b32e','5eb0e4bab6c3bb0006eeb1eb','True');
INSERT INTO Missions VALUES ('2010-06-04T18:45:00.000', 'Falcon 9
Test
Flight','5e9d0d95eda69973a809d1ec','5e9e4501f509094ba4566f84','5eb87c
ddffd86e000604b32f','5eb0e4bab6c3bb0006eeb1ec','True');


...


INSERT INTO Missions VALUES ('2018-11-15T20:46:00.000', 'Es'hail
2','5e9d0d95eda69973a809d1ec','5e9e4502f509094188566f88','5eb87d24ffd
86e000604b36f','5eb0e4cab6c3bb0006eeb22f','True');
INSERT INTO Missions VALUES ('2018-12-03T18:34:00.000',
'SSO-A','5e9d0d95eda69973a809d1ec','5e9e4502f509092b78566f87','5eb87d
25ffd86e000604b370','5eb0e4cab6c3bb0006eeb230','True');
INSERT INTO Missions VALUES ('2018-12-05T18:16:00.000',
'CRS-16','5e9d0d95eda69973a809d1ec','5e9e4501f509094ba4566f84','5eb87
d26ffd86e000604b371','5eb0e4cab6c3bb0006eeb231','True');




SELECT * FROM Missions;
```

Data

First 4 samples of Data

- ## Administrators

```sql
USE `SpaceX-DB`;


CREATE TABLE Administrators (admin_id VARCHAR(12) NOT NULL PRIMARY
KEY, name VARCHAR(25),password VARCHAR(20) CHECK ( LENGTH(password) >
8 ), access_level VARCHAR(10));

INSERT INTO Administrators VALUES ( '121810303009' ,'Rohan',
'121810303009', 'root' );
INSERT INTO Administrators VALUES ( '121810303033' ,'Hari Priya',
'121810303033', 'standard' );
INSERT INTO Administrators VALUES ( '121810303023' ,'Dheeraj',
'121810303023', 'standard' );
INSERT INTO Administrators VALUES ( '121810303032' ,'Nikhil',
'121810303032', 'standard' );
INSERT INTO Administrators VALUES ( '121810303062' ,'Kamala Sree',
'121810303062', 'standard' );
INSERT INTO Administrators VALUES ( '121810303046' ,'Sri Charan',
'121810303033', 'standard' );


SELECT * FROM Administrators;
```

Data

	admin_id	name	password	access_level
0	121810303009	Rohan	121810303009	root
1	121810303023	Dheeraj	121810303023	standard
2	121810303032	Nikhil	121810303032	standard
3	121810303033	Hari Priya	121810303033	standard
4	121810303046	Sri Charan	121810303033	standard
5	121810303062	Kamala Sree	121810303062	standard

- First Stage Recovery

```
USE `SpaceX-DB`;


CREATE TABLE First_stage_Recovery (ship_id VARCHAR(24), rocket_id
VARCHAR(24),role VARCHAR(50), FOREIGN KEY (ship_id) REFERENCES
DroneShip(ship_id), FOREIGN KEY (rocket_id) REFERENCES
Rockets(rocket_id));


INSERT INTO First_stage_Recovery VALUES
('5ea6ed2d080df4000697c901','5e9d0d95eda69955f709d1eb','Fairing
Recovery');
INSERT INTO First_stage_Recovery VALUES
('5ea6ed2e080df4000697c908','5e9d0d95eda69973a809d1ec','ASDS Tug');
INSERT INTO First_stage_Recovery VALUES
('5ea6ed2e080df4000697c90a','5e9d0d95eda69955f709d1eb','Fairing
Recovery');
INSERT INTO First_stage_Recovery VALUES
('5ea6ed2f080df4000697c90d','5e9d0d95eda69973a809d1ec','Support
Ship');
```

