**VYDEHI SCHOOL OF EXCELLENCE**

Affiliated to CBSE, Delhi

Vydehi campus, Whitefield, Bengaluru

Karnataka

A logo of a school

Description automatically generated

**COMPUTER SCIENCE (083)**

Project on:

**Banking System implemented using Python and MySQL**

Year: 2024-25

Submitted to Submitted by – Satwik Gupta

**Ms. Ranjeeta Shrivastava** Class – XII  **A**

**VYDEHI SCHOOL OF EXCELLENCE**A logo of a school

Description automatically generated

**DEPARTMENT OF COMPUTER SCIENCE**

**CERTIFICATE**

This is to certify that **SATWIK GUPTA** of class **XII-A** has successfully completed the project under the guidance of **MS. RANJEETA SHRIVASTAVA** during the academic year **2024-25** in partial fulfilment of **COMPUTER SCIENCE** practical examination conducted by AISSCE, New Delhi**.**

***Signature of the Principal***

***Signature of the external examiner Signature of the internal examiner***

External examiner no:

**ACKNOWLEDGMENT**

I want to express my most sincere thanks and gratitude to Ms. Ranjeeta, my computer science teacher, who's valuable feedback and guidance in this project was a major contribution. Her constant motivation and advice were the foundation to this project.

Next, I'd like to thank Ms. Chhavi Garg, our principal ma'am, for extending support and coordination wherever possible which aided in the productive and successful completion of this project.

Finally, I'd like to thank everyone who helped me directly, or indirectly in the completion of this project.

**INDEX**

|  |  |  |
| --- | --- | --- |
| **S.no** | **Title** | **Page no.** |
| 1 | Introduction | 6 |
| 2 | Why Python? | 7 |
| 3 | System Specs | 8 |
| 4 | Aim | 9 |
| 5 | Some Background | 9 |
| 6 | Program Code | 13 |
| 7 | Sample Output | 28 |
| 8 | Bibliography | 37 |

**INTRODUCTION**

This project is a terminal-based net-banking app, in which users can:

1. Create and log into a password protected account
2. Deposit money
3. Make transactions with other users
4. Create fixed deposits and gain interest

All user-data is stored in and retrieved from a MySQL database. For the application itself, Python is used.

One of the main features of this project in terms of development is its state machine architecture, which is discussed in detail later in this document.

**WHY PYTHON?**

* **Cross-platform Language**: Python can run equally well on variety of platforms – Windows, Linus/UNIX, smartphones, etc.
* **Simple and expressive syntax:** Python has a simple syntax similar to the English language. It is thus very expressive with fewer lines of code and simplicity compared to other popular languages like C++, Java etc.
* **Quick prototyping:** Python runs on an interpreter system, so the code can be executed as soon as it is written. This, along with its simplicity, means that prototyping can be very quick.
* **Multi-paradigm:** Python can be written in a procedural way, an object-oriented way or a functional way.

**SYSTEM SPECS**

|  |  |
| --- | --- |
| **Operating System** | Windows 11 |
| **Processor** | AMD Ryzen 7 5700U with Radeon Graphics 1.80 GHz |
| **RAM** | 32 GB |
| **Storage** | 1TB SSD |

**AIM**

To create a net-banking client application with terminal-based UI.

**Some Background**

As mentioned before, the state machine architecture of this application is a highlight of this project.

Based on what functionality the user wants to access, different kinds of processing have to be done. The idea of a state arises from this situation naturally. Based on user input, we will set a certain “state”, and based on the current state, some processing will be done. Each state can also change the current state to a different one, allowing navigation between different states.

A naïve implementation would declare constants that represent different states, and would check in an if-elif chain what state is currently set, and run code based on that, like so:

1 | STATE0 = 0

2 | STATE1 = 1

3 | currentState = 0

4 | ​

5 | while True: *# main process-loop*

6 |  if currentState == STATE0:

7 |  *# STATE0'S processing*

8 |

9 |  inp = userInput()

10|

11|  if inp == "change\_state":

12|             *# some user-input condition*

13|  currentState = STATE1

14|

15|  continue

16|

17|  elif currentState == STATE1:

18|  *# STATE1'S processing*

19|

20|  inp = userInput()

21|

22|  if inp == "change\_state":

23|  currentState = STATE0

24|

25|  continue

However, this if-elif chain can quickly grow very large. Since the states are being set by the code itself explicitly, there shouldn’t be any need to check for the state in each process-loop. Moreover, the implementation for different states cannot be separated and thus modularization cannot be achieved, which would be desirable from a code-design standpoint.

The problem is that the state in the above code is represented by an integer object, which does not contain any information about what kind of processing it needs. Thus, the current state needs to be checked and its implementation has to be provided by the main process-loop itself. However, if the state was represented by an object that itself contained information about the required processing, then we could just use that information without caring what the current state exactly is. This state-object can be a class that contains a process() function, which is called by the main process-loop. This eliminates the need of if-checks altogether. Also, since the class definitions can be written separately, it improves code-design by allowing modularization. This design is exemplified by the application code following this page.

