All OOPS Concepts

STUDENT INFORMATION SYSTEM

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Task 1: Define Classes

1.1 entity/student:

```
2  class Student:
3      def __init__(self, student_id, first_name, last_name, date_of_birth, email,
   phone_number):
4          self.student_id = student_id
5          self.first_name = first_name
6          self.last_name = last_name
7          self.date_of_birth = date_of_birth
8          self.email = email
9          self.phone_number = phone_number
10
```

1.2 entity/course

```
11 class Course:
12     def __init__(self, course_id, course_name, course_code, instructor_name):
13         self.course_id = course_id
14         self.course_name = course_name
15         self.course_code = course_code
16         self.instructor_name = instructor_name
17
```

1.3 entity/enrollment

```
2  class Enrollment:
3      def __init__(self, enrollment_id, student_id, course_id, enrollment_date):
4          self.enrollment_id = enrollment_id
5          self.student_id = student_id
6          self.course_id = course_id
7          self.enrollment_date = enrollment_date
8
```

1.4 entity/teacher

```
class Teacher:
    def __init__(self, teacher_id, first_name, last_name, email):
        self.teacher_id = teacher_id
        self.first_name = first_name
        self.last_name = last_name
        self.email = email

```

1.5 entity/payment

```
class Payment:
    def __init__(self, payment_id, student_id, amount, payment_date):
        self.payment_id = payment_id
        self.student_id = student_id
        self.amount = amount
        self.payment_date = payment_date

```

1.6 SIS Class

```
class SIS:
    def __init__(self):
        self.students = []       # List to hold all students
        self.courses = []        # List to hold all courses
        self.teachers = []       # List to hold all teachers
        self.enrollments = []    # List to hold all enrollments
        self.payments = []       # List to hold all payments
```

Task 2: Implement Constructors

Already implemented in Task 1.

2.1 entity/student

```
class Student:
    def __init__(self, student_id, first_name, last_name, date_of_birth, email, phone_number):
        self.student_id = student_id
        self.first_name = first_name
        self.last_name = last_name
        self.date_of_birth = date_of_birth
        self.email = email
        self.phone_number = phone_number

```

2.2 entity/course

```
class Course:
    def __init__(self, course_id, course_name, course_code, instructor_name):
        self.course_id = course_id
        self.course_name = course_name
        self.course_code = course_code
```

```
8           self.instructor_name = instructor_name
9
```

2.3 entity/enrollment

```
9   class Enrollment:
10      def __init__(self, enrollment_id, student_id, course_id, enrollment_date):
11          self.enrollment_id = enrollment_id
12          self.student_id = student_id
13          self.course_id = course_id
14          self.enrollment_date = enrollment_date
15
```

2.4 entity/teacher

```
3   class Teacher:
4       def __init__(self, teacher_id, first_name, last_name, email):
5           self.teacher_id = teacher_id
6           self.first_name = first_name
7           self.last_name = last_name
8           self.email = email
9
```

2.5 entity/payment

```
9   class Payment:
10      def __init__(self, payment_id, student_id, amount, payment_date):
11          self.payment_id = payment_id
12          self.student_id = student_id
13          self.amount = amount
14          self.payment_date = payment_date
15
```

2.6 entity/ SIS

```
16  class SIS:
17      def __init__(self):
18          self.students = []       # List to hold all students
19          self.courses = []        # List to hold all courses
20          self.teachers = []       # List to hold all teachers
21          self.enrollments = []    # List to hold all enrollments
22          self.payments = []       # List to hold all payments
```

Task 3: Implement Methods

3.1 Student Class

```python
import sys
import os

base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
sys.path.append(base_dir)

from entity.payment import Payment

class Student:
    def __init__(self, student_id, first_name, last_name, date_of_birth, email, phone_number):
        self.student_id = student_id
        self.first_name = first_name
        self.last_name = last_name
        self.date_of_birth = date_of_birth
        self.email = email
        self.phone_number = phone_number
        self.enrolled_courses = []  # List to store enrolled courses
        self.payments = []          # List to store payment records

    def enroll_in_course(self, course):
        self.enrolled_courses.append(course)

    def update_student_info(self, first_name, last_name, date_of_birth, email, phone_number):
        self.first_name = first_name
        self.last_name = last_name
        self.date_of_birth = date_of_birth
        self.email = email
        self.phone_number = phone_number

    def make_payment(self, amount, payment_date):
        payment = Payment(None, self.student_id, amount, payment_date)
        self.payments.append(payment)

    def display_student_info(self):
        print(f"Student ID: {self.student_id}")
        print(f"Name: {self.first_name} {self.last_name}")
        print(f"Date of Birth: {self.date_of_birth}")
        print(f"Email: {self.email}")
        print(f"Phone Number: {self.phone_number}")

    def get_enrolled_courses(self):
        return self.enrolled_courses

    def get_payment_history(self):
        return self.payments
```

3.2 Course Class:

```python
class Course:
    def __init__(self, course_id, course_name, course_code, instructor_name):
```

```
        self.course_id = course_id
        self.course_name = course_name
        self.course_code = course_code
        self.instructor_name = instructor_name
        self.enrollments = []  # List to store enrollments
        self.teacher = None

    def assign_teacher(self, teacher):
        self.teacher = teacher

    def update_course_info(self, course_code, course_name, instructor):
        self.course_code = course_code
        self.course_name = course_name
        self.instructor_name = instructor

    def display_course_info(self):
        print(f"Course ID: {self.course_id}")
        print(f"Course Name: {self.course_name}")
        print(f"Course Code: {self.course_code}")
        print(f"Instructor Name: {self.instructor_name}")

    def get_enrollments(self):
        return self.enrollments

    def get_teacher(self):
        return self.teacher
```

