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Class:	BCE – 4A
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Lab Report:	10
Subject:	Database Systems
Course Instructor:	Sir. Asad Ali Malik

Sky Vault Database

MySql Code:

```sql
-- Sky Vault Database Implementation
-- CSC-270 Project: Kamran, Attiq, Haroon

DROP SCHEMA
IF EXISTS skyvault;
        CREATE SCHEMA skyvault COLLATE = utf8_general_ci;

use skyvault;
-- Table: Monitoring_Stations
CREATE TABLE IF NOT EXISTS Monitoring_Stations (
  station_id INT PRIMARY KEY,
  location VARCHAR(100),
  altitude FLOAT,
  status ENUM('active', 'maintenance', 'offline')
);
```

```sql
-- Table: Sensors
CREATE TABLE IF NOT EXISTS Sensors (
   sensor_id INT PRIMARY KEY,
   station_id INT,
   type VARCHAR(50),
   last_calibration_date DATE,
   FOREIGN KEY (station_id) REFERENCES
Monitoring_Stations(station_id)
);
```

```sql
-- Table: Solar_Events
CREATE TABLE IF NOT EXISTS Solar_Events (
   event_id INT PRIMARY KEY,
   type VARCHAR(50),
   intensity ENUM('G1','G2','G3','G4','G5'),
   detection_time DATETIME
);
```

```sql
-- Table: Magnetic_Readings
CREATE TABLE IF NOT EXISTS Magnetic_Readings (
   reading_id INT PRIMARY KEY,
   sensor_id INT,
   timestamp DATETIME,
   disturbance_level FLOAT,
   FOREIGN KEY (sensor_id) REFERENCES
Sensors(sensor_id)
);
```

```sql
-- Table: Satellite_Alerts
CREATE TABLE IF NOT EXISTS Satellite_Alerts (
   alert_id INT PRIMARY KEY,
   satellite_name VARCHAR(50),
   event_id INT,
   risk_level VARCHAR(50),
   FOREIGN KEY (event_id) REFERENCES
Solar_Events(event_id)
);
```

```sql
-- Table: Ground_Impacts
CREATE TABLE IF NOT EXISTS Ground_Impacts (
   impact_id INT PRIMARY KEY,
   location VARCHAR(100),
   event_id INT,
   effects VARCHAR(100),
   FOREIGN KEY (event_id) REFERENCES
Solar_Events(event_id) );
```

```sql
-- Table: Response_Protocols
CREATE TABLE IF NOT EXISTS Response_Protocols (
   protocol_id INT PRIMARY KEY,
   trigger_condition VARCHAR(100),
   action VARCHAR(100),
   priority_level INT
);
```

```sql
-- Table: Historical_Geostorms
CREATE TABLE IF NOT EXISTS Historical_Geostorms (
   storm_id INT PRIMARY KEY,
   year INT,
   estimated_strength VARCHAR(50),
   damage_cost DECIMAL(15,2));
```

```sql
-- Table: Monitoring_Stations
CREATE TABLE IF NOT EXISTS Monitoring_Stations (
   station_id INT PRIMARY KEY,
   location VARCHAR(100),
   altitude FLOAT,
   status ENUM('active', 'maintenance', 'offline'));
```

```sql
-- Table: Equipment
CREATE TABLE IF NOT EXISTS Equipment (
    equipment_id INT PRIMARY KEY,
    station_id INT,
    type VARCHAR(50),
    sitrep VARCHAR(50),
    FOREIGN KEY (station_id) REFERENCES
Monitoring_Stations(station_id)
);

-- Table: Personnel
CREATE TABLE IF NOT EXISTS Personnel (
    person_id INT PRIMARY KEY,
    name VARCHAR(100),
    role VARCHAR(50),
    station_id INT,
    FOREIGN KEY (station_id) REFERENCES
Monitoring_Stations(station_id)
);
```