Note: We have designed the program so that many in-program days pass in just a few real-life seconds, so that we can demonstrate fixed deposit interests.

The complete development history and project files can be found [here](https://github.com/satwik-krit/banking-system/tree/normalTUI).

The general program execution can be expressed as follows:

**A diagram of a flowchart

Description automatically generated**

**PROGRAM**

**CODE**

***QUERY.SQL: Used to create the database schema.***

| ​

1 | DROP DATABASE IF EXISTS Bank;

2 | CREATE DATABASE Bank;

3 | USE Bank;

4 | ​

5 | CREATE TABLE Users (

6 |    password VARCHAR(10) NOT NULL,

7 |    username VARCHAR(50),

8 |    firstname VARCHAR(50) NOT NULL,

9 |    lastname VARCHAR(50) NOT NULL,

10|    age INT NOT NULL,

11|    phone VARCHAR(15) NOT NULL,

12|    inactive TINYINT(1) NOT NULL DEFAULT 0,

13| ​

14|    PRIMARY KEY(username),

15|    CHECK(age > 0)

16| );

17| ​

18| CREATE TABLE Account (

19|    balance INT NOT NULL,

20|    created DATE NOT NULL,

21|    frozen TINYINT(1) NOT NULL DEFAULT 0,

22|    username VARCHAR(50),

23| ​

24|    PRIMARY KEY(username),

25|    CHECK(balance >= 0),

26|    FOREIGN KEY(username) REFERENCES Users(username)

27|     ON DELETE CASCADE

28|     ON UPDATE CASCADE

29| );

30| ​

31| CREATE TABLE FixedDepo (

32|    fdName VARCHAR(30),

33|    username VARCHAR(50),

34|    principal INT NOT NULL,

35|    interest INT NOT NULL,

36|    creationdate DATE NOT NULL,

37|    timeperiod INT NOT NULL,

38|    maturedate DATE NOT NULL,

39|    withdrawn INT NOT NULL DEFAULT 0,

40| ​

41|    PRIMARY KEY(fdName, username),

42|    CHECK(principal > 0),

43|    CHECK(interest > 0),

44|    CHECK(timeperiod BETWEEN 0 AND 10),

45|    CHECK(maturedate = DATE\_ADD(creationdate, INTERVAL timeperiod

YEAR)),

46|    FOREIGN KEY(username) REFERENCES Users(username)

47|     ON DELETE CASCADE

48|     ON UPDATE CASCADE

49| );

50| ​

51| CREATE TABLE Transactions (

52|    transID INT AUTO\_INCREMENT,

53|    payerID VARCHAR(50) NOT NULL,

54|    receiverID VARCHAR(50) NOT NULL,

55|    transDate DATE NOT NULL,

56|    amount INT NOT NULL,

57|    comment TINYTEXT,

58| ​

59|    PRIMARY KEY(transID),

60|    CHECK(amount > 0),

61|    FOREIGN KEY(payerID) REFERENCES Users(username)

62|     ON DELETE RESTRICT

63|     ON UPDATE CASCADE,

64|    FOREIGN KEY(payerID) REFERENCES Users(username)

65|     ON DELETE RESTRICT

66|     ON UPDATE CASCADE

67| );

68| ​

69| CREATE TABLE Updates (

70|    username VARCHAR(50) NOT NULL,

71|    baseContent TINYTEXT NOT NULL,

72|    extraContent TEXT NOT NULL,

73|    updateDate DATE,

74| ​

75|    FOREIGN KEY(username) REFERENCES Users(username)

76| );

77| ​

78| CREATE TABLE EnvInfo (

79|    DBCreationDateTime TIMESTAMP DEFAULT CURRENT\_TIMESTAMP

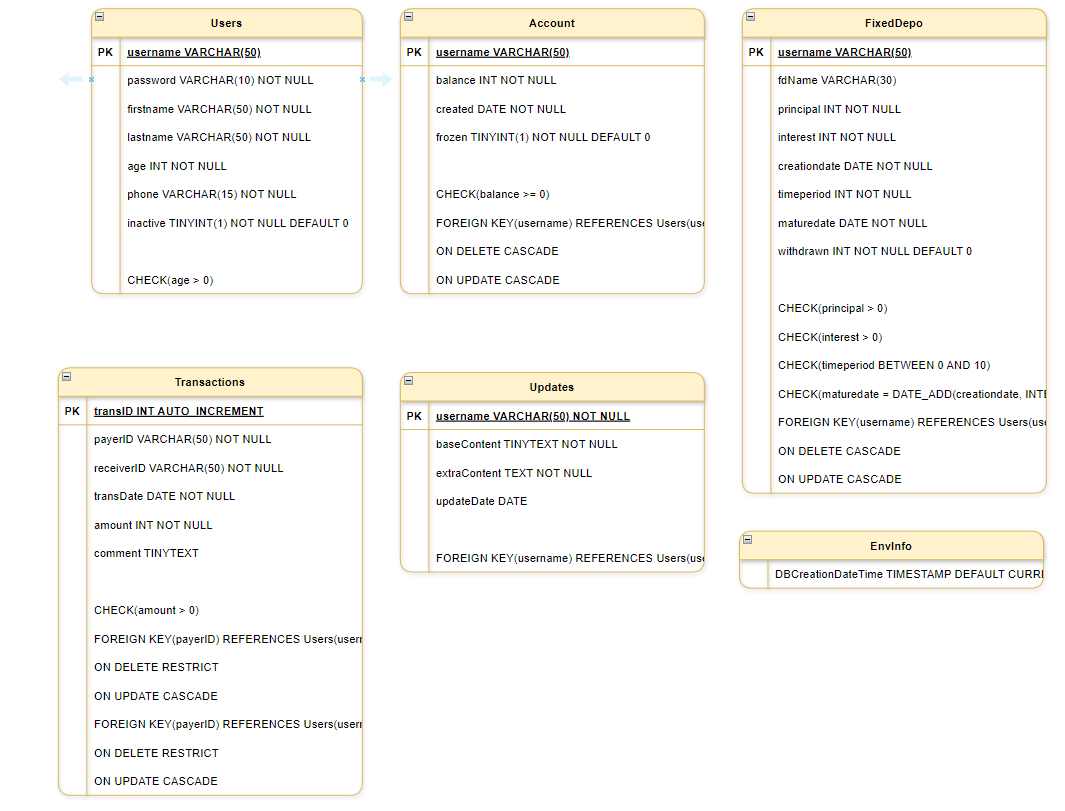
80| );

