

Group Assignment: Secure Data Storage and Encryption using GnuPG

Group Members:

Ishan Prabhune

Harshal Sawant

Pratik Darade

Aniket Singh

Raj Dedhia

Task1: Database Design and Setup

Enter MySQL

```
ishan@hpx360:~$ sudo mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 22
Server version: 8.0.34-0ubuntu0.22.04.1 (Ubuntu)

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql>
```

Create database Ecommerce

```
mysql> create database ecommerce;
Query OK, 1 row affected (0.01 sec)

mysql> show databases;
+-----+
| Database |
+-----+
| ecommerce |
| information_schema |
| mysql |
| performance_schema |
| sys |
| world |
+-----+
6 rows in set (0.00 sec)

mysql> use ecommerce;
Database changed
```

Creating tables

```
mysql> CREATE TABLE Users (  
->     UserID INT PRIMARY KEY,  
->     FirstName VARCHAR(50),  
->     LastName VARCHAR(50),  
->     Email VARCHAR(100) UNIQUE,  
->     Password VARCHAR(100),  
->     RegistrationDate DATE  
-> );  
Query OK, 0 rows affected (0.02 sec)  
  
mysql>  
mysql> CREATE TABLE Orders (  
->     OrderID INT PRIMARY KEY,  
->     UserID INT,  
->     OrderDate DATE,  
->     TotalAmount DECIMAL(10, 2),  
->     FOREIGN KEY (UserID) REFERENCES Users(UserID)  
-> );  
Query OK, 0 rows affected (0.01 sec)  
  
mysql>  
mysql> CREATE TABLE Products (  
->     ProductID INT PRIMARY KEY,  
->     ProductName VARCHAR(100),  
->     Price DECIMAL(10, 2),  
->     StockQuantity INT  
-> );  
Query OK, 0 rows affected (0.02 sec)  
  
mysql>  
mysql> CREATE TABLE OrderDetails (  
->     OrderDetailID INT PRIMARY KEY,  
->     OrderID INT,  
->     ProductID INT,  
->     Quantity INT,  
->     Subtotal DECIMAL(10, 2),  
->     FOREIGN KEY (OrderID) REFERENCES Orders(OrderID),  
->     FOREIGN KEY (ProductID) REFERENCES Products(ProductID)  
-> );  
Query OK, 0 rows affected (0.01 sec)
```

Task2: Secure Data Storage

Populating table Users

```
mysql> INSERT INTO Users (UserID, FirstName, LastName, Email, Password, RegistrationDate)
-> VALUES
-> (1, 'John', 'Doe', 'john.doe@example.com', 'password123', '2023-01-01'),
-> (2, 'Alice', 'Johnson', 'alice.j@example.com', 'securepass', '2023-01-02'),
-> (3, 'Michael', 'Brown', 'michael.b@example.com', 'mypass', '2023-02-28'),
-> (4, 'Emily', 'Smith', 'emily.s@example.com', 'pass1234', '2023-03-15'),
-> (5, 'William', 'Davis', 'william.d@example.com', 'qwerty', '2023-04-05'),
-> (6, 'Emma', 'Martinez', 'emma.m@example.com', 'abc123', '2023-04-18'),
-> (7, 'James', 'Anderson', 'james.a@example.com', 'p@ssw0rd', '2023-05-09'),
-> (8, 'Olivia', 'Garcia', 'olivia.g@example.com', 'letmein', '2023-06-22'),
-> (9, 'Liam', 'Hernandez', 'liam.h@example.com', 'welcome123', '2023-07-03'),
-> (10, 'Ava', 'Lopez', 'ava.l@example.com', '123456', '2023-08-14'),
-> (11, 'Noah', 'Clark', 'noah.c@example.com', 'qwerty123', '2023-09-05'),
-> (12, 'Sophia', 'Taylor', 'sophia.t@example.com', 'secure123', '2023-10-10'),
-> (13, 'Liam', 'Wilson', 'liam.w@example.com', 'password', '2023-11-01'),
-> (14, 'Olivia', 'Moore', 'olivia.m@example.com', '1qaz!@WSX', '2023-12-15'),
-> (15, 'Ethan', 'Hall', 'ethan.h@example.com', '12345678', '2024-01-01'),
-> (16, 'Ava', 'Young', 'ava.y@example.com', 'qwertyuiop', '2024-02-01'),
-> (17, 'Noah', 'King', 'noah.k@example.com', '123456789', '2024-03-01'),
-> (18, 'Sophia', 'Wright', 'sophia.w@example.com', '1234567890', '2024-04-01'),
-> (19, 'Liam', 'Scott', 'liam.s@example.com', '12345678901', '2024-05-01'),
-> (20, 'Olivia', 'Green', 'olivia.g@example.com', '123456789012', '2024-06-01'),
-> (21, 'Ethan', 'Adams', 'ethan.a@example.com', '1234567890123', '2024-07-01'),
-> (22, 'Ava', 'Baker', 'ava.b@example.com', '12345678901234', '2024-08-01'),
-> (23, 'Noah', 'Nelson', 'noah.n@example.com', '123456789012345', '2024-09-01'),
-> (24, 'Sophia', 'Hill', 'sophia.h@example.com', '1234567890123456', '2024-10-01'),
-> (25, 'Liam', 'Carter', 'liam.c@example.com', '12345678901234567', '2024-11-01'),
-> (26, 'Olivia', 'Meyer', 'olivia.m@example.com', '123456789012345678', '2024-12-01'),
-> (27, 'Ethan', 'Morgan', 'ethan.m@example.com', '1234567890123456789', '2025-01-01'),
-> (28, 'Ava', 'Barnes', 'ava.b@example.com', '12345678901234567890', '2025-02-01'),
-> (29, 'Noah', 'Foster', 'noah.f@example.com', '123456789012345678901', '2025-03-01'),
-> (30, 'Sophia', 'Perry', 'sophia.p@example.com', '1234567890123456789012', '2025-04-01'),
-> (31, 'Liam', 'Long', 'liam.l@example.com', '12345678901234567890123', '2025-05-01'),
-> (32, 'Olivia', 'Parker', 'olivia.p@example.com', '123456789012345678901234', '2025-06-01'),
-> (33, 'Ethan', 'Roberts', 'ethan.r@example.com', '1234567890123456789012345', '2025-07-01'),
-> (34, 'Ava', 'Turner', 'ava.t@example.com', '12345678901234567890123456', '2025-08-01'),
-> (35, 'Noah', 'Phillips', 'noah.p@example.com', '123456789012345678901234567', '2025-09-01'),
-> (36, 'Sophia', 'Cruz', 'sophia.c@example.com', '1234567890123456789012345678', '2025-10-01'),
-> (37, 'Liam', 'Diaz', 'liam.d@example.com', '12345678901234567890123456789', '2025-11-01'),
-> (38, 'Olivia', 'Hayes', 'olivia.h@example.com', '123456789012345678901234567890', '2025-12-01'),
-> (39, 'Ethan', 'Myers', 'ethan.m@example.com', '1234567890123456789012345678901', '2026-01-01'),
-> (40, 'Ava', 'Mason', 'ava.m@example.com', '12345678901234567890123456789012', '2026-02-01'),
-> (41, 'Ava', 'Hernandez', 'ava.h@example.com', 'faith', '2026-03-14'),
-> (42, 'Liam', 'Johnson', 'liam.j@example.com', 'courage', '2026-04-27'),
-> (43, 'Emma', 'Smith', 'emma.s@example.com', 'wisdom', '2026-05-08'),
-> (44, 'Olivia', 'Garca', 'olivia@example.com', 'patience', '2026-06-21'),
-> (45, 'Noah', 'Taylor', 'noah.t@example.com', 'kindness', '2026-07-04'),
-> (46, 'Sophia', 'Clark', 'sophia.c@example.com', 'compassion', '2026-08-17'),
-> (47, 'Liam', 'Anderson', 'liam.a@example.com', 'generosity', '2026-09-30'),
-> (48, 'Oliver', 'Martinez', 'oliver.m@example.com', 'humility', '2026-10-13'),
-> (49, 'Ava', 'Perez', 'ava.p@example.com', 'forgiveness', '2026-11-26'),
-> (50, 'Emma', 'Davis', 'emma.d@example.com', 'gratitude', '2026-12-07');
Query OK, 50 rows affected (0.04 sec)
Records: 50 Duplicates: 0 Warnings: 0
```