3.3 Enrollment class:

```
class Enrollment:
    def __init__(self, enrollment_id, student_id, course_id, enrollment_date):
        self.enrollment_id = enrollment_id
        self.student_id = student_id
        self.course_id = course_id
        self.enrollment_date = enrollment_date

    def get_student_id(self):
        return self.student_id

    def get_course_id(self):
        return self.course_id
```

3.4 Teacher Class:

```
class Teacher:
    def __init__(self, teacher_id, first_name, last_name, email):
        self.teacher_id = teacher_id
        self.first_name = first_name
        self.last_name = last_name
        self.email = email
        self.assigned_courses = []  # List to store assigned courses
```

```
115
116     def update_teacher_info(self, first_name, last_name, email):
117         self.first_name = first_name
118         self.last_name = last_name
119         self.email = email
120
121     def display_teacher_info(self):
122         print(f"Teacher ID: {self.teacher_id}")
123         print(f"Name: {self.first_name} {self.last_name}")
124         print(f"Email: {self.email}")
125
126     def get_assigned_courses(self):
127         return self.assigned_courses
```

3.5 Payment Class:

```
128class Payment:
129     def __init__(self, payment_id, student_id, amount, payment_date):
130         self.payment_id = payment_id
131         self.student_id = student_id
132         self.amount = amount
133         self.payment_date = payment_date
134
135     def get_student(self):
136         return self.student_id
137
138     def get_payment_amount(self):
139         return self.amount
140
141     def get_payment_date(self):
142         return self.payment_date
143
```

3.6 SIS Class:

```
144import sys
145import os
146
147base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
148sys.path.append(base_dir)
149
150from entity.enrollment import Enrollment
151from entity.payment import Payment
152from entity.student import Student
153
154class SIS:
155     def __init__(self):
156         self.students = []
157         self.courses = []
158         self.enrollments = []
159         self.payments = []
160
```

```
161     def enroll_student_in_course(self, student, course):
162         enrollment_date = '2024-01-01'
163         enrollment = Enrollment(len(self.enrollments) + 1, student.student_id,
    course.course_id, enrollment_date)
164         self.enrollments.append(enrollment)
165         print(f'Enrolled {student.first_name} in {course.course_name} on
    {enrollment_date}')
166 
167     def record_payment(self, student, amount, payment_date):
168         payment = Payment(len(self.payments) + 1, student.student_id, amount,
    payment_date)
169         self.payments.append(payment)
170         print(f'Recorded payment of {amount} from {student.first_name} on
    {payment_date}')
171 
172     def generate_enrollment_report(self, course):
173         enrollments = [enrollment for enrollment in self.enrollments if
    enrollment.course_id == course.course_id]
174         if not enrollments:
175             print(f"\nNo enrollments found for {course.course_name}")
176             return enrollments
177 
178         print(f'\nEnrollment Report for {course.course_name}:')
179         for enrollment in enrollments:
180             print(f'Student ID: {enrollment.student_id}, Course ID:
    {enrollment.course_id}, Enrollment Date: {enrollment.enrollment_date}')
181 
182         return enrollments
183 
184     def generate_payment_report(self, student):
185         payment_report = [payment for payment in self.payments if payment.student_id ==
    student.student_id]
186         print(f'\nPayment Report for {student.first_name} {student.last_name}:')
187         for payment in payment_report:
188             print(f'Amount: {payment.amount}, Payment Date: {payment.payment_date}')
189 
190     def calculate_course_statistics(self, course):
191         enrollments = [enrollment for enrollment in self.enrollments if
    enrollment.course_id == course.course_id]
192         if not enrollments:
193             print(f"\nNo enrollments found for {course.course_name}")
194             return 0, 0
195         total_payments = sum(payment.amount for payment in self.payments if
    payment.student_id in [e.student_id for e in enrollments])
196         return len(enrollments), total_payments
```

3.7 Testing the implemented methods:

```python
import sys
import os

base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
sys.path.append(base_dir)

from entity.student import Student
from entity.course import Course
from entity.teacher import Teacher
from entity.enrollment import Enrollment
from entity.payment import Payment
from entity.sis import SIS

def main():
    sis = SIS()

    student1 = Student(1, 'John', 'Doe', '1995-08-15', 'john.doe@example.com', '1234567890')
    student2 = Student(2, 'Jane', 'Smith', '1996-09-25', 'jane.smith@example.com', '0987654321')

    course1 = Course(1, 'Mathematics', 'MATH101', 'Dr. Alice')
    course2 = Course(2, 'Physics', 'PHYS101', 'Dr. Bob')

    sis.students.append(student1)
    sis.students.append(student2)
    sis.courses.append(course1)
    sis.courses.append(course2)

    sis.enroll_student_in_course(student1, course1)
    sis.enroll_student_in_course(student2, course2)

    print()

    sis.record_payment(student1, 5000.00, '2024-01-20')
    sis.record_payment(student2, 6000.00, '2024-02-15')

    print()
    sis.generate_enrollment_report(course2)
    print()

    sis.generate_payment_report(student1)

    num_enrollments, total_payments = sis.calculate_course_statistics(course1)
    print(f'\nStatistics for {course1.course_name}:')
    print(f'Number of Enrollments: {num_enrollments}, Total Payments: {total_payments}')

if __name__ == '__main__':
    main()
```

Output:

```
PS C:\Users\pumak\OneDrive\Desktop\Student Information System> & C:/Users/pumak/AppData/Local/Programs/Python/Python312/python.exe "c:/Users/pumak/OneDrive/Desktop/St
udent Information System/entity/tester.py"
Enrolled John in Mathematics on 2024-01-01
Enrolled Jane in Physics on 2024-01-01
Enrolled Jane in Physics on 2024-01-01

Recorded payment of 5000.0 from John on 2024-01-20
Enrolled Jane in Physics on 2024-01-01

Enrolled Jane in Physics on 2024-01-01

Recorded payment of 6000.0 from Jane on 2024-02-15


Enrollment Report for Physics:
Student ID: 2, Course ID: 2, Enrollment Date: 2024-01-01


Payment Report for John Doe:
Amount: 5000.0, Payment Date: 2024-01-20

Statistics for Mathematics:
Number of Enrollments: 1, Total Payments: 5000.0
PS C:\Users\pumak\OneDrive\Desktop\Student Information System>
```