-- INSERTS --

-- Monitoring_Stations
INSERT INTO Monitoring_Stations (station_id, location, altitude, status) VALUES
(1, '37.7749° N, 122.4194° W', 16.5, 'active'),
(2, '34.0522° N, 118.2437° W', 89.2, 'maintenance'),
(3, '40.7128° N, 74.0060° W', 10.1, 'offline'),
(4, '51.5074° N, 0.1278° W', 35.3, 'active'),
(5, '35.6895° N, 139.6917° E', 40.0, 'active'),
(6, '55.7558° N, 37.6173° E', 144.3, 'maintenance'),
(7, '28.6139° N, 77.2090° E', 216.8, 'active'),
(8, '19.0760° N, 72.8777° E', 14.0, 'offline'),
(9, '48.8566° N, 2.3522° E', 75.0, 'active'),
(10, '52.5200° N, 13.4050° E', 34.1, 'maintenance'),
(11, '31.7683° N, 35.2137° E', 754.0, 'active'),
(12, '41.9028° N, 12.4964° E', 21.0, 'active'),
(13, '1.3521° N, 103.8198° E', 15.3, 'offline'),
(14, '45.4215° N, 75.6972° W', 70.0, 'maintenance'),
(15, '33.6844° N, 73.0479° E', 508.0, 'active');