Populating table orders

```
mysql> INSERT INTO Orders (OrderID, UserID, OrderDate, TotalAmount)
-> VALUES
-> (1, 1, '2023-01-10', 175.25),
-> (2, 2, '2023-01-15', 220.75),
-> (3, 3, '2023-01-20', 180.50),
-> (4, 4, '2023-01-25', 205.00),
-> (5, 5, '2023-01-30', 195.75),
-> (6, 6, '2023-02-05', 160.25),
-> (7, 7, '2023-02-10', 210.50),
-> (8, 8, '2023-02-15', 175.25),
-> (9, 9, '2023-02-20', 190.75),
-> (10, 10, '2023-02-25', 200.00),
-> (11, 11, '2023-03-01', 185.75),
-> (12, 12, '2023-03-05', 170.25),
-> (13, 13, '2023-03-10', 215.50),
-> (14, 14, '2023-03-15', 195.00),
-> (15, 15, '2023-03-20', 205.75),
-> (16, 16, '2023-03-25', 180.25),
-> (17, 17, '2023-04-01', 225.50),
-> (18, 18, '2023-04-05', 165.00),
-> (19, 19, '2023-04-10', 210.75),
-> (20, 20, '2023-04-15', 190.25),
-> (21, 21, '2023-04-20', 200.50),
-> (22, 22, '2023-04-25', 185.00),
-> (23, 23, '2023-05-01', 220.75),
-> (24, 24, '2023-05-05', 170.25),
-> (25, 25, '2023-05-10', 215.50),
-> (26, 26, '2023-05-15', 195.00),
-> (27, 27, '2023-05-20', 205.75),
-> (28, 28, '2023-05-25', 180.25),
-> (29, 29, '2023-06-01', 225.50),
-> (30, 30, '2023-06-05', 165.00),
-> (31, 31, '2023-06-10', 210.75),
-> (32, 32, '2023-06-15', 190.25),
-> (33, 33, '2023-06-20', 200.50),
-> (34, 34, '2023-06-25', 185.00),
-> (35, 35, '2023-07-01', 220.75),
-> (36, 36, '2023-07-05', 170.25),
-> (37, 37, '2023-07-10', 215.50),
-> (38, 38, '2023-07-15', 195.00),
-> (39, 39, '2023-07-20', 205.75),
-> (40, 40, '2023-07-25', 180.25),
-> (41, 41, '2023-07-30', 197.25),
-> (42, 42, '2023-08-04', 205.50),
-> (43, 43, '2023-08-09', 192.75),
-> (44, 44, '2023-08-14', 175.25),
-> (45, 45, '2023-08-19', 160.50),
-> (46, 46, '2023-08-24', 145.75),
-> (47, 47, '2023-08-29', 198.25),
-> (48, 48, '2023-09-03', 210.50),
-> (49, 49, '2023-09-08', 185.75),
-> (50, 50, '2023-09-13', 197.25);
Query OK, 50 rows affected (0.00 sec)
Records: 50 Duplicates: 0 Warnings: 0
```