81| ​

82| INSERT INTO EnvInfo

83| VALUES ();

The database scheme then looks as follows:



***PROJECT.PY***

1 | import time

2 | from getpass import getpass

3 | import datetime as dt

4 | from dateutil.relativedelta import relativedelta

5 | import mysql.connector as sqlconn

6 | from mysql.connector import DataError, DatabaseError, OperationalError,

NotSupportedError, IntegrityError, ProgrammingError, InternalError

7 | ​

8 | try:

9 | ​

10|     currentState = None

11|     TIMEDELTA = 0.5

12|     currentDate = None

13| ​

14|     db = sqlconn.connect(host="localhost", user="root",

password="VSE@2022", database="bank", charset="utf8")

15|     crsr = db.cursor(buffered=True)

16|

17|     def EXIT(code=0):

18|         db.close()

19|         exit(code)

20| ​

21|     def execute(query : str, args : tuple) -> None:

22|         crsr.execute(query.format(\*args))

23| ​

24|     def resultExists(result):

25|         if len(result):

26|             return True

27|         else:

28|             return False

29| ​

30|     def getBalance(username : str) -> int:

31|         Q\_GET\_BALANCE = ("SELECT balance "

32|                          "FROM account "

33|                          "WHERE username = '{}';")

34| ​

35|         execute(Q\_GET\_BALANCE, (username,))

36|         return crsr.fetchone()[0]

37| ​

38|     def c\_changeBalance(username : str, change : int) -> None:

39|         QC\_CHANGE\_BALANCE = ("UPDATE Account "

40|                              "SET balance = balance + {1} "

41|                              "WHERE username = '{0}'; ")

42|

43|         execute(QC\_CHANGE\_BALANCE, (username, change))

44| ​

45|     def userExists(username : str) -> bool:

46|         Q\_CHECK\_USERNAME = ("SELECT username "

47|                             "FROM Users "

48|                             "WHERE username = '{}';")

49| ​

50|         execute(Q\_CHECK\_USERNAME, (username,))

51| ​

52|         if len(crsr.fetchall()) != 0:

53|             return True

54|         else:

55|             return False

56| ​

57|     def checkFDExists(username : str, fdName : str) -> bool:

58|         Q\_CHECK\_FD\_EXISTS = ("SELECT \* FROM FixedDepo "

59|                              "WHERE username = '{}' AND fdName = '{}';

")

60| ​

61|         execute(Q\_CHECK\_FD\_EXISTS, (username, fdName))

62| ​

63|         if len(crsr.fetchall()) != 0:

64|             return True

65|         else:

66|             return False

67| ​

68|     def intInput(prompt : str, failMsg : str = "Invalid input.") ->

int:

69|         while True:

70|             inpStr = input(prompt).strip()

71| ​

72|             if not inpStr.isdigit():

73|                 print(failMsg)

74|             else:

75|                 return int(inpStr)

76|

77|     def getUpdates(username, date=None):

78|         \_Q\_GET\_UPDATES\_ALL = ("SELECT baseContent, extraContent,

updateDate "

79|                               "FROM Updates "

80|                               "WHERE username = '{}';")

81| ​

82|         \_Q\_GET\_UPDATES\_DAY = ("SELECT baseContent, extraContent,

updateDate "

83|                               "FROM Updates "

84|                               "WHERE username = '{}' "

85|                               "AND updateDate = '{}'")

86| ​

87|         if date:

88|             execute(\_Q\_GET\_UPDATES\_DAY, (username, date))

89|             return crsr.fetchall()

90|         else:

91|             execute(\_Q\_GET\_UPDATES\_ALL, (username, ))

92|             return crsr.fetchall()

93| ​

94|     def c\_createUpdate(username, baseContent,

extraContent="No comment", \_date=None):