```
INSERT INTO First_stage_Recovery VALUES
('5ea6ed2d080df4000697c907','5e9d0d95eda69974db09d1ed','Support
Ship');
INSERT INTO First_stage_Recovery VALUES
('5ea6ed2d080df4000697c907','5e9d0d95eda69955f709d1eb','ASDS Tug');
INSERT INTO First_stage_Recovery VALUES
('5ea6ed30080df4000697c916','5e9d0d95eda69973a809d1ec','ASDS Tug');
INSERT INTO First_stage_Recovery VALUES
('5ea6ed2e080df4000697c908','5e9d0d95eda69973a809d1ec','Fairing
Recovery');
INSERT INTO First_stage_Recovery VALUES
('5ea6ed2e080df4000697c90a','5e9d0d95eda69973a809d1ec','ASDS Tug');
INSERT INTO First_stage_Recovery VALUES
('5ea6ed2f080df4000697c90d','5e9d0d95eda69955f709d1eb','Fairing
Recovery');

SELECT * FROM First_stage_Recovery
```

Data

	ship_id	rocket_id	role
0	5ea6ed2d080df4000697c901	5e9d0d95eda69955f709d1eb	Fairing Recovery
1	5ea6ed2e080df4000697c908	5e9d0d95eda69973a809d1ec	ASDS Tug
2	5ea6ed2e080df4000697c90a	5e9d0d95eda69955f709d1eb	Fairing Recovery
3	5ea6ed2f080df4000697c90d	5e9d0d95eda69973a809d1ec	Support Ship
4	5ea6ed2d080df4000697c907	5e9d0d95eda69974db09d1ed	Support Ship
5	5ea6ed2d080df4000697c907	5e9d0d95eda69955f709d1eb	ASDS Tug
6	5ea6ed30080df4000697c916	5e9d0d95eda69973a809d1ec	ASDS Tug
7	5ea6ed2e080df4000697c908	5e9d0d95eda69973a809d1ec	Fairing Recovery
8	5ea6ed2e080df4000697c90a	5e9d0d95eda69973a809d1ec	ASDS Tug
9	5ea6ed2f080df4000697c90d	5e9d0d95eda69955f709d1eb	Fairing Recovery

- Delivers

```
USE `SpaceX-DB`;

CREATE TABLE Delivers (payload_id VARCHAR(24), rocket_id
VARCHAR(24),name VARCHAR(50), FOREIGN KEY (payload_id) REFERENCES
Payloads(payload_id), FOREIGN KEY (rocket_id) REFERENCES
Rockets(rocket_id));


INSERT INTO Delivers VALUES ('5eb0e4b5b6c3bb0006eeb1e1',
'5e9d0d95eda69955f709d1eb', 'FalconSat');
INSERT INTO Delivers VALUES ('5eb0e4b7b6c3bb0006eeb1e5',
'5e9d0d95eda69955f709d1eb', 'DemoSat');
INSERT INTO Delivers VALUES ('5eb0e4b7b6c3bb0006eeb1e6',
'5e9d0d95eda69955f709d1eb', 'Trailblazer');


...

INSERT INTO Delivers VALUES ('5eb0e4c8b6c3bb0006eeb226',
'5e9d0d95eda69973a809d1ec', 'Bangabandhu-1');
INSERT INTO Delivers VALUES ('5eb0e4c8b6c3bb0006eeb227',
'5e9d0d95eda69973a809d1ec', 'Iridium NEXT Mission 6');
INSERT INTO Delivers VALUES ('5eb0e4c8b6c3bb0006eeb228',
'5e9d0d95eda69973a809d1ec', 'SES-12');
INSERT INTO Delivers VALUES ('5eb0e4c9b6c3bb0006eeb229',
'5e9d0d95eda69973a809d1ec', 'CRS-15');

SELECT * FROM Delivers;
```

Data

- Assigns

```sql
USE `SpaceX-DB`;