Populate table Products

```
mysql> INSERT INTO Products (ProductID, ProductName, Price, StockQuantity)
-> VALUES
-> (1, 'Laptop', 699.99, 30),
-> (2, 'Smartphone', 299.99, 50),
-> (3, 'Tablet', 199.99, 40),
-> (4, 'Gaming Console', 399.99, 25),
-> (5, 'Smart Watch', 149.99, 60),
-> (6, 'Desktop Computer', 899.99, 20),
-> (7, 'Wireless Mouse', 29.95, 100),
-> (8, 'External Hard Drive', 79.99, 45),
-> (9, 'Bluetooth Speaker', 59.99, 70),
-> (10, 'Printer', 129.95, 35),
-> (21, 'Security Camera', 129.99, 35),
-> (22, 'Graphic Tablet', 199.95, 20),
-> (23, 'Drones', 299.99, 10),
-> (24, 'Portable Projector', 159.95, 30),
-> (25, 'Gaming Keyboard', 69.99, 55),
-> (26, 'Wireless Router', 79.99, 40),
-> (27, 'Desk Lamp', 24.95, 90),
-> (28, 'Backpack', 39.99, 75),
-> (29, 'Cordless Phone', 59.95, 60),
-> (30, 'Headphones', 49.95, 80);
Query OK, 30 rows affected (0.01 sec)
Records: 30  Duplicates: 0  Warnings: 0
```

Populate table OrderDetails

```
mysql> INSERT INTO OrderDetails (OrderDetailID, OrderID, ProductID, Quantity, Subtotal)
-> VALUES
-> (1, 1, 1, 2, 1399.98),
-> (2, 2, 3, 4, 1199.96),
-> (3, 3, 5, 1, 149.99),
-> (4, 4, 8, 3, 239.97),
-> (5, 5, 10, 2, 259.90),
-> (6, 6, 12, 1, 79.99),
-> (7, 7, 14, 5, 249.95),
-> (8, 8, 17, 2, 69.90),
-> (9, 9, 19, 3, 449.97),
-> (10, 10, 21, 1, 199.99),
```

```
->      (41, 41, 27, 2, 149.90),  
->      (42, 42, 29, 1, 79.99),  
->      (43, 43, 2, 4, 1199.96),  
->      (44, 44, 4, 1, 399.99),  
->      (45, 45, 6, 2, 299.98),  
->      (46, 46, 7, 3, 194.97),  
->      (47, 47, 9, 1, 149.99),  
->      (48, 48, 11, 5, 399.95),  
->      (49, 49, 13, 2, 159.98),  
->      (50, 50, 15, 1, 79.99);  
Query OK, 50 rows affected (0.04 sec)  
Records: 50  Duplicates: 0  Warnings: 0
```

Exporting table data

```
ishan@hpx360:~$ mysqldump -u root -p ecommerce > ecom_data.sql  
Enter password:  
ishan@hpx360:~$
```

Task 3: Encryption using GnuPG

Installing GnuPG

```
ishan@hpx360:~$ sudo apt install gnupg
[sudo] password for ishan:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
gnupg is already the newest version (2.2.27-3ubuntu2.1).
gnupg set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 33 not upgraded.
ishan@hpx360:~$
```

Displaying the keys of GnuPG

```
ishan@hpx360:~$ gpg --gen-key
gpg (GnuPG) 2.2.27; Copyright (C) 2021 Free Software Foundation, Inc.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

gpg: directory '/home/ishan/.gnupg' created
gpg: keybox '/home/ishan/.gnupg/pubring.kbx' created
Note: Use "gpg --full-generate-key" for a full featured key generation dialog.

GnuPG needs to construct a user ID to identify your key.

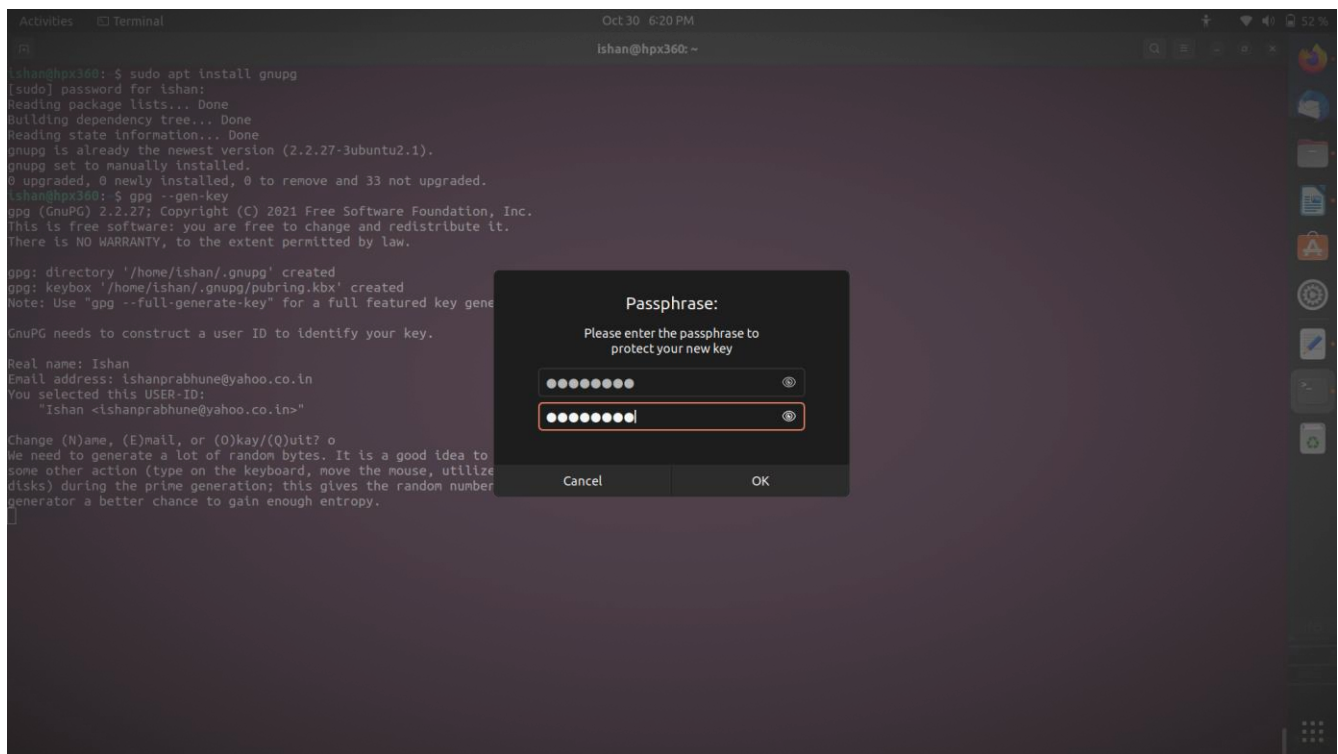
Real name: Ishan
Email address: ishanprabhune@yahoo.co.in
You selected this USER-ID:
    "Ishan <ishanprabhune@yahoo.co.in>"

Change (N)ame, (E)mail, or (O)kay/(Q)uit? o
We need to generate a lot of random bytes. It is a good idea to perform
some other action (type on the keyboard, move the mouse, utilize the
disks) during the prime generation; this gives the random number
generator a better chance to gain enough entropy.
We need to generate a lot of random bytes. It is a good idea to perform
some other action (type on the keyboard, move the mouse, utilize the
disks) during the prime generation; this gives the random number
generator a better chance to gain enough entropy.
gpg: /home/ishan/.gnupg/trustdb.gpg: trustdb created
gpg: key E238785FAA151885 marked as ultimately trusted
gpg: directory '/home/ishan/.gnupg/openpgp-revocs.d' created
gpg: revocation certificate stored as '/home/ishan/.gnupg/openpgp-revocs.d/324ED9FFFE6EDE03451E12CFE238785FAA151885.rev'
public and secret key created and signed.

pub   rsa3072 2023-10-30 [SC] [expires: 2025-10-29]
       324ED9FFFE6EDE03451E12CFE238785FAA151885
uid           Ishan <ishanprabhune@yahoo.co.in>
sub   rsa3072 2023-10-30 [E] [expires: 2025-10-29]

ishan@hpx360:~$
```