95|         \_QC\_CREATE\_UPDATE = ("INSERT INTO Updates "

96|                              "VALUES "

97|                              "('{}', '{}', '{}', '{}')")

98| ​

99|         if \_date:

100|             execute(\_QC\_CREATE\_UPDATE, (username, baseContent,

extraContent, \_date))

101|        else:

102|             execute(\_QC\_CREATE\_UPDATE, (username, baseContent,

extraContent, currentDate))

103| ​

104|     def getUserInfo(username):

105|         \_Q\_GET\_USER = ("SELECT firstname, lastname, age, phone,

inactive "

106|                        "FROM Users "

107|                        "WHERE username = '{}' ;")

108| ​

109|         execute(\_Q\_GET\_USER, (username,))

110|         return crsr.fetchone()

111| ​

112|     class LockedState:

113|         def \_\_init\_\_(self):

114|             pass

115| ​

116|         def process(self):

117|             global currentState

118| ​

119|             print("===================================================

===================")

120|             print("Enter username and password to view details or

create a new account")

121|             print("(1) Login")

122|             print("(2) Create an account")

123|             print("(3) Quit")

124|             print()

125| ​

126|             option = intInput("(Option) -> ")

127| ​

128|             if option == 1:

129|                 currentState = LoginState()

130| ​

131|             elif option == 2:

132|                 currentState = CreateAccountState()

133| ​

134|             elif option == 3:

135|                 EXIT()

136| ​

137|             else:

138|                 print()

139|                 print("Please choose a valid option.")

140| ​

141|     class LoginState:

142|         \_Q\_LOGIN\_USER = ("SELECT username, password "

143|                          "FROM Users "

144|                          "WHERE username = '{}'; ")

145| ​

146|         def \_\_init\_\_(self):

147|             pass

148| ​

149|         def \_login(self, username : str, password : str) -> int:

150|             global currentState

151| ​

152|             execute(self.\_Q\_LOGIN\_USER, (username,))

153|             record = crsr.fetchone()

154| ​

155|             if record == None:

156|                 print("Username not found.")

157|                 currentState = LockedState()

158|                 return

159|

160|             if record[1] != password:

161|                 print("Incorrect password.")

162|                 currentState = LockedState()

163|                 return

164| ​

165|             print("Logged in successfully.")

166| ​

167|             currentState = UnlockedState(username)

168| ​

169|         def process(self):

170|             print("=======================================")

171|             username = input("(Enter Username) -> ").strip()

172|             password = getpass("(Enter Password) -> ").strip()

173|             print()

174| ​

175|             self.\_login(username, password)

176| ​

177|     class CreateAccountState:

178|         \_QC\_CREATE\_USER = ("INSERT INTO Users VALUES "

179|                            "('{}', '{}', '{}', '{}', {}, '{}', {}); ")

180| ​

181|         \_QC\_CREATE\_ACCOUNT = ("INSERT INTO account "

182|                               "VALUES "

183|                               "({}, '{}', {}, '{}'); ")

184| ​

185|         def \_\_init\_\_(self):

186|             pass

187|

188|         def \_createNewUser(self, username : str, password : str,

firstname : str, lastname : str,

189|                          age : int, phone : int) -> int:

190|             execute(self.\_QC\_CREATE\_USER, (password, username,

firstname, lastname, age, phone, 0))

191|             execute(self.\_QC\_CREATE\_ACCOUNT, (0, str(currentDate), 0,

username))

192|             db.commit()

193| ​

194|         def process(self):

195|             global currentState

196| ​

197|             print("========================================")

198|             print("(0) Create account")

199|             print("(1) Abort")

200|             print()

201| ​

202|             option = intInput("(Option) -> ")

203| ​

204|             if option == 0:

205|                 print()

206|                 username = input("(Enter NEW Username) -> ").strip()

207| ​

208|                 if userExists(username):

209|                     print()

210|                     print("Username not unique.")

211|                     return

212| ​

213|                 while True:

214|                     password = input("(Enter NEW Password) ->

").strip()

215|                     confirmPassword = getpass("(Enter password for

confirmation) -> ").strip()

216| ​

217|                     if password == confirmPassword:

218|                         break

219| ​

220|                     print("Passwords do not match. Enter again.")

221| ​

222|                 firstname = input("(Enter first name) -> ").strip()

223|                 lastname = input("(Enter last name) -> ").strip()

224|                 age = intInput("(Enter age) -> ")

225|                 phone = intInput("(Enter phone no.) -> ")

226|                 print()

227| ​

228|                 self.\_createNewUser(username, password, firstname,

lastname, age, phone)

229| ​

230|                 currentState = UnlockedState(username)

231| ​

232|             elif option == 1:

233|                 currentState = LockedState()

234| ​

235|             else:

236|                 print()

237|                 print("Please choose a valid option")

238| ​

239|     class UnlockedState:

240|         def \_\_init\_\_(self, username : str):

241|             self.\_username = username

242| ​

243|         def process(self):

244|             global currentState

245|             global currentDate

246| ​

247|             # print and remove updates

248|             balance = getBalance(self.\_username)