CREATE TABLE Assigns (date DATETIME,name VARCHAR(50) ,rocket_id
VARCHAR(24), launch_id VARCHAR(24), FOREIGN KEY (launch_id)
REFERENCES Missions(launch_id), FOREIGN KEY (rocket_id) REFERENCES
Rockets(rocket_id));


INSERT INTO Assigns VALUES ('2006-03-24T22:30:00.000' ,'FalconSat',
'5e9d0d95eda69955f709d1eb','5eb87cd9ffd86e000604b32a');
INSERT INTO Assigns VALUES ('2007-03-21T01:10:00.000' ,'DemoSat',
'5e9d0d95eda69955f709d1eb','5eb87cdaffd86e000604b32b');
INSERT INTO Assigns VALUES ('2008-08-03T03:34:00.000' ,'Trailblazer',
'5e9d0d95eda69955f709d1eb','5eb87cdbffd86e000604b32c');
INSERT INTO Assigns VALUES ('2008-09-28T23:15:00.000' ,'RatSat',
'5e9d0d95eda69955f709d1eb','5eb87cdbffd86e000604b32d');
INSERT INTO Assigns VALUES ('2009-07-13T03:35:00.000' ,'RazakSat',
```

```
'5e9d0d95eda69955f709d1eb','5eb87cdcffd86e000604b32e');

...

INSERT INTO Assigns VALUES ('2015-03-02T03:50:00.000' ,'ABS-3A /
Eutelsat 115W B',
'5e9d0d95eda69973a809d1ec','5eb87ceaffd86e000604b33e');
INSERT INTO Assigns VALUES ('2015-04-14T20:10:00.000' ,'CRS-6',
'5e9d0d95eda69973a809d1ec','5eb87cecffd86e000604b33f');
INSERT INTO Assigns VALUES ('2015-04-27T23:03:00.000' ,'TürkmenÄlem
52°E / MonacoSAT',
'5e9d0d95eda69973a809d1ec','5eb87cedffd86e000604b340');
INSERT INTO Assigns VALUES ('2015-06-28T14:21:00.000' ,'CRS-7',
'5e9d0d95eda69973a809d1ec','5eb87ceeffd86e000604b341');
INSERT INTO Assigns VALUES ('2015-12-22T01:29:00.000' ,'OG-2 Mission
2', '5e9d0d95eda69973a809d1ec','5eb87cefffd86e000604b342');




SELECT * FROM Assigns;
```

Data

First 16 samples of Data

- Updates Data

```
USE `SpaceX-DB`;

CREATE TABLE Updates_data (admin_id VARCHAR(12), launch_id
VARCHAR(24),name VARCHAR(50), launch_status VARCHAR(10), FOREIGN KEY
(admin_id) REFERENCES Administrators(admin_id), FOREIGN KEY
(launch_id) REFERENCES Missions(launch_id));
```

```
INSERT INTO Updates_data VALUES ('121810303009'



,'5eb87cd9ffd86e000604b32a', 'FalconSat', 'False');
INSERT INTO Updates_data VALUES ('121810303009'
,'5eb87cdaffd86e000604b32b', 'DemoSat', 'False');
INSERT INTO Updates_data VALUES ('121810303023'
,'5eb87cdbffd86e000604b32c', 'Trailblazer', 'False');
INSERT INTO Updates_data VALUES ('121810303032'
,'5eb87cdbffd86e000604b32d', 'RatSat', 'True');
INSERT INTO Updates_data VALUES ('121810303033'
,'5eb87cdcffd86e000604b32e', 'RazakSat', 'True');
INSERT INTO Updates_data VALUES ('121810303033'
,'5eb87cddffd86e000604b32f', 'Falcon 9 Test Flight', 'True');


...