setting a password for gnupg



Listing keys and exporting our key

```
ishan@hpx360:~$ gpg --list-keys
gpg: checking the trustdb
gpg: marginals needed: 3  completes needed: 1  trust model: pgp
gpg: depth: 0  valid: 1  signed: 0  trust: 0-, 0q, 0n, 0m, 0f, 1u
gpg: next trustdb check due at 2025-10-29
/home/ishan/.gnupg/pubring.kbx
-----
pub   rsa3072 2023-10-30 [SC] [expires: 2025-10-29]
      324ED9FFFE6EDE03451E12CFE238785FAA151885
uid           [ultimate] Ishan <ishanprabhune@yahoo.co.in>
sub   rsa3072 2023-10-30 [E] [expires: 2025-10-29]

ishan@hpx360:~$ gpg --output public_key.gpg --armor --export ishanprabhune@yahoo.co.in
ishan@hpx360:~$
```

installing GnuPG for python pip


```

ishan@hpx360:~$ pip3 install gnupg
Defaulting to user installation because normal site-packages is not writeable
Collecting gnupg
  Downloading gnupg-2.3.1.tar.gz (100 kB)
    100.4/100.4 kB 2.2 MB/s eta 0:00:00
  Preparing metadata (setup.py) ... done
Collecting psutil>=1.2.1 (from gnupg)
  Downloading psutil-5.9.6-cp36-abi3-manylinux_2_12_x86_64.manylinux2010_x86_64.manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (21 kB)
  Downloading psutil-5.9.6-cp36-abi3-manylinux_2_12_x86_64.manylinux2010_x86_64.manylinux_2_17_x86_64.manylinux2014_x86_64.whl (283 kB)
    283.6/283.6 kB 14.8 MB/s eta 0:00:00
Building wheels for collected packages: gnupg
  Building wheel for gnupg (setup.py) ... done
  Created wheel for gnupg: filename=gnupg-2.3.1-py3-none-any.whl size=94622 sha256=cfd2a18b9efe3c5ca77f070696bde17f9eec323bad19de4ba9a1fa522ef7d3b
  Stored in directory: /home/ishan/.cache/pip/wheels/96/12/15/82eadc149bbdb08063f4ce8b1b3971cc5d0e442707368f995f
Successfully built gnupg
Installing collected packages: psutil, gnupg
Successfully installed gnupg-2.3.1 psutil-5.9.6

```

installing mysql connector

```

ishan@hpx360:~$ pip3 install mysql-connector-python
Defaulting to user installation because normal site-packages is not writeable
Collecting mysql-connector-python
  Downloading mysql_connector_python-8.2.0-cp310-cp310-manylinux_2_17_x86_64.whl.metadata (2.1 kB)
Collecting protobuf<=4.21.12,>=4.21.1 (from mysql-connector-python)
  Downloading protobuf-4.21.12-cp37-abi3-manylinux2014_x86_64.whl (409 kB)
    409.8/409.8 kB 7.9 MB/s eta 0:00:00
  Downloading mysql_connector_python-8.2.0-cp310-cp310-manylinux_2_17_x86_64.whl (31.6 MB)
    31.6/31.6 MB 36.5 MB/s eta 0:00:00
Installing collected packages: protobuf, mysql-connector-python
Successfully installed mysql-connector-python-8.2.0 protobuf-4.21.12
ishan@hpx360:~$