249|             updates = getUpdates(self.\_username, currentDate)

250| ​

251|             print("===================================")

252|             print(currentDate)

253|             print(f"BALANCE: {balance}")

254|             if resultExists(updates):

255|                 print("TODAY'S UPDATES:", end=" ")

256|                 for content, \_, \_\_ in updates:

257|                     print(f"{content}", end=", ")

258|             print()

259|             print("(0) Logout")

260|             print("(1) Pay")

261|             print("(2) Deposit")

262|             print("(3) Create a fixed deposit")

263|             print("(4) Modify/View fixed deposits")

264|             print("(5) View all updates for your account")

265|             print()

266| ​

267|             option = intInput("(Option) -> ")

268| ​

269|             if option == 1:

270|                 currentState = PayState(self.\_username)

271| ​

272|             elif option == 2:

273|                 currentState = DepositState(self.\_username)

274| ​

275|             elif option == 3:

276|                 currentState = CreateFDState(self.\_username)

277| ​

278|             elif option == 0:

279|                 currentState = LockedState()

280| ​

281|             elif option == 4:

282|                 currentState = ViewFDState(self.\_username)

283|

284|             elif option == 5:

285|                 currentState = ViewUpdatesState(self.\_username)

286| ​

287|             else:

288|                 print()

289|                 print("Please choose a valid option.")

290| ​

291|     class PayState:

292|         \_QC\_PAY\_USER = ("INSERT INTO transactions "

293|                         "(payerID, receiverID, transDate, amount,

comment) "

294|                         "VALUES "

295|                         "('{}', '{}', '{}', {}, '{}'); ")

296|

297|         \_Q\_GETUSERPASSWORD = ("SELECT password "

298|                               "FROM Users "

299|                               "WHERE username = '{}'; ")

300| ​

301|         def \_\_init\_\_(self, username : str):

302|             self.\_username = username

303| ​

304|         def \_pay(self, receiverName : str, amount : float,

comment: str) -> int:

305|             global currentState

306| ​

307|             global currentState

308|             balance = getBalance(self.\_username)

309| ​

310|             if receiverName == self.\_username:

311|                 print("You cannot pay yourself.")

312|                 return

313| ​

314|             if not userExists(receiverName):

315|                 print("This receiver does not exist.")

316|                 return

317| ​

318|             if amount == 0:

319|                 print("Enter a valid amount to pay.")

320|                 return

321| ​

322|             if amount > balance:

323|                 print("You do not have sufficient balance.")

324|                 return

325| ​

326|             inpPwd = getpass("(Enter password to proceed with payment)

-> ")

327|             execute(self.\_Q\_GETUSERPASSWORD, (self.\_username, ))

328|             userPwd = crsr.fetchone()[0]

329| ​

330|             if inpPwd != userPwd:

331|                 print("Incorrect password, aborting payment.")

332|                 return

333| ​

334|             c\_changeBalance(self.\_username, -amount)

335|             execute(self.\_QC\_PAY\_USER, (self.\_username, receiverName,

str(currentDate), amount, comment))

336|             c\_changeBalance(receiverName, amount)

337| ​

338|             recFirstName = getUserInfo(receiverName)[0]

339|             userFirstName = getUserInfo(self.\_username)[0]

340|             c\_createUpdate(receiverName, f"{userFirstName} paid

{amount}", f"{comment}")

341|             c\_createUpdate(self.\_username, f"Paid {amount} to

{recFirstName}", f"{comment}")

342| ​

343|             db.commit()

344| ​

345|             print("Transaction made successfully.")

346| ​

347|         def process(self):

348|             global currentState

349| ​

350|             print("===========================")

351|             print("(0) Pay to another user")

352|             print("(1) Abort")

353|             print()

354| ​

355|             option = intInput("(Option) -> ")

356| ​

357|             if option == 0:

358|                 print()

359|                 receiverName = input("(Enter username of receiver) ->

").strip()

360|                 amount = intInput("(Enter amount to pay) -> ")

361|                 comment =  input("Enter comment (optional)) ->

").strip()

362|                 print()

363| ​

364|                 if not comment:

365|                     comment = "No comment"

366| ​

367|                 self.\_pay(receiverName, amount, comment)

368| ​

369|             elif option == 1:

370|                 currentState = UnlockedState(self.\_username)

371| ​

372|             else:

373|                 print()

374|                 print("Please choose a valid option.")

375| ​

376|     class DepositState:

377|         def \_\_init\_\_(self, username : str):

378|             self.\_username = username

379| ​

380|         def \_deposit(self, amount : int) -> None:

381|             c\_changeBalance(self.\_username, amount)

382|             c\_createUpdate(self.\_username, f"Deposit {amount}")

383|             db.commit()

384| ​

385|         def process(self):

386|             global currentState

387| ​

388|             print("===================================================

===================")

389|             amount = intInput("(Enter amount to deposit (cash to

digital money)) -> ")

390|             self.\_deposit(amount)

391| ​

392|             currentState = UnlockedState(self.\_username)

393| ​

394|     class CreateFDState:

395|         \_QC\_CREATE\_FD = ("INSERT INTO FixedDepo "

396|                          "(fdName, username, principal, interest,

creationdate, timeperiod, maturedate) "

397|                          "VALUES('{}', '{}', {}, {}, '{}', {}, '{}');

")

398| ​

399|         def \_\_init\_\_(self, username : str):

400|             self.\_username = username

401| ​

402|         def \_createFD(self, name : str, amount : int, period : int)

-> None:

403|             if checkFDExists(self.\_username, name):

404|                 print("FD with this name already exists")

405|                 return

406| ​

407|             if getBalance(self.\_username) < amount:

408|                 print("You do not have sufficient balance.")