Task 4: Exceptions handling and Custom Exceptions

Exception/custom_exceptions.py

All the given custom exceptions are implemented below.

```python
import sys
import os

base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
sys.path.append(base_dir)

class DuplicateEnrollmentException(Exception):
    def __init__(self, message="Student is already enrolled in this course."):
        self.message = message
        super().__init__(self.message)

class CourseNotFoundException(Exception):
    def __init__(self, message="Course not found in the system."):
        self.message = message
        super().__init__(self.message)

class StudentNotFoundException(Exception):
    def __init__(self, message="Student not found in the system."):
        self.message = message
        super().__init__(self.message)

class TeacherNotFoundException(Exception):
    def __init__(self, message="Teacher not found in the system."):
        self.message = message
        super().__init__(self.message)

class PaymentValidationException(Exception):
    def __init__(self, message="Payment validation failed."):
        self.message = message
        super().__init__(self.message)

class InvalidStudentDataException(Exception):
```

```
    def __init__(self, message="Invalid data provided for the student."):
        self.message = message
        super().__init__(self.message)

class InvalidCourseDataException(Exception):
    def __init__(self, message="Invalid data provided for the course."):
        self.message = message
        super().__init__(self.message)

class InvalidEnrollmentDataException(Exception):
    def __init__(self, message="Invalid data provided for the enrollment."):
        self.message = message
        super().__init__(self.message)

class InvalidTeacherDataException(Exception):
    def __init__(self, message="Invalid data provided for the teacher."):
        self.message = message
        super().__init__(self.message)

class InsufficientFundsException(Exception):
    def __init__(self, message="Insufficient funds for enrollment."):
        self.message = message
        super().__init__(self.message)

```

Task 5: Collections

Implement Collections:

5.1 Student Class:

Two lists are created here namely enrolled_courses and payments, to list the couses enrolled by a student and payment respectively.

```
class Student:
    def __init__(self, student_id, first_name, last_name, date_of_birth, email, phone_number):
        self.student_id = student_id
        self.first_name = first_name
        self.last_name = last_name
        self.date_of_birth = date_of_birth
        self.email = email
        self.phone_number = phone_number
        self.enrolled_courses = []  # List to store enrolled courses
        self.payments = []          # List to store payment records

    def enroll_in_course(self, course):
        self.enrolled_courses.append(course)

    def get_enrolled_courses(self):
        return self.enrolled_courses
```

5.2 Course class:

A list to store enrollments has been created with getters and setters namely, get_enrollments and enroll_student.

```
316class Course:
317    def __init__(self, course_id, course_name, course_code, instructor_name):
318        self.course_id = course_id
319        self.course_name = course_name
320        self.course_code = course_code
321        self.instructor_name = instructor_name
322        self.enrollments = []  # List to store Enrollment objects
323        self.teacher = None
324
325    def enroll_student(self, student, enrollment_date):
326        enrollment = Enrollment(len(self.enrollments) + 1, student.student_id,
   self.course_id, enrollment_date)
327        self.enrollments.append(enrollment)
328
329    def get_enrollments(self):
330        return self.enrollments
331
```

5.3 Enrollment Class:

References for student and course has been created along with getters and setters.

```
class Enrollment:
    def __init__(self, enrollment_id, student, course, enrollment_date):
        self.enrollment_id = enrollment_id
        self.student_id = None
        self.course_id = None
        self.enrollment_date = enrollment_date
        self.student = student # To hold reference to Student object
        self.course = course   # To hold reference to Course object

    def set_student(self, student):
        self.student = student  # Method to set the Student reference

    def get_student(self):
        return self.student  # Method to get the Student object

    def set_course(self, course):
        self.course = course  # Method to set the Course reference

    def get_course(self):
        return self.course  # Method to get the Course object

    def display_enrollment_info(self):
        student_name = f"{self.student.first_name} {self.student.last_name}" if
self.student else "N/A"
        course_name = self.course.course_name if self.course else "N/A"

        print(f"Enrollment ID: {self.enrollment_id}")
        print(f"Student Name: = (Name: {student_name})")
```

```
        print(f"Course Name:(Course Name: {course_name})")
        print(f"Enrollment Date: {self.enrollment_date}")
```

5.4 Teacher Class:

A list for assigned_courses has been created.

```
class Teacher:
    def __init__(self, teacher_id, first_name, last_name, email):
        self.teacher_id = teacher_id
        self.first_name = first_name
        self.last_name = last_name
        self.email = email
        self.assigned_courses = []  # List to store assigned courses

    def assign_course(self, course):
        if course not in self.assigned_courses:
            self.assigned_courses.append(course)
            course.assign_teacher(self)  # Assuming Course has an assign_teacher method
        else:
            print(f"{self.first_name} is already assigned to {course.course_name}.")

    def get_assigned_courses(self):
        return self.assigned_courses
```

5.5 Payment Class:

A student reference to the payment class has been created.

```
class Payment:
    def __init__(self, payment_id, student, amount, payment_date):
        self.payment_id = payment_id
        self.student = student; # Store reference to Student object
        self.student_id = None # Store student ID
        self.amount = amount
        self.payment_date = payment_date

    def get_student(self):
        return self.student  # Return the Student object

    def set_student(self, student):
        self.student = student  # Method to set the Student referen

    def get_student_id(self):
        return self.student_id  # Return the Student ID

    def get_payment_amount(self):
        return self.amount  # Return the payment amount

    def get_payment_date(self):
        return self.payment_date  # Return the payment date
```

```
    def display_payment_info(self):
        print(f"Payment ID: {self.payment_id}")
        print(f"Student ID: {self.student_id} (Name: {self.student.first_name}
{self.student.last_name})")
        print(f"Amount: {self.amount}")
        print(f"Payment Date: {self.payment_date}")
```

