SpaceX Database Management System

Academic Mini Project

Batch - 09



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Computer Science and Engineering

Project Collaborators

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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

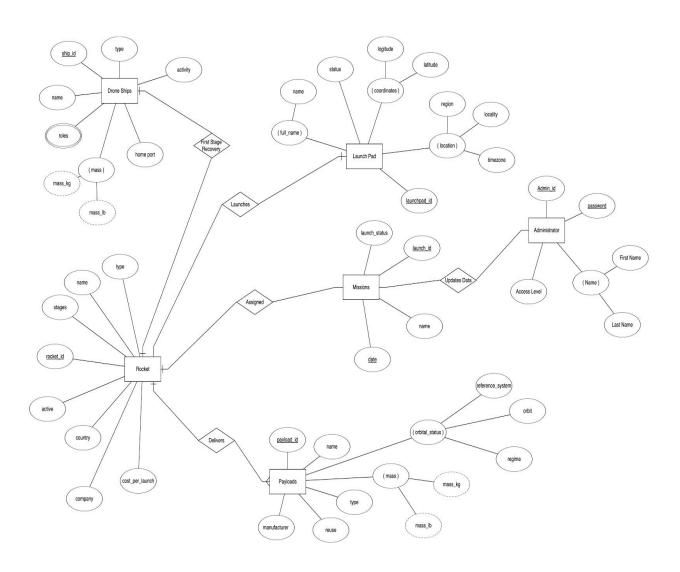
6. Administrators

- 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 (payload_id: VARCHAR(24), 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), launch_id: VARCHAR(24), 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 (ship_id: VARCHAR(24), 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), admin_id: VARCHAR(12), password: VARCHAR(20) CHECK (LENGTH(password) > 8), access_level: VARCHAR(10));

Conceptual Schema for Relations

launch_status: VARCHAR(10));

Assigned (date: DATETIME, name: VARCHAR(50), rocket_id: VARCHAR(24), launch_id: VARCHAR(24));
 First_stage_recovery (rocket_id: VARCHAR(24), ship_id: VARCHAR(24), roles: VARCHAR(50));
 Updates_Data (admin_id: VARCHAR(12), launch_id: VARCHAR(24), name: VARCHAR(50),

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

5. Launches (<u>launchpad id: VARCHAR(24</u>), <u>rocket id: VARCHAR(24</u>), 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;

MYSQL Syntax to CREATE TABLES and INSERT VALUES

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
```

	rocket_id	name	type	active	country	company	cost_per_launch
ı	te9d0d8teda388tti709dleb	Falcen I	rocket	False	Republic of the Morshall Islands	SpaceX	6700000
ı	te9d0d8teda398/Sa809dlec	Falcon 8	rocket	Pue	United States	SpoosX	50000000
ı	t Ee9d0d8Eedq39874db08dled	Falcon Heavy	rocket	true	United States	SpeceX	80000000
	Ee9d0d86edd388382d38dlee	Starship	rocket	Fake	United States	SpeceX	7000000

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;
```

	payload_id	name	type	reuse	manufacture	mass_kg	mdss_lb	orbit	reference_system
0	6cb0c4b6b0c3bb00006cbblcl	FalconSAT-2	Sato lito	Falso	SSTL	20.0	43.00	CSU	goocentris
1	Bcb0c4b7b8c8bb000Bccb1c9	RetBat	Satelite	False	SpoccX	166.0	202.00	LEO	geogentrio
2	Sab0e4h7b8e3bb0008aable8	RemakSAT	Sote lite	False	Satree	203.0	440.00	LEO	geocentric
3	SabCo4bab8e3bbCCC6coblea	cots bemo Right 2	Dragen 1.0	False	SpoceX	5250	1157.00	LEO	geocentric
4	GcbCo4tssb5o3tsbCCCGccbTos	CRS-1	Dragon 1.0	Falso	SpoccX	400.0	881.00	183	geocentrio
-									-
78	Gcb0o4olab6o8bla9998ccb237	CRS-17	Dragon II	Truc	SpoccX	24920	6472.00	153	goodentrio
77	5eb0e4cbb0c3bb0008eeb239	Starlink v0.8	Sote lite	False	SpaceX	13820.0	3002700	VLEC	geocentric
78	5ab0e4ccd:8::3bb0005eeb:239	Raparsat Constellation	Sotelite	False	Mexor Technologies	1425.0	3141.59	980	gecondric
79	Enb0c4ccin8n3bb0000ccin23h	CCSMC-2	Setelite	False	National Space Organization	0.8991	2877.30	LEO	geocontrie
80	5eb0e4cdc8c3bb0005eeb23c	GFIM	Sote lite	False	Ball Aerospace & Technologies Corp	0.09	98800	œ	geocentric
t1 1	oso × 10 volumes								