409|                 return

410| ​

411|             c\_changeBalance(self.\_username, -amount)

412|             execute(self.\_QC\_CREATE\_FD, (name, self.\_username, amount,

2, str(currentDate), period,

413|                     currentDate + relativedelta(years=period)))

414|             c\_createUpdate(self.\_username, f"Create {name} FD")

415|             db.commit()

416|             print("FD created successfully.")

417| ​

418|         def process(self):

419|             global currentState

420| ​

421|             print("======================")

422|             print("(0) Create new FD")

423|             print("(1) Return")

424|             print()

425| ​

426|             option = intInput("(Option) -> ")

427| ​

428|             if option == 0:

429|                 print()

430|                 name = input("(Enter FD name) -> ")

431|                 amount = intInput("(Enter amount) -> ")

432|                 period = intInput("(Enter time period in years (under

10)) -> ")

433|                 print()

434| ​

435|                 self.\_createFD(name, amount, period)

436| ​

437|             elif option == 1:

438|                 currentState = UnlockedState(self.\_username)

439| ​

440|             else:

441|                 print()

442|                 print("Please choose a valid option.")

443| ​

444|     class ViewFDState:

445|         \_Q\_GET\_FD\_DETAILS = ("SELECT \* FROM FixedDepo "

446|                              "WHERE username = '{}' AND fdName = '{}';

")

447|         \_QC\_WITHDRAW\_FD = ("UPDATE FixedDepo "

448|                            "SET withdrawn = 1 "

449|                            "WHERE username = '{}' AND fdName = '{}';

")

450|         \_Q\_GET\_ALL\_FDS = ("SELECT fdName FROM FixedDepo "

451|                           "WHERE username = '{}'; ")

452| ​

453|         def \_\_init\_\_(self, username : str):

454|             self.\_username = username

455| ​

456|         def \_getFDComputedDetails(self, record : tuple):

457|                 passedTimeDelta = relativedelta(currentDate,

record[4])

458|                 yearsPassed = int(passedTimeDelta.years +

(passedTimeDelta.months / 12) +

(passedTimeDelta.days / 365.25))

459|                 matured = False if yearsPassed < record[5] else True

460|                 value = (record[2] \* record[3] \* (record[5]

if matured else yearsPassed) / 100) +

record[2]

461| ​

462|                 return (yearsPassed, matured, value)

463| ​

464|         def \_printFD(self, fdName : str) -> None:

465|             if not checkFDExists(self.\_username, fdName):

466|                 print("FD with this name does not exist.")

467|                 return

468|

469|             execute(self.\_Q\_GET\_FD\_DETAILS, (self.\_username, fdName))

470|             record = crsr.fetchone()

471|             computedDetails = self.\_getFDComputedDetails(record)

472| ​

473|             print(f"Principal : {record[2]}")

474|             print(f"Interest : {record[3]}")

475|             print(f"Created : {record[4]}")

476|             print(f"Total time period (years) : {record[5]}")

477|             print(f"Time passed (years) : {computedDetails[0]}")

478|             print(f"Current value : {computedDetails[2]}")

479|             print(f"Mature date : {record[6]}")

480|             print(f"Matured? : {'Yes' if computedDetails[1] else

'No'}")

481|             print(f"Widthdrawn? : {'Yes' if record[7] else 'No'}")

482| ​

483|         def \_withdrawFD(self, fdName : str) -> None:

484|             if not checkFDExists(self.\_username, fdName):

485|                 print("FD with this name does not exist.")

486|                 return

487| ​

488|             execute(self.\_Q\_GET\_FD\_DETAILS, (self.\_username, fdName))

489|             record = crsr.fetchone()

490| ​

491|             if record[7]:

492|                 print("You have already withdrawn this FD.")

493|                 return

494|

495|             computedDetails = self.\_getFDComputedDetails(record)

496|             execute(self.\_QC\_WITHDRAW\_FD, (self.\_username, fdName))

497|             c\_changeBalance(self.\_username, computedDetails[2])

498|             c\_createUpdate(self.\_username, f"Withdrew amount

{computedDetails[2]} from FD {fdName}.")

499| ​

500|             db.commit()

501| ​

502|             print(f"Withdrew amount {computedDetails[2]} from FD

{fdName}.")