Task 6: Create Methods for Managing Relationships

6.1 AddEnrollment:

```
349    def AddEnrollment(self, student, course, enrollment_date):
350
351        if any(enrollment.student_id == student.student_id and enrollment.course_id ==
   course.course_id for enrollment in self.enrollments):
352            raise Exception("Student is already enrolled in this course.")
353
354        enrollment = Enrollment(len(self.enrollments) + 1, student.student_id,
   course.course_id, enrollment_date)
355
356        enrollment.set_student(student)
357        enrollment.set_course(course)
358
359        self.enrollments.append(enrollment)
360
361        student.enrolled_courses.append(course)
362        course.enrollments.append(enrollment)
363
364        print(f'Enrolled {student.first_name} in {course.course_name} on
   {enrollment_date}')
```

6.2 AssignCourseToTeacher:

```
365    def assign_course_to_teacher(self, course, teacher):
366        if course not in teacher.assigned_courses:
367            teacher.assigned_courses.append(course)
368            print(f'Course {course.course_name} has been assigned to teacher
   {teacher.first_name} {teacher.last_name}.')
369        else:
370            print(f'Course {course.course_name} is already assigned to teacher
   {teacher.first_name} {teacher.last_name}.')
371
```

6.3 AddPayment:

```
372def add_payment(self, student, amount, payment_date):
373
374        payment = Payment(len(self.payments) + 1, student.student_id, amount,
   payment_date)
375
376        student.make_payment(amount, payment_date)
```

```
377
378         self.payments.append(payment)
379
380         print(f'Recorded payment of {amount} from {student.first_name} on
    {payment_date}')
```

6.4 GetEnrollmentsForStudent:

```
381def GetEnrollmentsForStudent(self, student):
382         return [enrollment for enrollment in self.enrollments if
    enrollment.student.student_id == student.student_id]
383
```

6.5 GetCoursesForTeacher:

```
384     def GetCoursesForTeacher(self, teacher):
385         return [course for course in self.courses if course in
    teacher.assigned_courses]
386
```

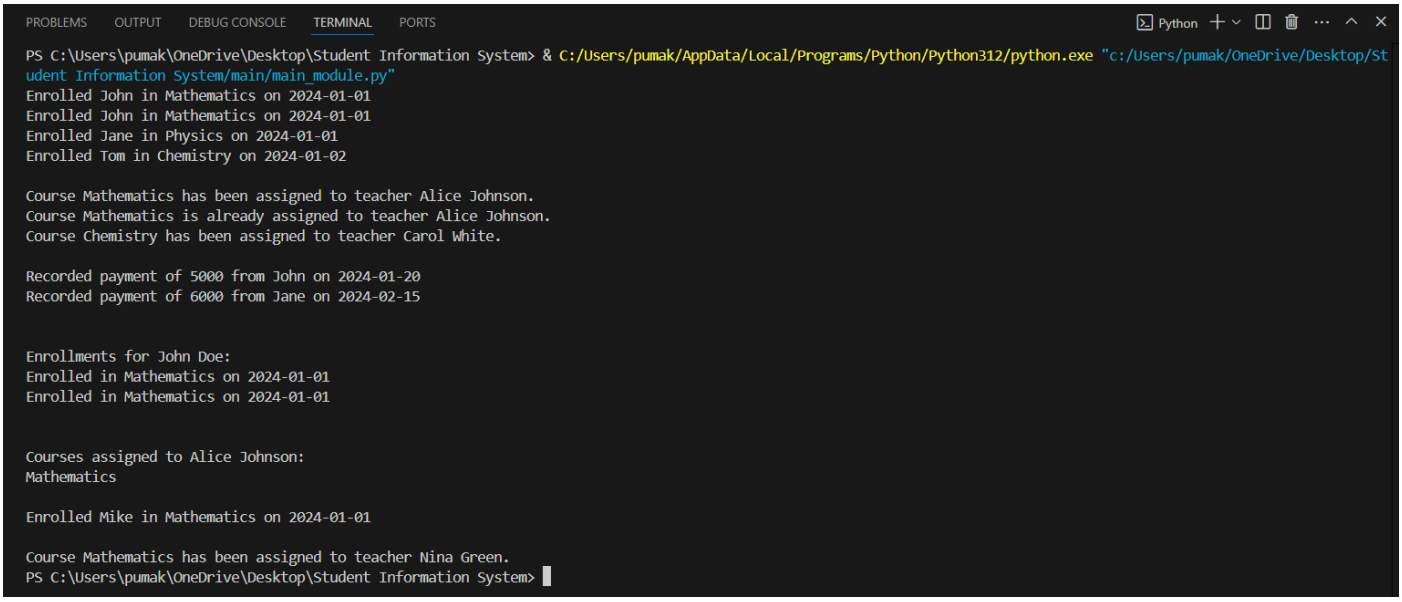
6.6 Main Method:

```
import sys
import os

base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
sys.path.append(base_dir)

from entity.student import Student
from entity.course import Course
from entity.enrollment import Enrollment
from entity.sis import SIS
from entity.teacher import Teacher
from entity.payment import Payment
from dao.sisserviceprovider import SISServiceProvider
from exception.custom_exceptions import (
    DuplicateEnrollmentException,
    CourseNotFoundException,
    StudentNotFoundException,
    TeacherNotFoundException,
    PaymentValidationException,
    InvalidStudentDataException,
    InvalidCourseDataException,
    InvalidEnrollmentDataException,
    InvalidTeacherDataException,
    InsufficientFundsException
)

def main():
    sis = SIS()
```

```
    student1 = Student(1, 'John', 'Doe', '1995-08-15', 'john.doe@example.com',
'1234567890')
    student2 = Student(2, 'Jane', 'Smith', '1996-09-25', 'jane.smith@example.com',
'0987654321')
    student3 = Student(3, 'Tom', 'Brown', '1997-11-30', 'tom.brown@example.com',
'1122334455')

    course1 = Course(1, 'Mathematics', 'MATH101', 'Dr. Alice')
    course2 = Course(2, 'Physics', 'PHYS101', 'Dr. Bob')
    course3 = Course(3, 'Chemistry', 'CHEM101', 'Dr. Carol')

    teacher1 = Teacher(1, 'Alice', 'Johnson', 'alice.johnson@example.com')
    teacher2 = Teacher(2, 'Bob', 'Smith', 'bob.smith@example.com')
    teacher3 = Teacher(3, 'Carol', 'White', 'carol.white@example.com')

    sis.students.append(student1)
    sis.students.append(student2)
    sis.students.append(student3)

    sis.courses.append(course1)
    sis.courses.append(course2)
    sis.courses.append(course3)

    sis.teachers.append(teacher1)
    sis.teachers.append(teacher2)
    sis.teachers.append(teacher3)

    try:
        sis.AddEnrollment(student1, course1, '2024-01-01')
        sis.AddEnrollment(student1, course1, '2024-01-01')
    except DuplicateEnrollmentException as e:
        print(f"Error: {e}")

    try:
        sis.AddEnrollment(student2, course2, '2024-01-01')
        sis.AddEnrollment(student3, course3, '2024-01-02')
    except Exception as e:
        print(f"Error: {e}")

    print()

    try:
        sis.assign_course_to_teacher(course1, teacher1)
        sis.assign_course_to_teacher(course1, teacher1)
        sis.assign_course_to_teacher(course3, teacher3)
    except Exception as e:
        print(f"Error: {e}")

    print()

    try:
        sis.add_payment(student1, 5000, '2024-01-20')
        sis.add_payment(student2, 6000, '2024-02-15')
    except Exception as e:
```

```
        print(f"Error: {e}")

    print()
    try:
        enrollments_for_john = sis.GetEnrollmentsForStudent(student1)
        print(f"\nEnrollments for {student1.first_name} {student1.last_name}:")
        for enrollment in enrollments_for_john:
            print(f'Enrolled in {enrollment.course.course_name} on
{enrollment.enrollment_date}')
    except Exception as e:
        print(f"Error: {e}")
    print()

    try:
        courses_for_alice = sis.GetCoursesForTeacher(teacher1)
        print(f"\nCourses assigned to {teacher1.first_name} {teacher1.last_name}:")
        for course in courses_for_alice:
            print(course.course_name)
    except Exception as e:
        print(f"Error: {e}")
    print()

    try:
        non_existent_student = Student(4, 'Mike', 'Jones', '1998-12-01',
'mike.jones@example.com', '9999999999')
        sis.AddEnrollment(non_existent_student, course1, '2024-01-01')
    except StudentNotFoundException as e:
        print(f"Error: {e}")
    print()

    try:
        non_existent_teacher = Teacher(4, 'Nina', 'Green', 'nina.green@example.com')
        sis.assign_course_to_teacher(course1, non_existent_teacher)
    except TeacherNotFoundException as e:
        print(f"Error: {e}")



if __name__ == '__main__':
    main()
```