Drone Ships

```
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
Tuq', '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','Tuq','ASDS Tuq','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
```

	ship_id	home_port	name	type	roles	activity	mass_kg	mass_lb
0	CoaSod25080at40005976801	Port of Los Angeles	American Champion	Tug	Support Ship	Falso	255712	eññ000
1	5ec6ed2d000df4000397c807	Port Congvered	GO Ms Chief	High Speed Craft	Foring Recovery	Irae	448864	882000
2	5ec/Sed2d080df4000397c809	Port Congverol	GO Novigotor	Corgo	Support Ship	Irae	451778	888000
3	bensed2e080cf4000687c905	Port of Los Angelas	Botty R Camborella	lug	ASDS Tog	False	202302	446000
4	beased2e090cf4000087c905	Port Congverol	Elsbeth II	Tug	ASDS Tog	False	273983	602000
6	tem5ed2e090cf4000087c908	Port Congverel	GO Ms Tree	High Speeci Craft	Foring Recovery	True	446664	882000
6	tea5ad2a090af4000087a90a	Port Congverol	GO Fursuit	Corgo	Support Ship	Falso	602999	1109920
7	Gca9od21088st74000997a90a	Port Congverel	GO Scarahor	Corgo	Support Ship	True	450870	994000
8	5ag8ad2tg88df4000807c9gd	Port Congress of	HeWK	Ti.g	ASDS Tug	False	508023	просос
9	5eq5ed2l000df4000597c90e	Fort Lauderdale	Helywood	Tug	ASDS Tog	True	020208	700000
10	5ec6ed30090cf4000697c912	Port of Los Angeles	NRC Quest	Cargo	Support Ship	Trae	440082	872000
11	Secretion#000/4000#9709И	Port of Los Angeles	Encific Freedom	n.g	asus ing	11:18	68611	198000
12	Sea8ed33080cf4000607c975	Port of Los Angeles	Pacific Warrier	Πg	ASDS Tug	False	351030	774000
13	5eg8ed30080cf4000607c918	Port Congverel	DACHEL	Tug	ASDS Tug	False	312072	essccc
14	SeeP(icB62ic22)1335id500565	Port Connected	Firm Folgout	hig	Support Ship	Tr.IN	043802	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;
```

Г	launchpad_id	name	full_name	status	locality	region	TimeZone	Latitude	Longitude
٥	емянсесиярясню-искии»	VAFB SLC SW	Vondenberg Ar Force Boxe Space Lounch Complex 3W	retired	Vandenberg Ar Force Date	Catternia	America) as_Angeles	24.64/00	- 30 או מעד
1	Cc85450H509C84554566f84	CCAIS SIC 40	Cape Canaveral Air Force Station Space Launch	activo	Cape Canaveral	Florido	America/Now York	28.00190	-80,6774
2	54964502/5090027f8588/85	STIS	SpaceX South Teves Launch Site	under construction	Boda Chica Village	Tessus	Americo/Chicago	15,99780	-07/681
3	6c054502f506002b78506f87	VAF1SIC 4E	Vandenberg Air Force Base Space Launch Complex 48	activo	Vandenberg Air Ferce Base	California	Americo/Les_Angeles	34.68210	-120,9110
4	0c904002*506094189550f88	K90 LC 394	Kennedy Space Center Historio Launch Complex 38A	activo	Capa Canaveral	Florido	America/Naw_York	28.609NC	ON03.06-
	5e8e450255080895ce583595	Kwojalcin Atoli	Kwajolein Atoli Omelek Island	beriter	Ome ek Island	Marshall Islands	Pacific/Kwajala n	9.04772	167,7400

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',
```

```
'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
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;
```