503|

504|         def process(self):

505|             global currentState

506| ​

507|             # display FDs

508| ​

509|             print("=============================")

510|             print("(0) Show all FDs")

511|             print("(1) View details of a particular FD")

512|             print("(2) Withdraw an FD")

513|             print("(3) Return")

514|             print()

515| ​

516|             option = intInput("(Option) -> ")

517| ​

518|             if option == 0:

519|                 execute(self.\_Q\_GET\_ALL\_FDS, (self.\_username,))

520|                 fdNames = crsr.fetchall()

521| ​

522|                 if not resultExists(fdNames):

523|                     print("You don't have any FDs yet.")

524|                     return

525|

526|                 for fdName in fdNames:

527|                     print(fdName[0])

528| ​

529|             elif option == 1:

530|                 print()

531|                 fdName = input("(Enter FD name) -> ").strip()

532|                 print()

533|                 self.\_printFD(fdName)

534| ​

535|             elif option == 2:

536|                 print()

537|                 fdName = input("(Enter FD name) -> ").strip()

538|                 print()

539|                 self.\_withdrawFD(fdName)

540| ​

541|             elif option == 3:

542|                 currentState = UnlockedState(self.\_username)

543| ​

544|             else:

545|                 print()

546|                 print("Please choose a valid option.")

547| ​

548|     class ViewUpdatesState:

549|         def \_\_init\_\_(self, username):

550|             self.\_username = username

551| ​

552|         def \_displayUpdates(self, updates):

553|             if not resultExists(updates) :

554|                 print("You have no updates for the requested query.")

555|                 return

556| ​

557|             # sort updates from most recent to last

558|             updates.sort(key = lambda x: x[2])

559|             for index, update in enumerate(updates):

560|                 baseContent, extraContent, updateDate = update

561|                 print()

562|                 print(f"({index}): {baseContent}")

563|                 print(f"Date: {updateDate}")

564|                 print(f"Comment: {extraContent}")

565| ​

566|         def process(self):

567|             global currentState

568| ​

569|             print("=============================")

570|             print("(0) View all updates")

571|             print("(1) View all updates for a day")

572|             print("(2) Return")

573|             print()

574| ​

575|             option = intInput("(Option) -> ")

576| ​

577|             if option == 0:

578|                 updates = getUpdates(self.\_username)

579|                 self.\_displayUpdates(updates)

580| ​

581|             elif option == 1:

582|                 inp = input("(Required date, in YYYY-MM-DD format) ->

")

583| ​

584|                 try:

585|                     date = dt.date.fromisoformat(inp)

586|                     updates = getUpdates(self.\_username, date)

587|                     self.\_displayUpdates(updates)

588| ​

589|                 except ValueError:

590|                     print("Invalid date.")

591| ​

592|             elif option == 2:

593|                 currentState = UnlockedState(self.\_username)

594| ​

595|             else:

596|                 print("Please choose a valid option.")

597| ​

598|     if \_\_name\_\_ == '\_\_main\_\_':

599|         currentState = LockedState()

600| ​

601|         \_Q\_GETDBCREATIONDATETIME = ("SELECT DBCreationDateTime "

602|                                     "FROM EnvInfo ;")

603| ​

604|         # Get the date and time when we created the database

605|         execute(\_Q\_GETDBCREATIONDATETIME, ())

606| ​

607|         creationDateTime = crsr.fetchone()[0]

608|         creationTime = creationDateTime.timestamp()

609|         creationDate = creationDateTime.date()

610| ​

611|         previousTime = creationTime

612|         currentDate = creationDate

613| ​

614|         while True:

615|             currentTime = time.time()

616|             elapsedDays = (currentTime - previousTime) // TIMEDELTA

617|             currentDate += dt.timedelta(days=elapsedDays)

618| ​

619|             currentState.process()

620|             previousTime = currentTime

621| ​

622| except (DataError, DatabaseError, OperationalError, NotSupportedError,

IntegrityError, ProgrammingError, InternalError) as e:

623|     print("DB Error!", e)

624| ​

625| except KeyboardInterrupt:

626|     EXIT(0)

627| ​

628| except Exception as e:

629|     print("ERROR: ", e) 630|     EXIT(1)

**SAMPLE**

**OUTPUT**

Enter username and password to view details or create a new account

(1) Login

(2) Create an account

(3) Quit

​

(Option) -> 2

========================================

(0) Create account

(1) Abort

​

(Option) -> 0

​

(Enter NEW Username) -> ng

(Enter NEW Password) -> ng@2007

(Enter password for confirmation) ->

(Enter first name) -> nandan

(Enter last name) -> goyal

(Enter age) -> 19

(Enter phone no.) -> 9837461850

​

===================================

2025-01-01

BALANCE: 0

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 2

======================================================================

(Enter amount to deposit (cash to digital money)) -> 5000

===================================

2025-01-10

BALANCE: 5000

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 3

======================

(0) Create new FD

(1) Return

​

(Option) -> 0

​

(Enter FD name) -> fd1

(Enter amount) -> 1000

(Enter time period in years (under 10)) -> 5

​

FD created successfully.