Output:



Task 7: Database Connectivity

7.1 Database Initialization:

7.1.1 Util/db_property_util:

```
387class DBPropertyUtil:
388    @staticmethod
389    def get_connection_string():
390        return 'Driver={SQL
   Server};Server=PUMA\\SQLEXPRESS;Database=SISDB;Trusted_Connection=yes;'
391
392
```

7.1.2 util/db_conn_util:

```
393# DBConnUtil.py
394import sys
395import os
396
397base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
398sys.path.append(base_dir)
399
400import pyodbc
401from util.db_property_util import DBPropertyUtil
402
403class DBConnUtil:
404    @staticmethod
405    def get_connection():
406        connection_string = DBPropertyUtil.get_connection_string()
407        try:
408            conn = pyodbc.connect(connection_string)
409            print("Connected Successfully")
410            return conn
411        except Exception as e:
```

```
            print("Connection failed:", e)
            return None


```

7.1. util/DatabaseManager(For DB Initialization):

```
import sys
import os

base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
sys.path.append(base_dir)
import pyodbc
from util.db_conn_util import DBConnUtil

class DatabaseManager:
    def __init__(self):
        self.conn = DBConnUtil.get_connection()
        if self.conn:
            self.cursor = self.conn.cursor()
            self.initialize_database()

    def initialize_database(self):
        sql_commands = [
            '''
            IF NOT EXISTS (SELECT * FROM sysobjects WHERE name='Students' AND
   xtype='U')
            CREATE TABLE Students (
                id INT PRIMARY KEY IDENTITY(1,1),
                first_name NVARCHAR(100) NOT NULL,
                last_name NVARCHAR(100) NOT NULL,
                dob DATE NOT NULL,
                email NVARCHAR(255) NOT NULL UNIQUE,
                phone NVARCHAR(15) NOT NULL
            );
            ''',
            '''
            IF NOT EXISTS (SELECT * FROM sysobjects WHERE name='Courses' AND xtype='U')
            CREATE TABLE Courses (
                id INT PRIMARY KEY IDENTITY(1,1),
                course_name NVARCHAR(100) NOT NULL,
                course_code NVARCHAR(20) NOT NULL UNIQUE,
                instructor_name NVARCHAR(100) NOT NULL
            );
            ''',
            '''
            IF NOT EXISTS (SELECT * FROM sysobjects WHERE name='Enrollments' AND
   xtype='U')
            CREATE TABLE Enrollments (
                id INT PRIMARY KEY IDENTITY(1,1),
                student_id INT NOT NULL,
                course_id INT NOT NULL,
                enrollment_date DATE NOT NULL,
```

```
                FOREIGN KEY (student_id) REFERENCES Students (id),
                FOREIGN KEY (course_id) REFERENCES Courses (id),
                UNIQUE (student_id, course_id)
            );
            ''',
            '''
            IF NOT EXISTS (SELECT * FROM sysobjects WHERE name='Teachers' AND
   xtype='U')
            CREATE TABLE Teachers (
                id INT PRIMARY KEY IDENTITY(1,1),
                first_name NVARCHAR(100) NOT NULL,
                last_name NVARCHAR(100) NOT NULL,
                email NVARCHAR(255) NOT NULL UNIQUE
            );
            ''',
            '''
            IF NOT EXISTS (SELECT * FROM sysobjects WHERE name='Payments' AND
   xtype='U')
            CREATE TABLE Payments (
                id INT PRIMARY KEY IDENTITY(1,1),
                student_id INT NOT NULL,
                amount DECIMAL(10, 2) NOT NULL,
                payment_date DATE NOT NULL,
                FOREIGN KEY (student_id) REFERENCES Students (id)
            );
            '''
        ]

        for command in sql_commands:
            self.cursor.execute(command)

        self.conn.commit()

    def close(self):
        if self.conn:
            self.conn.close()