INSERT INTO Updates_data VALUES ('121810303009'
,'5eb87d23ffd86e000604b36e', 'SAOCOM 1A', 'True');
INSERT INTO Updates_data VALUES ('121810303023'
,'5eb87d24ffd86e000604b36f', 'Es','hail 2', 'True');
INSERT INTO Updates_data VALUES ('121810303046'
,'5eb87d25ffd86e000604b370', 'SSO-A', 'True');
INSERT INTO Updates_data VALUES ('121810303009'
,'5eb87d26ffd86e000604b371', 'CRS-16', 'True');


SELECT * FROM Updates_data;
```

Data

	admin_id	launch_id	name	launch_status
0	121810303009	5eb87cd9ffd86e000604b32a	FalconSat	False
1	121810303009	5eb87cdaffd86e000604b32b	DemoSat	False
2	121810303023	5eb87cdbffd86e000604b32c	Trailblazer	False
3	121810303032	5eb87cdbffd86e000604b32d	RatSat	True
4	121810303033	5eb87cdcffd86e000604b32e	RazakSat	True
...	...	...	...	...
66	121810303033	5eb87d22ffd86e000604b36d	Telstar 18V	True
67	121810303009	5eb87d23ffd86e000604b36e	SAOCOM 1A	True
68	121810303023	5eb87d24ffd86e000604b36f	Es'hail 2	True
69	121810303046	5eb87d25ffd86e000604b370	SSO-A	True
70	121810303009	5eb87d26ffd86e000604b371	CRS-16	True

71 rows × 4 columns

- Launches

```
USE `SpaceX-DB`;

CREATE TABLE Launches (launchpad_id VARCHAR(24),rocket_id
VARCHAR(24), name VARCHAR(50), status VARCHAR(30), FOREIGN KEY
(launchpad_id) REFERENCES LaunchPads(launchpad_id), FOREIGN KEY
(rocket_id) REFERENCES Rockets(rocket_id));


INSERT INTO Launches VALUES ('5e9e4501f509094ba4566f84'
,'5e9d0d95eda69973a809d1ec', 'CCAFS SLC 40','active');
INSERT INTO Launches VALUES ('5e9e4502f5090995de566f86'
```

```sql
,'5e9d0d95eda69955f709d1eb', 'Kwajalein Atoll','retired');
INSERT INTO Launches VALUES ('5e9e4502f5090927f8566f85'
,'5e9d0d95eda69973a809d1ec', 'STLS','under construction');
INSERT INTO Launches VALUES ('5e9e4502f509092b78566f87'
,'5e9d0d95eda69973a809d1ec', 'VAFB SLC 4E','active');
INSERT INTO Launches VALUES ('5e9e4502f509092b78566f87'
,'5e9d0d95eda69973a809d1ec', 'VAFB SLC 4E','active');
INSERT INTO Launches VALUES ('5e9e4502f5090927f8566f85'
,'5e9d0d95eda69973a809d1ec', 'STLS','under construction');


...


INSERT INTO Launches VALUES ('5e9e4502f5090927f8566f85'
,'5e9d0d95eda69973a809d1ec', 'STLS','under construction');
INSERT INTO Launches VALUES ('5e9e4502f5090927f8566f85'
,'5e9d0d95eda69973a809d1ec', 'STLS','under construction');
INSERT INTO Launches VALUES ('5e9e4501f509094ba4566f84'
,'5e9d0d95eda69973a809d1ec', 'CCAFS SLC 40','active');
INSERT INTO Launches VALUES ('5e9e4502f5090927f8566f85'
,'5e9d0d95eda69973a809d1ec', 'STLS','under construction');
INSERT INTO Launches VALUES ('5e9e4502f509094188566f88'
,'5e9d0d95eda69973a809d1ec', 'KSC LC 39A','active');
INSERT INTO Launches VALUES ('5e9e4502f5090995de566f86'
,'5e9d0d95eda69973a809d1ec', 'Kwajalein Atoll','retired');
INSERT INTO Launches VALUES ('5e9e4502f5090927f8566f85'
,'5e9d0d95eda69973a809d1ec', 'STLS','under construction');
INSERT INTO Launches VALUES ('5e9e4502f5090995de566f86'
,'5e9d0d95eda69973a809d1ec', 'Kwajalein Atoll','retired');
INSERT INTO Launches VALUES ('5e9e4501f509094ba4566f84'
,'5e9d0d95eda69973a809d1ec', 'CCAFS SLC 40','active');