-- Sensors
INSERT INTO Sensors (sensor_id, station_id, type, last_calibration_date) VALUES
(1, 1, 'magnetometer', '2025-01-12'),
(2, 1, 'spectrometer', '2024-12-05'),
(3, 2, 'radiometer', '2025-03-10'),
(4, 3, 'magnetometer', '2025-02-18'),
(5, 4, 'spectrometer', '2024-11-15'),
(6, 5, 'infrared sensor', '2024-12-22'),
(7, 6, 'magnetometer', '2025-01-01'),
(8, 7, 'gamma detector', '2024-10-30'),
(9, 8, 'magnetometer', '2025-01-20'),
(10, 9, 'spectrometer', '2025-02-28'),
(11, 10, 'ultraviolet sensor', '2024-09-09'),
(12, 11, 'magnetometer', '2025-03-01'),
(13, 12, 'radiometer', '2025-01-15'),
(14, 13, 'gamma detector', '2025-02-10'),
(15, 14, 'spectrometer', '2025-03-05');

```sql
-- Solar_Events
INSERT INTO Solar_Events (event_id, type, intensity, detection_time) VALUES
(1, 'solar flare', 'G3', '2025-03-12 14:30:00'),
(2, 'CME', 'G2', '2025-02-27 11:10:00'),
(3, 'solar wind', 'G1', '2025-04-01 06:45:00'),
(4, 'solar flare', 'G4', '2025-01-20 23:50:00'),
(5, 'CME', 'G5', '2025-03-03 13:25:00'),
(6, 'solar wind', 'G1', '2025-04-05 04:00:00'),
(7, 'solar flare', 'G2', '2025-01-10 18:00:00'),
(8, 'CME', 'G3', '2025-03-15 09:10:00'),
(9, 'solar wind', 'G1', '2025-02-22 05:00:00'),
(10, 'solar flare', 'G4', '2025-03-28 12:30:00'),
(11, 'CME', 'G3', '2025-01-05 07:25:00'),
(12, 'solar wind', 'G2', '2025-03-18 16:10:00'),
(13, 'solar flare', 'G5', '2025-02-02 21:55:00'),
(14, 'CME', 'G1', '2025-01-25 02:40:00'),
(15, 'solar wind', 'G2', '2025-03-07 19:00:00');

INSERT INTO Magnetic_Readings (reading_id, sensor_id, timestamp, disturbance_level) VALUES
(1, 1, '2025-05-10 08:00:00', 120.5),
(2, 2, '2025-05-10 08:05:00', 115.3),
(3, 3, '2025-05-10 08:10:00', 110.7),
(4, 4, '2025-05-10 08:15:00', 108.9),
(5, 5, '2025-05-10 08:20:00', 130.2),
(6, 6, '2025-05-10 08:25:00', 125.4),
(7, 7, '2025-05-10 08:30:00', 122.1),
(8, 8, '2025-05-10 08:35:00', 118.0),
(9, 9, '2025-05-10 08:40:00', 117.2),
(10, 10, '2025-05-10 08:45:00', 114.8),
(11, 11, '2025-05-10 08:50:00', 116.9),
(12, 12, '2025-05-10 08:55:00', 119.3),
(13, 13, '2025-05-10 09:00:00', 121.0),
(14, 14, '2025-05-10 09:05:00', 113.5),
(15, 15, '2025-05-10 09:10:00', 111.6);

INSERT INTO Satellite_Alerts (alert_id, satellite_name, event_id, risk_level) VALUES
(1, 'GOES', 1, 'medium'),
(2, 'DSCOVR', 2, 'low'),
(3, 'GOES', 3, 'low'),
(4, 'DSCOVR', 4, 'high'),
(5, 'GOES', 5, 'critical'),
(6, 'DSCOVR', 6, 'low'),
(7, 'GOES', 7, 'medium'),
(8, 'DSCOVR', 8, 'high'),
(9, 'GOES', 9, 'low'),
(10, 'DSCOVR', 10, 'high'),
(11, 'GOES', 11, 'medium'),
(12, 'DSCOVR', 12, 'medium'),
(13, 'GOES', 13, 'critical'),
(14, 'DSCOVR', 14, 'low'),
(15, 'GOES', 15, 'medium');
```

```sql
INSERT INTO Ground_Impacts (impact_id, location, event_id, effects) VALUES
(1, 'California, USA', 1, 'power grid disruption'),
(2, 'Texas, USA', 2, 'radio disruption'),
(3, 'Florida, USA', 3, 'GPS disruption'),
(4, 'Ontario, Canada', 4, 'power grid disruption'),
(5, 'Berlin, Germany', 5, 'radio disruption'),
(6, 'Tokyo, Japan', 6, 'GPS disruption'),
(7, 'Delhi, India', 7, 'power grid disruption'),
(8, 'Karachi, Pakistan', 8, 'radio disruption'),
(9, 'Paris, France', 9, 'GPS disruption'),
(10, 'Rome, Italy', 10, 'power grid disruption'),
(11, 'Moscow, Russia', 11, 'radio disruption'),
(12, 'London, UK', 12, 'GPS disruption'),
(13, 'Beijing, China', 13, 'power grid disruption'),
(14, 'Cairo, Egypt', 14, 'radio disruption'),
(15, 'Rio de Janeiro, Brazil', 15, 'GPS disruption');

INSERT INTO Response_Protocols (protocol_id, trigger_condition, action, priority_level) VALUES
(1, 'G3 event detected', 'Notify control centers', 2),
(2, 'G4 event detected', 'Activate emergency protocols', 1),
(3, 'Solar flare > G2', 'Alert satellite operators', 3),
(4, 'Radio disruption reported', 'Switch frequencies', 2),
(5, 'GPS loss', 'Enable inertial navigation', 3),
(6, 'High disturbance level > 120', 'Calibrate sensors', 2),
(7, 'Power grid instability', 'Reduce load', 1),
(8, 'Radiation alert', 'Advise aircraft reroute', 1),
(9, 'CME detection', 'Isolate sensitive equipment', 2),
(10, 'High-priority alert from GOES', 'Initiate backup communication', 1),
(11, 'G5 intensity', 'Full lockdown of satellites', 1),
(12, 'Multiple sensor errors', 'Diagnostic test', 3),
(13, 'Low calibration score', 'Manual override', 3),
(14, 'Equipment failure', 'Notify maintenance team', 2),
(15, 'Historical storm match', 'Consult archival logs', 3);

INSERT INTO Historical_Geostorms (storm_id, year, estimated_strength, damage_cost) VALUES
(1, 1859, 'Carrington-class', 2000000000.00),
(2, 1921, 'Strong', 1500000000.00),
(3, 1989, 'Moderate', 500000000.00),
(4, 2000, 'Strong', 750000000.00),
(5, 2003, 'Extreme', 1200000000.00),
(6, 2012, 'Severe', 2500000000.00),
(7, 1994, 'Moderate', 300000000.00),
(8, 1991, 'Strong', 450000000.00),
(9, 2015, 'Weak', 150000000.00),
(10, 1972, 'Strong', 900000000.00),
(11, 1960, 'Moderate', 250000000.00),
(12, 2006, 'Weak', 180000000.00),
(13, 2017, 'Moderate', 400000000.00),
(14, 1997, 'Severe', 1000000000.00),
(15, 2021, 'Moderate', 550000000.00);
```
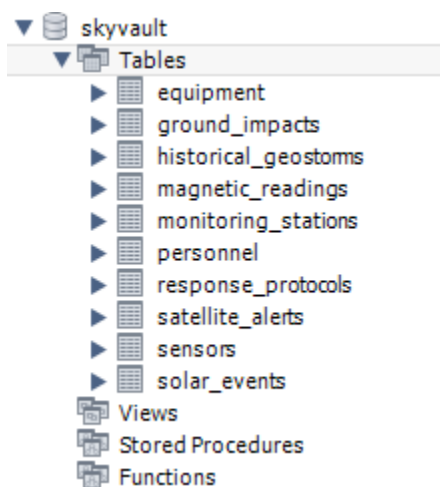
INSERT INTO Equipment (equipment_id, station_id, type, sitrep) VALUES
(1, 1, 'backup generator', 'operational'),
(2, 1, 'antenna', 'faulty'),
(3, 2, 'power inverter', 'operational'),
(4, 3, 'antenna', 'operational'),
(5, 4, 'backup generator', 'damaged'),
(6, 5, 'cooling system', 'operational'),
(7, 6, 'antenna', 'damaged'),
(8, 7, 'battery bank', 'operational'),
(9, 8, 'backup generator', 'faulty'),
(10, 9, 'antenna', 'operational'),
(11, 10, 'power inverter', 'damaged'),
(12, 11, 'cooling system', 'operational'),
(13, 12, 'battery bank', 'operational'),
(14, 13, 'antenna', 'operational'),
(15, 14, 'backup generator', 'faulty');