```

encrypting entire file using GnuPG

```

ishan@hpx360:~$ gpg -e -r ishanprabhune@yahoo.co.in ecom_data.sql

```

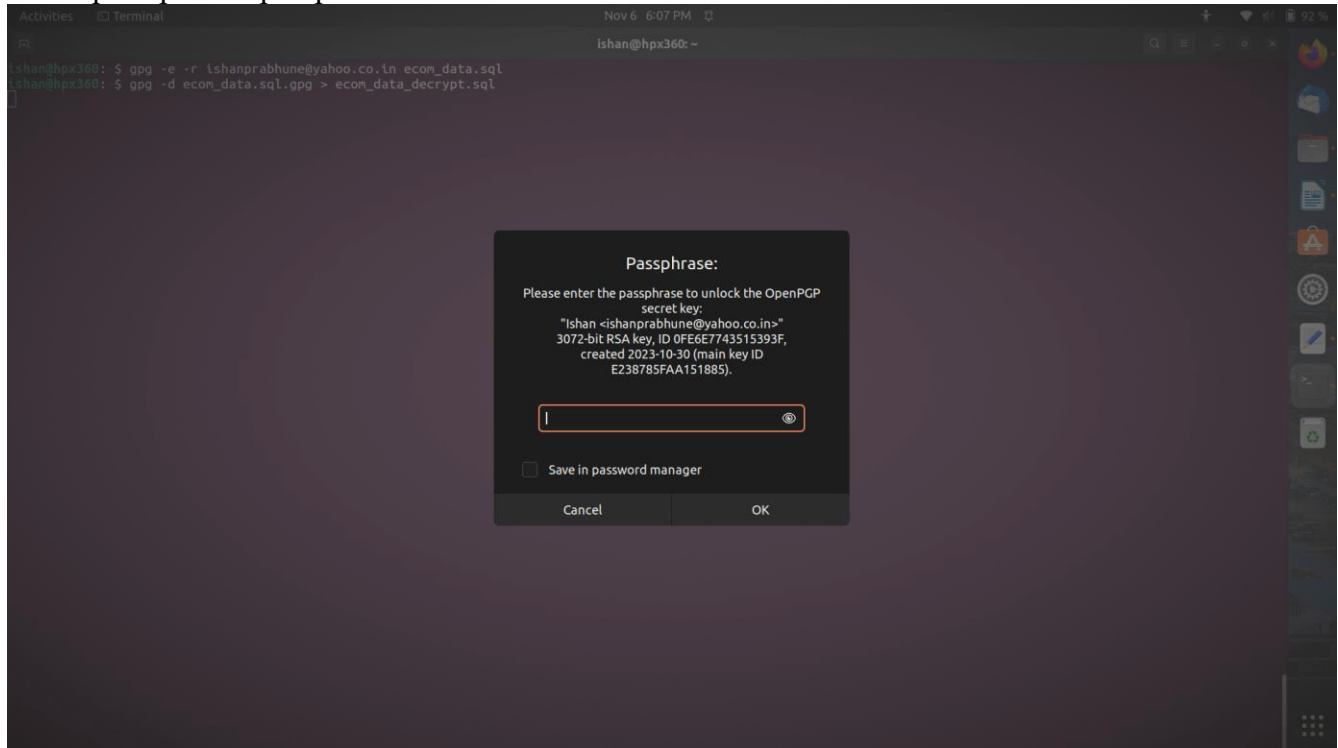
File before encrypting


```
Activities Text Editor Nov 6 6:04 PM ecom_data.sql
6
7 /*140101 SET @OLD_CHARACTER_SET_CLIENT=@@CHARACTER_SET_CLIENT */;
8 /*140101 SET @OLD_CHARACTER_SET_RESULTS=@@CHARACTER_SET_RESULTS */;
9 /*140101 SET @OLD_COLLATION_CONNECTION=@@COLLATION_CONNECTION */;
10 /*150503 SET NAMES utf8mb4 */;
11 /*140103 SET @OLD_TIME_ZONE=@@TIME_ZONE */;
12 /*140103 SET TIME_ZONE='+00:00' */;
13 /*140014 SET @OLD_UNIQUE_CHECKS=@@UNIQUE_CHECKS, UNIQUE_CHECKS=0 */;
14 /*140014 SET @OLD_FOREIGN_KEY_CHECKS=@@FOREIGN_KEY_CHECKS, FOREIGN_KEY_CHECKS=0 */;
15 /*140101 SET @OLD_SQL_MODE=@@SQL_MODE, SQL_MODE='NO_AUTO_VALUE_ON_ZERO' */;
16 /*140111 SET @OLD_SQL_NOTES=@@SQL_NOTES, SQL_NOTES=0 */;
17
18 --
19 -- Table structure for table 'OrderDetails'
20 --
21
22 DROP TABLE IF EXISTS `OrderDetails`;
23 /*140101 SET @saved_cs_client = @@character_set_client */;
24 /*150503 SET character_set_client = utf8mb4 */;
25 CREATE TABLE `OrderDetails` (
26   `OrderDetailID` int NOT NULL,
27   `OrderID` int DEFAULT NULL,
28   `ProductID` int DEFAULT NULL,
29   `Quantity` int DEFAULT NULL,
30   `Subtotal` decimal(10,2) DEFAULT NULL,
31   PRIMARY KEY (`OrderDetailID`),
32   KEY `OrderID` (`OrderID`),
33   KEY `ProductID` (`ProductID`),
34   CONSTRAINT `OrderDetails_ibfk_1` FOREIGN KEY (`OrderID`) REFERENCES `Orders` (`OrderID`),
35   CONSTRAINT `OrderDetails_ibfk_2` FOREIGN KEY (`ProductID`) REFERENCES `Products` (`ProductID`)
36 ) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;
37 /*140101 SET character_set_client = @saved_cs_client */;
38
39 --
40 -- Dumping data for table 'OrderDetails'
41 --
42
43 LOCK TABLES `OrderDetails` WRITE;
44 /*140000 ALTER TABLE `OrderDetails` DISABLE KEYS */;
45 INSERT INTO `OrderDetails` VALUES ((1,1,1,2,1399.98),(2,2,3,4,1199.96),(3,3,5,1,149.99),(4,4,8,3,239.97),(5,5,10,2,259.98),(6,6,12,1,79.99),(7,7,14,5,249.95),
(8,8,17,2,69.98),(9,9,19,3,449.97),(10,10,21,1,199.99),(11,11,23,4,799.88),(12,12,25,2,399.98),(13,13,27,3,74.85),(14,14,29,1,39.99),(15,15,1,2,1399.98),
(16,16,3,3,1799.94),(17,17,5,1,149.99),(18,18,8,2,159.98),(19,19,10,3,389.85),(20,20,12,1,79.99),(21,21,14,4,199.88),(22,22,17,2,139.98),(23,23,19,1,149.99),
(24,24,21,3,599.97),(25,25,23,2,799.88),(26,26,25,1,199.99),(27,27,27,4,299.88),(28,28,29,3,119.97),(29,29,1,1,699.99),(30,30,3,2,599.98),(31,31,5,3,449.97),
(32,32,9,4,79.99),(33,33,18,5,649.75),(34,34,13,3,159.99),(35,35,14,3,374.85),(36,36,17,4,69.98),(37,37,10,4,599.95),(38,38,24,2,399.99),(39,39,22,1,399.99),
(40,40,1,1,1399.98),(41,41,1,1,1399.98),(42,42,1,1,1399.98),(43,43,1,1,1399.98),(44,44,1,1,1399.98),(45,45,1,1,1399.98),(46,46,1,1,1399.98),(47,47,1,1,1399.98),
(48,48,1,1,1399.98),(49,49,1,1,1399.98),(50,50,1,1,1399.98),(51,51,1,1,1399.98),(52,52,1,1,1399.98),(53,53,1,1,1399.98),(54,54,1,1,1399.98),(55,55,1,1,1399.98),
(56,56,1,1,1399.98),(57,57,1,1,1399.98),(58,58,1,1,1399.98),(59,59,1,1,1399.98),(60,60,1,1,1399.98),(61,61,1,1,1399.98),(62,62,1,1,1399.98),(63,63,1,1,1399.98),
(64,64,1,1,1399.98),(65,65,1,1,1399.98),(66,66,1,1,1399.98),(67,67,1,1,1399.98),(68,68,1,1,1399.98),(69,69,1,1,1399.98),(70,70,1,1,1399.98),(71,71,1,1,1399.98),
(72,72,1,1,1399.98),(73,73,1,1,1399.98),(74,74,1,1,1399.98),(75,75,1,1,1399.98),(76,76,1,1,1399.98),(77,77,1,1,1399.98),(78,78,1,1,1399.98),(79,79,1,1,1399.98),