SELECT * FROM Launches;
```

Data

	launchpad_id	rocket_id	name	status
0	5e9e450lf509094ba4566f84	5e9d0d95eda69973a809dlec	CCAFS SLC 40	active
1	5e9e4502f5090995de568f85	5e9d0d95eda69955f709dleb	Kwajalein Atoll	retired
2	5e9e4502f5090927f8568f85	5e9d0d95eda69973a809dlec	STLS	under construction
3	5e9e4502f5090092b78566f87	5e9d0d95eda69973a809dlec	VAFB SLC 4E	active
4	5e9e4502f5090092b78566f87	5e9d0d95eda69973a809dlec	VAFB SLC 4E	active
5	5e9e4502f5090927f8568f85	5e9d0d95eda69973a809dlec	STLS	under construction
6	5e9e450lf509094ba4568f84	5e9d0d95eda69973a809dlec	CCAFS SLC 40	active
7	5e9e450lf509094ba4568f84	5e9d0d95eda69973a809dlec	CCAFS SLC 40	active
8	5e9e450lf509094ba4568f84	5e9d0d95eda69973a809dlec	CCAFS SLC 40	active
9	5e9e4502f5090995de568f85	5e9d0d95eda69973a809dlec	Kwajalein Atoll	retired
10	5e9e4502f5090995de568f85	5e9d0d95eda69973a809dlec	Kwajalein Atoll	retired
11	5e9e4502f5090994188568f85	5e9d0d95eda69973a809dlec	KSC LC 39A	active
12	5e9e4502f5090995de568f85	5e9d0d95eda69973a809dlec	Kwajalein Atoll	retired
13	5e9e4502f5090994188568f85	5e9d0d95eda69974db09a1ed	KSC LC 39A	active
14	5e9e4502f5090995de568f85	5e9d0d95eda69973a809dlec	Kwajalein Atoll	retired
15	5e9e4502f5090994188568f85	5e9d0d95eda69973a809dlec	KSC LC 39A	active
16	5e9e4502f5090927f8568f85	5e9d0d95eda69973a809dlec	STLS	under construction

SCHEMA REFINEMENT

- *Schema Refinement* is a procedure employed on Relational Database Architectures to employ robust actions to prevent any redundancies to be included in the database systems. Integrity constraints, in particular *functional dependencies*, can be used to identify schemas with such problems and to suggest refinements.

    The Real Time Data used for this Project is very well structured during the initial collection sequence where the data is passed through a pipeline which programmatically structures and eliminates redundancies or data discrepancies of any kind whatsoever.

    To Summarize, there's *no requirement of any Normalization technique* to be employed on this Database architecture in particular considering that we already have *Preprocessed Data* as well as the portion of data used is miniature.

PHYSICAL DATABASE DESIGN

Physical Database Design is technically the last stage to establish a Database Architecture connected to an Application in Development whether it be a Desktop Model or a Web Based Model.

This Project's Application's codebase is written in Python with a few external libraries to manage for database connectivity as well as rendering some GUI elements.

Connecting to the Database from the Application

```
mydb = mysql.connector.connect( host="localhost",
user="root", password="*********", database="spacex-db" )
```

Inbuilt Subroutines are used to pose raw *Queries* to the *Database* from the Application's Codebase

```
        # Define a Cursor to parse through the database
        # from the python-codebase
        mycursor = mydb.cursor()
        mycursor.execute("SELECT name,password FROM
Administrators
        WHERE admin_id = '121810303009';") # Example Query
        result = mycursor.fetchall()


        --
        result - (rohan,121810303009)

```

Similarly any query can be constructed programmatically to retrieve data and manipulate it as well.