	date	namo	rocket_id	launchpad_id	launch_id	payload_id	launah_status
0	2006- 03-24 22:80:00	Falconset	549d0c95edu59055/709drea	5x0x4502/50009X50x558885	5eb87ce9fid88e000804652a	5abCa4b5o5c3bb0005cantel	fase
	2007- 08-21 0110:00	Darrestat.	5-9d0c95edus99657/09dleb	6v0v4602/5000006dW658/86	5cb8/cceffd8ce000804b326	6.bcs4b/b8.85bc0c8seb66	tuse
2	2008 68-68 68:24:00	Trailplazor	5c9d0c95cda50565709dleb	6e9e4602/5000096dc658f86	5cb87ccbffd88e500804b82e	6:b0:4b7b8c8bbC9c8ccblce	Fase
8	300H- 00-28 23/8/00	RotScit	500d0c05cda50565/7c0dlelo	6050450215000095dc658185	5cb87ccbffd96e060604b82d	65b664b6b668bb6006cctoci	True
4	3009- 07-15 00:35:00	RozakSat	5c0d0c05cda50565708cfeb	GoGo-450215090095dc650185	Gcb87cdoffd805000004b32c	GabGa4babGa8abG00Gacalab	Truo

First 4 samples of Data

Administrators

```
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;
```

	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
```

	ship_id	rocket_id	role
0	5ea6ed2d080df4000697c901	5e9d0d95eda69955f709dleb	Fairing Recovery
1	5ea6ed2e080df4000697c908	5e9d0d95eda69973a809dlec	ASDS Tug
2	5ea6ed2e080df4000697c90a	5e9d0d95eda69955f709dleb	Fairing Recovery
3	5ea6ed2f080df4000697c90d	5e9d0d95eda69973a809dlec	Support Ship
4	5ea6ed2d080df4000697c907	5e9d0d95eda69974db09dled	Support Ship
5	5ea6ed2d080df4000697c907	5e9d0d95eda69955f709d1eb	ASDS Tug
6	5ea6ed30080df4000697c916	5e9d0d95eda69973a809dlec	ASDS Tug
7	5ea6ed2e080df4000697c908	5e9d0d95eda69973a809dlec	Fairing Recovery
8	5ea6ed2e080df4000697c90a	5e9d0d95eda69973a809dlec	ASDS Tug
9	5ea6ed2f080df4000897c90d	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;
```

П	payload_id	rocket_id	name
0	5eb0e4b5b6o3bb0006eeblel	6e9d0d96eda69966f/09dleb	FalcanSat
1	5eb0e4b7b6c3bb0006eeb1e5	5e9d0d95edd69955f709dleb	DemoSat
2	5eb0e4b7b6c3bb0006eeb1e8	5e9d0d95eda69955f709dleb	Trailblazer
3	Seb0e4bab5c3bb0005ceb1ca	5e9dDd95eda69955f709dleb	RatSat
4	5eb0e4bab8c3bb0008eeb1eb	5e9d0d95eda69955f709dleb	RazakSat
88	5eb0e4c9b8c3bb0008eeb22d	5e9d0d95eda69973a809dlec	Telstor 18V
67	5eb0e4c9b8c3bb0008eeb22e	5e9d0d95eda69973a809dloc	SACCOM IA
68	5eb0e4eab6e3bb0006eeb22f	5e9d0d95eda69973a809dlee	Fs'hail 2
69	5eb0e4cab6c3bb0006eeb230	5e9d0d95eda69973a809dlec	SSO-A
70	5eb0e4cab6c3bb0006eeb231	6e9d0d95eda69973a809dloo	CRS-16
71 7	rows × 3 columns		

Assigns

```
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',
    '5e9d0d95eda69955f709dleb','5eb87cd9ffd86e000604b32a');
INSERT INTO Assigns VALUES ('2007-03-21T01:10:00.000', 'DemoSat',
    '5e9d0d95eda69955f709dleb','5eb87cdaffd86e000604b32b');
INSERT INTO Assigns VALUES ('2008-08-03T03:34:00.000', 'Trailblazer',
    '5e9d0d95eda69955f709dleb','5eb87cdbffd86e000604b32c');
INSERT INTO Assigns VALUES ('2008-09-28T23:15:00.000', 'RatSat',
    '5e9d0d95eda69955f709dleb','5eb87cdbffd86e000604b32d');
INSERT INTO Assigns VALUES ('2008-09-28T23:15:00.000', 'RatSat',
    '5e9d0d95eda69955f709dleb','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');
```