INSERT INTO Personnel (person_id, name, role, station_id) VALUES
(1, 'Dr. Sara Ali', 'meteorologist', 1),
(2, 'Engr. John Smith', 'engineer', 1),
(3, 'Dr. Maria Lin', 'meteorologist', 2),
(4, 'Engr. David Kim', 'engineer', 2),
(5, 'Dr. Zoe Chen', 'meteorologist', 3),
(6, 'Engr. Omar Hussain', 'engineer', 3),
(7, 'Dr. Elena Petrova', 'meteorologist', 4),
(8, 'Engr. Khalid Noor', 'engineer', 4),
(9, 'Dr. Alice Ray', 'meteorologist', 5),
(10, 'Engr. Faisal Khan', 'engineer', 5),
(11, 'Dr. Nora Patel', 'meteorologist', 6),
(12, 'Engr. Jamie Watts', 'engineer', 6),
(13, 'Dr. Adeel Raza', 'meteorologist', 7),
(14, 'Engr. Carla Diaz', 'engineer', 7),
(15, 'Dr. Hana Yoon', 'meteorologist', 8);

Output:

▼ skyvault
  ▼ Tables
    ▶ equipment
    ▶ ground_impacts
    ▶ historical_geostorms
    ▶ magnetic_readings
    ▶ monitoring_stations
    ▶ personnel
    ▶ response_protocols
    ▶ satellite_alerts
    ▶ sensors
    ▶ solar_events
  Views
  Stored Procedures
  Functions

Tables:

equipment

equipment_id	station_id	type	sitrep
1	1	backup generator	operational
2	1	antenna	faulty
3	2	power inverter	operational
4	3	antenna	operational
5	4	backup generator	damaged
6	5	cooling system	operational
7	6	antenna	damaged
8	7	battery bank	operational
9	8	backup generator	faulty

ground_impacts

impact_id	location	event_id	effects
1	California, USA	1	power grid disruption
2	Texas, USA	2	radio disruption
3	Florida, USA	3	GPS disruption
4	Ontario, Canada	4	power grid disruption
5	Berlin, Germany	5	radio disruption
6	Tokyo, Japan	6	GPS disruption
7	Delhi, India	7	power grid disruption
8	Karachi, Pakistan	8	radio disruption
9	Paris, France	9	GPS disruption

historical_geostorms

storm_id	year	estimated_strength	damage_cost
1	1859	Carrington-class	2000000000.00
2	1921	Strong	1500000000.00
3	1989	Moderate	500000000.00
4	2000	Strong	750000000.00
5	2003	Extreme	1200000000.00
6	2012	Severe	2500000000.00
7	1994	Moderate	300000000.00
8	1991	Strong	450000000.00
9	2015	Weak	150000000.00