======================

(0) Create new FD

(1) Return

​

(Option) -> 1

===================================

2025-01-22

BALANCE: 4000

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 4

=============================

(0) Show all FDs

(1) View details of a particular FD

(2) Withdraw an FD

(3) Return

​

(Option) -> 0

fd1

=============================

(0) Show all FDs

(1) View details of a particular FD

(2) Withdraw an FD

(3) Return

​

(Option) -> 1

​

(Enter FD name) -> fd1

​

Principal : 1000

Interest : 2

Created : 2025-01-17

Total time period (years) : 5

Time passed (years) : 0

Current value : 1000.0

Mature date : 2030-01-17

Matured? : No

Widthdrawn? : No

=============================

(0) Show all FDs

(1) View details of a particular FD

(2) Withdraw an FD

(3) Return

​

(Option) -> 3

===================================

2025-02-02

BALANCE: 4000

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 5

=============================

(0) View all updates

(1) View all updates for a day

(2) Return

​

(Option) -> 0

​

(0): Deposit 5000

Date: 2025-01-05

Comment: No comment

​

(1): Create fd1 FD

Date: 2025-01-17

Comment: No comment

=============================

(0) View all updates

(1) View all updates for a day

(2) Return

​

(Option) -> 2

===================================

2025-02-10

BALANCE: 4000

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 0

======================================================================

Enter username and password to view details or create a new account

(1) Login

(2) Create an account

(3) Quit

​

(Option) -> 2

========================================

(0) Create account

(1) Abort

​

(Option) -> sg

Invalid input.

(Option) -> 0

​

(Enter NEW Username) -> sg

(Enter NEW Password) -> sg@2007

(Enter password for confirmation) ->

(Enter first name) -> satwik

(Enter last name) -> gupta

(Enter age) -> 18

(Enter phone no.) -> 9487468553

​

===================================

2025-02-27

BALANCE: 0

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 2

======================================================================

(Enter amount to deposit (cash to digital money)) -> 10000

===================================

2025-03-01

BALANCE: 10000

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 1

===========================

(0) Pay to another user

(1) Abort

​

(Option) -> 0

​

(Enter username of receiver) -> ng

(Enter amount to pay) -> 2000

Enter comment (optional)) -> first payment

​

(Enter password to proceed with payment) ->

Transaction made successfully.

===========================

(0) Pay to another user

(1) Abort

​

(Option) -> 1

===================================

2025-03-12

BALANCE: 8000

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 5

=============================

(0) View all updates

(1) View all updates for a day

(2) Return

​

(Option) -> 0

​

(0): Deposit 10000

Date: 2025-02-28

Comment: No comment

​

(1): Paid 2000 to nandan

Date: 2025-03-03

Comment: first payment

=============================

(0) View all updates

(1) View all updates for a day

(2) Return

​

(Option) -> 2

===================================

2025-03-20

BALANCE: 8000

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 0

======================================================================

Enter username and password to view details or create a new account

(1) Login

(2) Create an account

(3) Quit

​

(Option) -> 1

=======================================

(Enter Username) -> ng

(Enter Password) ->

​

Logged in successfully.

===================================

2025-03-22

BALANCE: 6000

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 5

=============================

(0) View all updates

(1) View all updates for a day

(2) Return

​

(Option) -> 0

​

(0): Deposit 5000

Date: 2025-01-05

Comment: No comment

​

(1): Create fd1 FD

Date: 2025-01-17

Comment: No comment

​

(2): satwik paid 2000

Date: 2025-03-03

Comment: first payment

=============================

(0) View all updates

(1) View all updates for a day

(2) Return

​

(Option) -> 2

===================================

2025-04-01

BALANCE: 6000

​

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

​

(Option) -> 5

=============================

(0) View all updates

(1) View all updates for a day

(2) Return

​

(Option) -> 0

​

(0): Deposit 5000

Date: 2025-01-05

Comment: No comment

​

(1): Create fd1 FD

Date: 2025-01-17

Comment: No comment

​

(2): satwik paid 2000

Date: 2025-03-03

=============================

(0) View all updates

(1) View all updates for a day

(2) Return

(Option) -> 2

===================================

2040-04-19

BALANCE: 6000

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

(Option) -> 4

=============================

(0) Show all FDs

(1) View details of a particular FD

(2) Withdraw an FD

(3) Return

(Option) -> 1

(Enter FD name) -> fd1

Principal : 1000

Interest : 2

Created : 2025-01-17

Total time period (years) : 5

Time passed (years) : 15

Current value : 1100.0

Mature date : 2030-01-17

Matured? : Yes

Widthdrawn? : No

=============================

(0) Show all FDs

(1) View details of a particular FD

(2) Withdraw an FD

(3) Return

(Option) -> 2

(Enter FD name) -> fd1

Withdrew amount 1100.0 from FD fd1.

=============================

(0) Show all FDs

(1) View details of a particular FD

(2) Withdraw an FD

(3) Return

(Option) -> 3

===================================

2040-08-22

BALANCE: 7100

(0) Logout

(1) Pay

(2) Deposit

(3) Create a fixed deposit

(4) Modify/View fixed deposits

(5) View all updates for your account

Comment: first payment

**BIBLIOGRAPHY**

* Sumita Arora Textbook Computer Science with Python Class XII
* Various online resources