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(88,88,1,1,1399.98),(89,89,1,1,1399.98),(90,90,1,1,1399.98),(91,91,1,1,1399.98),(92,92,1,1,1399.98),(93,93,1,1,1399.98),(94,94,1,1,1399.98),(95,95,1,1,1399.98),
(96,96,1,1,1399.98),(97,97,1,1,1399.98),(98,98,1,1,1399.98),(99,99,1,1,1399.98),(100,100,1,1,1399.98),(101,101,1,1,1399.98),(102,102,1,1,1399.98),(103,103,1,1,1399.98),
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(125,125,1,1,1399.98),(126,126,1,1,1399.98),(127,127,1,1,1399.98),(128,128,1,1,1399.98),(129,129,1,1,1399.98),(130,130,1,1,1399.98),(131,131,1,1,1399.98),
(132,132,1,1,1399.98),(133,133,1,1,1399.98),(134,134,1,1,1399.98),(135,135,1,1,1399.98),(136,136,1,1,1399.98),(137,137,1,1,1399.98),(138,138,1,1,1399.98),
(139,139,1,1,1399.98),(140,140,1,1,1399.98),(141,141,1,1,1399.98),(142,142,1,1,1399.98),(143,143,1,1,1399.98),(144,144,1,1,1399.98),(145,145,1,1,1399.98),
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(153,153,1,1,1399.98),(154,154,1,1,1399.98),(155,155,1,1,1399.98),(156,156,1,1,1399.98),(157,157,1,1,1399.98),(158,158,1,1,1399.98),(159,159,1,1,1399.98),
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(272,272,1,1,1399.98),(273,273,1,1,1399.98),(274,274,1,1,1399.98),(275,275,1,1,1399.98),(276,276,1,1,1399.98),(277,277,1,1,1399.98),(278,278,1,1,1399.98),
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(384,384,1,1,1399.98),(385,385,1,1,1399.98),(386,386,1,1,1399.98),(387,387,1,1,1399.98),(388,388,1,1,1399.98),(389,389,1,1,1399.98),(390,390,1,1,1399.98),
(391,391,1,1,1399.98),(392,392,1,1,1399.98),(393,393,1,1,1399.98),(394,394,1,1,1399.98),(395,395,1,1,1399.98),(396,396,1,1,1399.98),(397,397,1,1,1399.98),
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(405,405,1,1,1399.98),(406,406,1,1,1399.98),(407,407,1,1,1399.98),(408,408,1,1,1399.98),(409,409,1,1,1399.98),(410,410,1,1,1399.98),(411,411,1,1,1399.98),
(412,412,1,1,1399.98),(413,413,1,1,1399.98),(414,414,1,1,1399.98),(415,415,1,1,1399.98),(416,416,1,1,1399.98),(417,417,1,1,1399.98),(418,418,1,1,1399.98),
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(426,426,1,1,1399.98),(427,427,1,1,1399.98),(428,428,1,1,1399.98),(429,429,1,1,1399.98),(430,430,1,1,1399.98),(431,431,1,1,1399.98),(432,432,1,1,1399.98),
(433,433,1,1,1399.98),(434,434,1,1,1399.98),(435,435,1,1,1399.98),(436,436,1,1,1399.98),(437,437,1,1,1399.98),(438,438,1,1,1399.98),(439,439,1,1,1399.98),
(440,440,1,1,1399.98),(441,441,1,1,1399.98),(442,442,1,1,1399.98),(443,443,1,1,1399.98),(444,444,1,1,1399.98),(445,445,1,1,1399.98),(446,446,1,1,1399.98),
(447,447,1,1,1399.98),(448,448,1,1,1399.98),(449,449,1,1,1399.98),(450,450,1,1,1399.98),(451,451,1,1,1399.98),(452,452,1,1,1399.98),(453,453,1,1,1399.98),
(454,454,1,1,1399.98),(455,455,1,1,1399.98),(456,456,1,1,1399.98),(457,457,1,1,1399.98),(458,458,1,1,1399.98),(459,459,1,1,1399.98),(460,460,1,1,1399.98),
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(468,468,1,1,1399.98),(469,469,1,1,1399.98),(470,470,1,1,1399.98),(471,471,1,1,1399.98),(472,472,1,1,1399.98),(473,473,1,1,1399.98),(474,474,1,1,1399.98),
(475,475,1,1,1399.98),(476,476,1,1,1399.98),(477,477,1,1,1399.98),(478,478,1,1,1399.98),(479,479,1,1,1399.98),(480,480,1,1,1399.98),(481,481,1,1,1399.98),
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(573,573,1,1,1399.98),(574,574,1,1,1399.98),(575,575,1,1,1399.98),(576,576,1,1,1399.98),(577,577,1,1,1399.98),(578,578,1,1,1399.98),(579,579,1,1,1399.98),
(580,580,1,1,1399.98),(581,581,1,1,1399.98),(582,582,1,1,1399.98),(583,583,1,1,1399.98),(584,584,1,1,1399.98),(585,585,1,1,1399.98),(586,586,1,1,1399.98),
(587,587,1,1,1399.98),(588,588,1,1,1399.98),(589,589,1,1,1399.98),(
```