П	date	name	rocket_id	launch_id
0	2006-03-24 22:30:00	FalconSat	5e9d0d95eda69955f709d1eb	5eb87cd9ffd86e000604b32a
1	2007-03-21 01:10:00	DemoSat	5e9d0d95eda69955f709d1eb	5eb87cdaffd86e000604b32b
2	2008-08-03 03:34:00	Trailblazer	5e9d0d95eda69955f709d1eb	5eb87cdbffd86e000804b32c
3	2008-09-28 23:15:00	RatSat	5e9d0d95eda69955f709d1eb	5eb87cdbffd88e000804b32d
4	2009-07-13 03:35:00	RazakSat	5e9d0d95eda69955f709d1eb	5eb87cdcffd86e000604b32e
5	2010-06-0418:45:00	Falcan 9 Test Flight	5e9d0d95eda69973a809dlec	5eb87cddffd86e000604b32f
6	2010-12-08 15:43:00	COTS1	5e9d0d95eda69973a809dlec	5eb87cdeffd86e000604b330
7	2012-05-22 07:44:00	COTS 2	5e9d0d95eda69973a809dlec	5eb87cdfffd86e000604b331
8	2012-10-08 00:35:00	CRS-1	5e9d0d95eda69973a809dlec	5eb87ce0ffd86e000604b332
9	2013-03-0119:10:00	CRS-2	5e9d0d95eda69973a809dlec	5eb87ce1ffd86e000604b333
10	2013-09-29 18:00:00	CASSIOPE	5e9d0d95eda69973a809dlec	5eb87ce1ffd88e000604b334
n	2013-12-03 22:41:00	SES-8	5e9d0d95eda69973a809dlec	5eb87ce2ffd86e000604b335
12	2014-01-06 19:06:00	Thaicom 6	5e9d0d95eda69973a909dlec	5eb87ce3ffd86e000604b336
13	2014-04-18 19:25:00	CRS-3	5e9d0d95eda69973a809dlec	5eb87ce4ffd88e000804b337
14	2014-07-14 15:15:00	OG-2 Mission 1	5e9d0d95eda69973a809dlec	5eb87ce4ffd86e000604b338
15	2014-08-05 08:00:00	AsiaSat 8	5e9d0d95eda69973a809dlec	5eb87ce5ffd86e000604b339
16	2014-09-07 05:00:00	AsiaSat 6	5e9d0d95eda69973a809dlec	5eb87ce6ffd86e000604b33a

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;
```

г	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	5eb87d26ffd86e000604b37l	CRS-16	True
71 r	ows × 4 colum	ns		

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', '5e9d0d95eda69973a809dlec', 'CCAFS SLC 40','active');
INSERT INTO Launches VALUES ('5e9e4502f5090995de566f86'
```

```
,'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;
```

	launchpad_id	rocket_id	name	status
0	5e9e4501f509094ba4568f84	5e9d0d95eda89973a809dlec	CCAFS SLC 40	active
1	5e9e4502f5090895de568f86	5e9d0d95eda89955f709dleb	Kwajalein Atoll	retired
2	5e9e4502f5090927f8566f85	5e9d0d95eda89973a809dlec	STLS	under construction
3	5e9e4502f509092b78566f87	5e9d0d95eda69973a809dfec	VAFB SLC 4E	active
4	5e9e4502f509092b78566f87	5e9d0d95eda89973a809dlec	VAFB SLC 4E	active
5	5e9e4502f5090927f8568f85	5e9d0d95eda89973a809dlec	STLS	under construction
6	5e9e4501f509094ba4568f84	5e9d0d95eda69973a809dlec	CCAFS SLC 40	active
7	5e9e4501f509094ba4568f84	5e9d0d95eda89973a809dlec	CCAFS SLC 40	active
8	5e9e4501f509094ba4568f84	5e9d0d95eda89973a809dlec	CCAFS SLC 40	active
9	5e9e4502f5090995de568f86	5e9d0d95eda89973a809dlec	Kwajalein Atoll	retired
10	5e9e4502f5090995de568f88	5e9d0d95eda89973a809dlec	Kwajalein Atoll	retired
11	5e9e4502f509094188568f88	5e9d0d95eda89973a809dlec	KSC LC 3BA	active
12	5e9e4502f5090995de568f88	5e9d0d95eda89973a809dlec	Kwajalein Atoll	retired
13	5e9e4502f509094188568f88	5e9d0d95eda89974db09dled	KSC LC 3BA	active
14	5e9e4502f5090995de568f88	5e9d0d95eda89973a809dlec	Kwajalein Atoll	retired
16	5e9e4502f509094188568f88	5e9d0d95eda89973a809dlec	KSC LC 3BA	active
16	5e9e4502f5090827f8568f85	5e9d0d95eda89973a809dlec	STLS	under construction

SCHFMA RFFINFMENT

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.