```

7.2 Data Retrieval:

```
def dynamic_query(self, table, columns=None, conditions=None, order_by=None):
        try:
            columns = ', '.join(columns) if columns else '*'
            query = f"SELECT {columns} FROM {table}"
            if conditions:
                query += " WHERE " + ' AND '.join(conditions)
            if order_by:
                query += " ORDER BY " + order_by

            self.cursor.execute(query)
            return self.cursor.fetchall()
        except Exception as e:
```

```
            print("Error executing dynamic query:", e)
            return []

    def get_students(self):
        return self.dynamic_query("Students")

    def get_courses(self):
        return self.dynamic_query("Courses")

    def get_enrollments(self):
        return self.dynamic_query("Enrollments")

    def get_teachers(self):
        return self.dynamic_query("Teachers")

    def get_payments(self):
        return self.dynamic_query("Payments")

```

7.3 Data Insertion and Updating:

```
def insert_student(self, first_name, last_name, dob, email, phone):
        try:
            self.cursor.execute(
                "INSERT INTO Students (first_name, last_name, dob, email, phone) VALUES (?, ?, ?, ?, ?)",
                (first_name, last_name, dob, email, phone)
            )
            self.conn.commit()
            print(f"Inserted student: {first_name} {last_name}")
        except Exception as e:
            print("Error inserting student:", e)

    def update_student(self, student_id, first_name, last_name, dob, email, phone):
        try:
            self.cursor.execute(
                "UPDATE Students SET first_name = ?, last_name = ?, dob = ?, email = ?, phone = ? WHERE id = ?",
                (first_name, last_name, dob, email, phone, student_id)
            )
            self.conn.commit()
            print(f"Updated student ID {student_id}")
        except Exception as e:
            print("Error updating student:", e)

    def insert_enrollment(self, student_id, course_id, enrollment_date):
        try:
            self.cursor.execute(
                "INSERT INTO Enrollments (student_id, course_id, enrollment_date) VALUES (?, ?, ?)",
                (student_id, course_id, enrollment_date)
            )
            self.conn.commit()
```

```
            print(f"Inserted enrollment for student ID {student_id} in course ID
    {course_id}")
        except Exception as e:
            print("Error inserting enrollment:", e)

    def record_payment(self, student_id, amount, payment_date):
        try:
            self.cursor.execute(
                "INSERT INTO Payments (student_id, amount, payment_date) VALUES (?, ?,
    ?)",
                (student_id, amount, payment_date)
            )
            self.conn.commit()
            print(f"Inserted payment of {amount} from student ID {student_id}")
        except Exception as e:
            print("Error inserting payment:", e)

```

7.4 Transaction Management:

```
def begin_transaction(self):
        self.conn.autocommit = False

    def commit_transaction(self):
        self.conn.commit()
        self.conn.autocommit = True

    def rollback_transaction(self):
        self.conn.rollback()
        self.conn.autocommit = True

def insert_student(self, first_name, last_name, dob, email, phone):
        try:
            self.cursor.execute(
                "INSERT INTO Students (first_name, last_name, dob, email, phone) VALUES
    (?, ?, ?, ?, ?)",
                (first_name, last_name, dob, email, phone)
            )
            self.conn.commit()
            print(f"Inserted student: {first_name} {last_name}")
        except Exception as e:
            print("Error inserting student:", e)

    def update_student(self, student_id, first_name, last_name, dob, email, phone):
        try:
            self.cursor.execute(
                "UPDATE Students SET first_name = ?, last_name = ?, dob = ?, email = ?,
    phone = ? WHERE id = ?",
                (first_name, last_name, dob, email, phone, student_id)
            )
            self.conn.commit()
            print(f"Updated student ID {student_id}")
        except Exception as e:
```

```
            print("Error updating student:", e)

    def insert_enrollment(self, student_id, course_id, enrollment_date):
        try:
            self.cursor.execute(
                "INSERT INTO Enrollments (student_id, course_id, enrollment_date)
   VALUES (?, ?, ?)",
                (student_id, course_id, enrollment_date)
            )
            self.conn.commit()
            print(f"Inserted enrollment for student ID {student_id} in course ID
   {course_id}")
        except Exception as e:
            print("Error inserting enrollment:", e)

    def record_payment(self, student_id, amount, payment_date):
        try:
            self.cursor.execute(
                "INSERT INTO Payments (student_id, amount, payment_date) VALUES (?, ?,
   ?)",
                (student_id, amount, payment_date)
            )
            self.conn.commit()
            print(f"Inserted payment of {amount} from student ID {student_id}")
        except Exception as e:
            print("Error inserting payment:", e)

    def enroll_student_with_payment(self, student_id, course_id, enrollment_date,
   amount, payment_date):
        self.begin_transaction()
        try:
            self.insert_enrollment(student_id, course_id, enrollment_date)
            self.record_payment(student_id, amount, payment_date)
            self.commit_transaction()
        except Exception as e:
            self.rollback_transaction()
            print("Transaction failed:", e)