Procedure for decryption

```
ishan@hpx360:~$ gpg -d ecom_data.sql.gpg > ecom_data_decrypt.sql
gpg: encrypted with 3072-bit RSA key, ID 0FE6E7743515393F, created 2023-10-30
"Ishan <ishanprabhune@yahoo.co.in>"
```

It will prompt for a passphrase



This will decrypt the file.

```
Activities Text Editor Nov 6 6:09 PM ecom_data_decrypt.sql
Open Save
1 -- MySQL dump 10.13 Distrib 8.0.34, for Linux (x86_64)
2 --
3 -- Host: localhost Database: ecommerce
4 --
5 -- Server version 8.0.34-0ubuntu0.22.04.1
6
7 /*!40101 SET @OLD_CHARACTER_SET_CLIENT=@@CHARACTER_SET_CLIENT */;
8 /*!40101 SET @OLD_CHARACTER_SET_RESULTS=@@CHARACTER_SET_RESULTS */;
9 /*!40101 SET @OLD_COLLATION_CONNECTION=@@COLLATION_CONNECTION */;
10 /*!50503 SET NAMES utf8mb4 */;
11 /*!40103 SET @OLD_TIME_ZONE=@@TIME_ZONE */;
12 /*!40103 SET TIME_ZONE='+00:00' */;
13 /*!40014 SET @OLD_UNIQUE_CHECKS=@@UNIQUE_CHECKS, UNIQUE_CHECKS=0 */;
14 /*!40014 SET @OLD_FOREIGN_KEY_CHECKS=@@FOREIGN_KEY_CHECKS, FOREIGN_KEY_CHECKS=0 */;
15 /*!40101 SET @OLD_SQL_MODE=@@SQL_MODE, SQL_MODE='NO_AUTO_VALUE_ON_ZERO' */;
16 /*!40111 SET @OLD_SQL_NOTES=@@SQL_NOTES, SQL_NOTES=0 */;
17
18 --
19 -- Table structure for table `OrderDetails`
20 --
21
22 DROP TABLE IF EXISTS `OrderDetails`;
23 /*!40101 SET @saved_cs_client = @@character_set_client */;
24 /*!50503 SET character_set_client = utf8mb4 */;
25 CREATE TABLE `OrderDetails` (
26   `OrderDetailID` int NOT NULL,
27   `OrderID` int DEFAULT NULL,
28   `ProductID` int DEFAULT NULL,
29   `Quantity` int DEFAULT NULL,
30   `Subtotal` decimal(10,2) DEFAULT NULL,
31   PRIMARY KEY (`OrderDetailID`),
32   KEY `OrderID` (`OrderID`),
33   KEY `ProductID` (`ProductID`),
34   CONSTRAINT `OrderDetails_ibfk_1` FOREIGN KEY (`OrderID`) REFERENCES `Orders` (`OrderID`),
35   CONSTRAINT `OrderDetails_ibfk_2` FOREIGN KEY (`ProductID`) REFERENCES `Products` (`ProductID`)
36 ) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;
37 /*!40101 SET character_set_client = @saved_cs_client */;
38
39 --
40 -- Dumping data for table `OrderDetails`
41 --
42
43 LOCK TABLES `OrderDetails` WRITE;
44 /*!40000 ALTER TABLE `OrderDetails` DISABLE KEYS */;
```