magnetic_readings

reading_id	sensor_id	timestamp	disturbance_level
1	1	2025-05-10 08:00:00	120.5
2	2	2025-05-10 08:05:00	115.3
3	3	2025-05-10 08:10:00	110.7
4	4	2025-05-10 08:15:00	108.9
5	5	2025-05-10 08:20:00	130.2
6	6	2025-05-10 08:25:00	125.4
7	7	2025-05-10 08:30:00	122.1
8	8	2025-05-10 08:35:00	118
9	9	2025-05-10 08:40:00	117.2

monitoring_stations

station_id	location	altitude	status
1	37.7749° N, 122.4194° W	16.5	active
2	34.0522° N, 118.2437° W	89.2	maintenance
3	40.7128° N, 74.0060° W	10.1	offline
4	51.5074° N, 0.1278° W	35.3	active
5	35.6895° N, 139.6917° E	40	active
6	55.7558° N, 37.6173° E	144.3	maintenance
7	28.6139° N, 77.2090° E	216.8	active
8	19.0760° N, 72.8777° E	14	offline
9	48.8566° N, 2.3522° E	75	active

personnel

person_id	name	role	station_id
1	Dr. Sara Ali	meteorologist	1
2	Engr. John Smith	engineer	1
3	Dr. Maria Lin	meteorologist	2
4	Engr. David Kim	engineer	2
5	Dr. Zoe Chen	meteorologist	3
6	Engr. Omar Hussain	engineer	3
7	Dr. Elena Petrova	meteorologist	4
8	Engr. Khalid Noor	engineer	4
9	Dr. Alice Ray	meteorologist	5

response_protocols

protocol_id	trigger_condition	action	priority_level
1	G3 event detected	Notify control centers	2
2	G4 event detected	Activate emergency protocols	1
3	Solar flare > G2	Alert satellite operators	3
4	Radio disruption reported	Switch frequencies	2
5	GPS loss	Enable inertial navigation	3
6	High disturbance level > 120	Calibrate sensors	2
7	Power grid instability	Reduce load	1
8	Radiation alert	Advise aircraft reroute	1
9	CME detection	Isolate sensitive equipment	2

satellite_alerts

alert_id	satellite_name	event_id	risk_level
1	GOES	1	medium
2	DSCOVR	2	low
3	GOES	3	low
4	DSCOVR	4	high
5	GOES	5	critical
6	DSCOVR	6	low
7	GOES	7	medium
8	DSCOVR	8	high
9	GOES	9	low

sensors

	sensor_id	station_id	type	last_calibration_date
▶	1	1	magnetometer	2025-01-12
	2	1	spectrometer	2024-12-05
	3	2	radiometer	2025-03-10
	4	3	magnetometer	2025-02-18
	5	4	spectrometer	2024-11-15
	6	5	infrared sensor	2024-12-22
	7	6	magnetometer	2025-01-01
	8	7	gamma detector	2024-10-30
	9	8	magnetometer	2025-01-20

solar_events

	event_id	type	intensity	detection_time
▶	1	solar flare	G3	2025-03-12 14:30:00
	2	CME	G2	2025-02-27 11:10:00
	3	solar wind	G1	2025-04-01 06:45:00
	4	solar flare	G4	2025-01-20 23:50:00
	5	CME	G5	2025-03-03 13:25:00
	6	solar wind	G1	2025-04-05 04:00:00
	7	solar flare	G2	2025-01-10 18:00:00
	8	CME	G3	2025-03-15 09:10:00
	9	solar wind	G1	2025-02-22 05:00:00

Critical Analysis

In this lab, I created the database of our project titled as 'Sky Vault'. It is used to monitor and archive solar storms, space weather, and planetary electromagnetic disruptions through a centralized and normalized database system. I created 10 tables each having multiple attributes and having 15 entries of data. Firstly, I created a schema of the database using **CREATE SCHEMA skyvault COLLATE = utf8_general_ci;** syntax then I created the 10 tables defining their data types, length and constraints. Then I inserted 15 entries of data in attributes of each table one by one. This is the first step which is database creation and we will perform multiple enhancements and operations in future to make it intuitive and a secure database of storing information about sensors, solar events, response protocols, satellite alerts, monitoring stations, personnel, historical geostorms, magnetic readings, equipment and ground impacts.

Lab Assessment		
Lab Task Evaluation	**/6**	**/10**
Lab Report	**/4**	
Instructor Signature and Comments		