```

7.5 Dynamic Query Builder:

```
def dynamic_query(self, table, columns=None, conditions=None, order_by=None):
        try:
            columns = ', '.join(columns) if columns else '*'
            query = f"SELECT {columns} FROM {table}"
            if conditions:
                query += " WHERE " + ' AND '.join(conditions)
            if order_by:
                query += " ORDER BY " + order_by

            self.cursor.execute(query)
            return self.cursor.fetchall()
```

```
        except Exception as e:
            print("Error executing dynamic query:", e)
            return []

```

Task 8: Student Enrollment:

```
import sys
import os

base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
sys.path.append(base_dir)

from util.DatabaseManager import DatabaseManager
from util.db_conn_util import DBConnUtil
from entity.student import Student
from entity.course import Course
from entity.enrollment import Enrollment
from entity.sis import SIS
from entity.teacher import Teacher
from entity.payment import Payment
from exception.custom_exceptions import (
    DuplicateEnrollmentException,
    CourseNotFoundException,
    StudentNotFoundException,
    TeacherNotFoundException,
    PaymentValidationException,
    InvalidStudentDataException,
    InvalidCourseDataException,
    InvalidEnrollmentDataException,
    InvalidTeacherDataException,
    InsufficientFundsException
)


if __name__ == "__main__":
    db_manager = DatabaseManager()

    first_name = 'John'
    last_name = 'Doe'
    dob = '1995-08-15'
    email = 'john.doe@example.com'
    phone = '123-456-7890'

    db_manager.insert_student(first_name, last_name, dob, email, phone)

    course_names = ['Introduction to Programming', 'Mathematics 101']
    course_ids = []

    for course_name in course_names:

        course = db_manager.dynamic_query(
            "Courses",
```

```
            columns=["course_id"],
            conditions=[f"course_name = '{course_name}'"]
        )
        if course:
            course_ids.append(course[0][0])

    student_id = db_manager.dynamic_query("Students", columns=["student_id"],
   conditions=[f"email = '{email}'"])[0][0]

    enrollment_date = "2024-01-01”
    for course_id in course_ids:
        db_manager.insert_enrollment(student_id, course_id, enrollment_date)

    print(f"John Doe has been enrolled in the following courses: {course_names}")


    db_manager.close()

```

Output:

```
PS> & C:/Users/pumak/AppData/Local/Programs/Python/Python312/python.exe "c:/Users/pumak/OneDrive/Desktop/Student Information System/main/task8main.py"
Connected Successfully
Inserted student: John Doe
John Doe has been enrolled in the following courses: ['Introduction to Programming', 'Mathematics 101']
PS C:\Users\pumak\OneDrive\Desktop\Student Information System>
```

Task 9: Teacher Assignment

In this task, a new teacher, Sarah Smith, is assigned to teach a course. The system needs to update the course record to reflect the teacher assignment

```
import sys
import os

base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
sys.path.append(base_dir)
import pyodbc
from util.db_conn_util import DBConnUtil
from util.DatabaseManager import DatabaseManager


if __name__ == "__main__":
    db_manager = DatabaseManager()


    first_name = 'Sarah'
    last_name = 'Smith'
    email = 'sarah.smith@example.com'

    db_manager.insert_teacher(first_name, last_name, email)

    course_id = 12

```

```
    query = "SELECT * FROM Courses WHERE course_id = ?"
    course = db_manager.execute_query(query, (course_id,))

    if course:
        teacher = db_manager.get_teacher_by_email(email)

        if teacher:

            update_query = "UPDATE Courses SET teacher_id = ? WHERE course_id = ?"
            db_manager.execute_query(update_query, (teacher[0], course_id))
            print(f"Assigned {first_name} {last_name} to teach course ID {course_id}.")
        else:
            print("Teacher not found.")
    else:
        print("Course not found.")

    db_manager.close()
```

Output:

```
PS C:\Users\pumak\OneDrive\Desktop\Student Information System> & C:/Users/pumak/AppData/Local/Programs/Python/Python312/python.exe "c:/Users/
eDrive/Desktop/Student Information System/main/task9main.py"
Connected Successfully
Inserted teacher: Sarah Smith
Assigned Sarah Smith to teach course ID 12.
PS C:\Users\pumak\OneDrive\Desktop\Student Information System>
```

Updated teacher and course databases:

100 %

Results | Messages

	teacher_id	first_name	last_name	email
1	2	Ram	Narayan	ram.narayan@example.com
2	3	Janani	Sivakumar	janani.sivakumar@example.com
3	4	Saravanan	Raja	saravanan.raja@example.com
4	5	Muthu	Palanisamy	muthu.palanisamy@example.com
5	6	Vijaya	Lakshmi	vijaya.lakshmi@example.com
6	7	Kamal	Mani	kamal.mani@example.com
7	8	Radhika	Sankar	radhika.sankar@example.com
8	9	Ganesh	Perumal	ganesh.perumal@example.com
9	10	Thiru	Arasan	thiru.arasan@example.com
10	11	Madhavi	Natesan	madhavi.natesan@example.com
11	12	kumar	sangakara	ks@gmail.com
12	19	Sarah	Smith	sarah.smith@example.com

	course_id	course_name	credits	teacher_id
1	2	Mathematics	4	2
2	3	Physics	4	3
3	4	Chemistry	3	4
4	5	Computer Science	5	5
5	6	Biology	4	6
6	7	History	2	7
7	8	Geography	2	8
8	9	Political Science	3	9
9	10	Economics	4	10
10	12	Advanced Datab...	4	19

Task 10: Payment Record

In this task, a student, Jane Johnson, makes a payment for her enrolled courses. The system needs to record this payment in the database.