Python script to integrate GnuPG encryption into the database operations
This script will encrypt the password for UserID = 2 in the Users table.

```
*encrypt.py
1 import gnupg
2 import mysql.connector
3 import subprocess
4 import gzip
5 # Initialize the GnuPG object
6 gpg = gnupg.GPG()
7
8 # Load the recipient's public key
9 recipient_key = open('public_key.gpg').read()
10
11 # Connect to the MySQL database
12 db_connection = mysql.connector.connect(
13     host="localhost",
14     user="root",
15     password="Prabhune@123",
16     database="ecommerce"
17 )
18
19 # Create a cursor
20 cursor = db_connection.cursor()
21
22 # Data to be encrypted
23 data = "securepass"
24 # Encrypt the data
25 encrypted_data = subprocess.getoutput(f'echo "{data}" | gpg --encrypt --recipient {"ishanprabhune@yahoo.co.in"} --armor')
26 print(encrypted_data)
27 # Insert the encrypted data into the Users table
28 insert_query = "INSERT INTO Users (UserID, FirstName, LastName, Email, Password, RegistrationDate) VALUES (%s, %s, %s, %s, %s, %s)"
29 cursor.execute(insert_query, ("2", "Alice", "Johnson", "alice.j@example.com", str(encrypted_data), "2023-01-02"))
30
31 # Commit the transaction
32 db_connection.commit()
33
34 # Close the cursor and database connection
35 cursor.close()
36 db_connection.close()
```

Running python script. This is the encrypted password.

```

ishan@hpx360:~$ python3 encrypt.py
-----BEGIN PGP MESSAGE-----

hQGMaw/m53Q1FTk/AQv/a+QtIBlB2XpsCzPpX5uMYvzMNUsdC6kiIwMX7oo5SY2/
mf9zB1lpwsD5TksvXPnG4nb41q707u3LVTy5eLuNZttMqvxa1VXa3p4ZWkX2yKYd
hgufpmIC3vJn1BQmyDTZGrNEIy14TSpfFafrR/GyUB/le6fBb20lTvQ0Yt4CyNUR
p0umB/OueQYmDSbx3a0S1944w64aUyeXgZGuJa0cKxYIGMcUpRwoCoxiRHDFMqQ6
JIWdvQXgM1xnBN05/rb1EvKsKSP4dUWsDLm6do5eeiGF04c30yqI3SVGKM9fZfDn
KNE1rWANhtrvALJE/r2Fck9bQy1ppBh4/OL02Nw622dnERa+39SNSeEANO95DK21
NSM+31WgDhkMKzyhkLPPlgyZZr8ajkCaTffvpfZcrqR6XuNVietWyN9gi9B70sGw
EtfXYKA9QJpTh4PmA46dm1uZB1MlwwJr11w30IEBrnrYXKJIsjla2KI8BhL0gxb
YeuLWyJBxBd2osTOudFK0kMBquWzUcNAWHLWy2CBdZzma1U+w26Mj9S+B0tH0Jo1
1KdtVTllceGJQ3VF6lroARXS0zam6QRyzYYRjSxeknx1aU36
=Vtg5
-----END PGP MESSAGE-----

```

Script has encrypted the password data for UserID =2.

Data is not visible in the table as it is encrypted for UserID = 2.

UserID	FirstName	LastName	Email	Password	RegistrationDate
0	Ishan	Prabhune	ishan.p@example.com	password1234	2023-01-09
1	John	Doe	john.doe@example.com	password123	2023-01-01
2	Alice	Johnson	alice.j@example.com		2023-01-02
3	Michael	Brown	michael.b@example.com		2023-02-28
4	Emily	Smith	emily.s@example.com		2023-03-15
5	William	Davis	william.d@example.com	qwerty	2023-04-05
6	Emma	Martinez	emma.m@example.com	abc123	2023-04-18
7	James	Anderson	james.a@example.com	p@ssw0rd	2023-05-09
8	Olivia	Garcia	olivia.g@example.com	letmein	2023-06-22
9	Liam	Hernandez	liam.h@example.com	welcome123	2023-07-03
10	Ava	Lopez	ava.l@example.com	123456	2023-08-14

Script for decryption


```

41
42 # Select encrypted data from the Customers table
43 select_query = "SELECT Password FROM Users WHERE UserID = 2"
44 cursor.execute(select_query)
45 encrypted_data = cursor.fetchone()[0]
46
47 # Decrypt the data
48 decrypted_data = gpg.decrypt(encrypted_data, passphrase='prabhune')
49
50 # Use the decrypted data
51 print(decrypted_data.data)
52
53 # Close the cursor and database connection
54 cursor.close()
55 db_connection.close()

```

Script has decrypted the Password Data for UserID = 2

UserID	FirstName	LastName	Email	Password	RegistrationDate
0	Ishan	Prabhune	ishan.p@example.com	password1234	2023-01-09
1	John	Doe	john.doe@example.com	password123	2023-01-01
2	Alice	Johnson	alice.j@example.com	securepass	2023-01-02
3	Michael	Brown	michael.b@example.com		2023-02-28
4	Emily	Smith	emily.s@example.com		2023-03-15
5	William	Davis	william.d@example.com	qwerty	2023-04-05
6	Emma	Martinez	emma.m@example.com	abc123	2023-04-18
7	James	Anderson	james.a@example.com	p@ssw0rd	2023-05-09
8	Olivia	Garcia	olivia.g@example.com	letmein	2023-06-22
9	Liam	Hernandez	liam.h@example.com	welcome123	2023-07-03
10	Ava	Lopez	ava.l@example.com	123456	2023-08-14