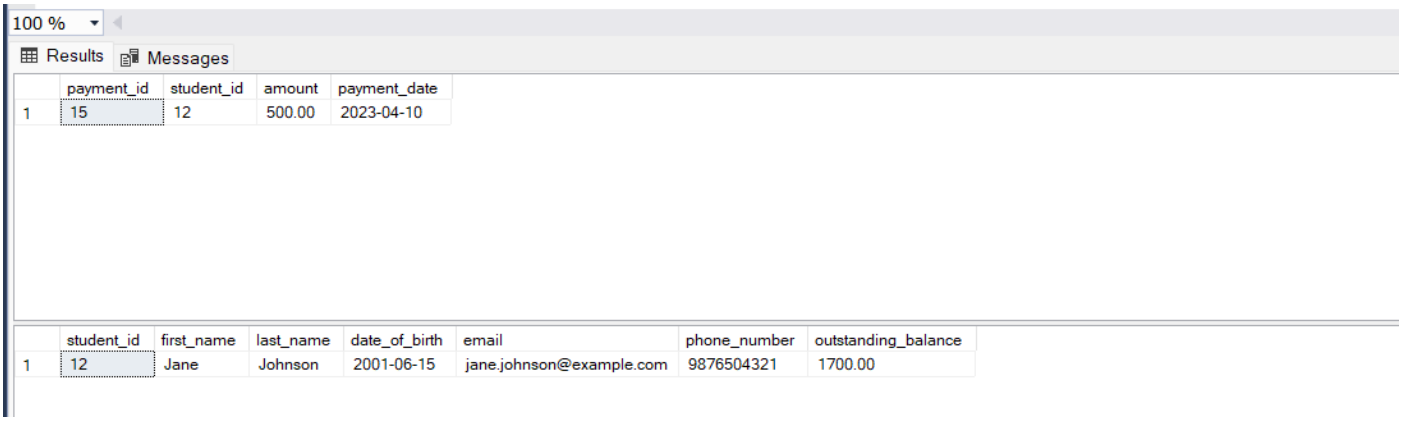
```
import sys
import os

base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
sys.path.append(base_dir)

from util.DatabaseManager import DatabaseManager
from decimal import Decimal

db_manager = DatabaseManager()



first_name = 'Jane'
last_name = 'Johnson'

try:
    query = "SELECT student_id, outstanding_balance FROM Students WHERE first_name = ? AND
last_name = ?"
    student = db_manager.execute_query(query, (first_name, last_name))

    if student:
        student_id = student[0][0]
        outstanding_balance = student[0][1] if student[0][1] is not None else
Decimal('0.00')
        print(f"Found student ID {student_id} with outstanding balance
{outstanding_balance}")

        payment_amount = Decimal('500.00')
        payment_date = '2023-04-10'


        if outstanding_balance > Decimal('0.00'):

            db_manager.record_payment(student_id, payment_amount, payment_date)
            print(f"Recorded payment of {payment_amount} for student ID {student_id} on
{payment_date}")


            new_balance = outstanding_balance - payment_amount
            if new_balance < Decimal('0.00'):
                new_balance = Decimal('0.00')

            update_balance_query = "UPDATE Students SET outstanding_balance = ? WHERE
student_id = ?"
            db_manager.execute_query(update_balance_query, (new_balance, student_id))
            print(f"Updated outstanding balance to {new_balance} for student ID
{student_id}")
        else:
            print("Payment not required, outstanding balance is already 0 or negative.")
    else:
```

```
        print("Student not found.")
except Exception as e:
    print("Error processing payment:", e)
finally:
    db_manager.close()
```

Output:

```
Information System> & C:/Users/pumak/AppData/Local/Programs/Python/Python312/python.exe "c:/Users/pumak/OneDrive/Desktop/Student Information System/main/task10main.py"
Connected Successfully
Found student ID 12 with outstanding balance 2200.00
Inserted payment of 500.00 from student ID 12
Recorded payment of 500.00 for student ID 12 on 2023-04-10
Updated outstanding balance to 1700.00 for student ID 12
PS C:\Users\pumak\OneDrive\Desktop\Student Information System>
```

Updated student and payment records:



100 %

Results | Messages

	payment_id	student_id	amount	payment_date
1	15	12	500.00	2023-04-10

	student_id	first_name	last_name	date_of_birth	email	phone_number	outstanding_balance
1	12	Jane	Johnson	2001-06-15	jane.johnson@example.com	9876504321	1700.00

Task 11: Enrollment Report Generation

In this task, an administrator requests an enrollment report for a specific course, "Computer Science ." The system needs to retrieve enrollment information from the database and generate a report.

```
def generate_enrollment_report_for_course(self, course_id):
        course = self.database_manager.get_course_by_id(course_id)

        if not course:
            print(f"Course with ID '{course_id}' not found.")
            return

        enrollments = self.database_manager.get_enrollments_by_course(course_id)
        if not enrollments:
            print(f"No enrollments found for course ID '{course_id}'.")
            return
```

```
        print(f"\nEnrollment Report for Course ID '{course_id}':")
        print("-------------------------------------------------")
        for enrollment in enrollments:
            student_id, first_name, last_name, enrollment_date = enrollment
            print(f"Student ID: {student_id}, Name: {first_name} {last_name}, Enrollment
Date: {enrollment_date}")
        print("-------------------------------------------------")
```

```
import sys
import os

base_dir = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
sys.path.append(base_dir)

from entity.sis import SIS

if __name__ == "__main__":
    sis = SIS()
    course_id = 5
    sis.generate_enrollment_report_for_course(course_id)
```

Output: